Emerging Themes in Business 2012

Encouraging women innovators: applying a gender perspective to innovation in Wales

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(5005 words)

Abstract

Previous research, past and present policy documents reveal the continuing paucity of women inventors and innovators and the missed opportunity this represents in relation to individual personal fulfilment but also to post-crisis economic regeneration and European competitiveness. This paper reports on initial cycles in a long term action research project to encourage more women inventors and innovators in Wales, UK, prepare them for and promote investment in their ideas. The paper highlights the contextual, economic and soft obstacles which limit women's potential contribution and supports the case for targeted learning programmes, mentoring, benchmarking and internationalisation as the way forward.

Introduction and objectives

The aim of the paper is to contribute to the debate on women, innovation and entrepreneurship by reflecting on initial cycles in a long term action research project that aims to encourage more women inventors and innovators in Wales, UK, prepare them for and promote investment in their ideas. The catalyst for the project was a survey of inventors in Wales which found women represented only 10% of Welsh inventors (Thomas and Gornall, 2009). It continues to be given impetus by UK and EU studies confirming women's under-representation in entrepreneurship and in all areas of invention and innovation, but particularly in science and technology (Levie and Hart, 2009; Technopolis, 2008).

Data on women entrepreneurs in science and technology in the UK indicates that only 5% of women are engaged in early stage activity in the technology sector compared with 12% of men; again 5% of women led established business is in the technology sector compared with 11% men (Technopolis, 2008). Further, according to recent indicators in the EU context, only 8.3% of patents issued by the European Patent Office were awarded to women; women represent only 20.3% of businesses started with venture capital and women assess the level of innovation of their own business lower than men do:

	Innovation type			
	Product	Process	Organisational	Marketing
Women	13.90%	4.10%	5.20%	9.10%
Men	14.50%	7.80%	6.50%	10.45%

Figure 1 Self assessment by men and women of level of innovation in own business (Technopolis, 2008:2)

Research in the UK has indicated a correlation between innovative businesses and faster than normal growth in employment and sales (Bravo-Biosca and Westlake, 2009). The concomitant positive implications in relation to economic growth and global competitiveness have not been lost on governments and policy makers resulting in an emphasis on improving innovation performance (Department for Business, Innovation & Skills, 2011). However, the gender gap in entrepreneurship and innovation, illustrated above, has also been recognised and the promotion of women innovators and entrepreneurs has been identified as a priority area from EU to local level:

> "Women's intellectual potential and their contribution to Europe's competitiveness are not being maximised. DG Enterprise and Industry is seeking to support women innovators/inventors who wish to become entrepreneurs, and women who want to set up a business in science and technology fields". (Technopolis, 2008:1-2).

The following sections of the paper begin with definitions and a discussion of key concepts. An explanation and further detail of the action research methodology and methods employed in the underpinning empirical research follows. The findings of the initial action research cycles including obstacles, support needs and benchmarking examples identified by research participants are reported upon and discussed in relation to the wider context. The final section draws together key conclusions with implications for the support of the development of the individual woman innovator but also the creation of a gender aware innovation milieu in Wales.

Background

This section introduces definitions and concepts underpinning the paper: innovation, followed by a focus on the individual: the entrepreneur, the innovator, female entrepreneurs and female innovators and ends with views on the support system needed to enable innovation to flourish.

Innovation

> "Innovation is the specific tool of entrepreneurs, the means by which they exploit change as an opportunity for a different business or a different service" (Drucker,P.,1985).

Innovation has long been viewed as the engine of economic growth (Trott, 2008) with entrepreneurs central to Schumpeter's creative destruction' whereby newly created firms replace those which are established but inefficient (Burns, 2011). Together with the further description of innovation as resulting from technological progress, these views shaped traditional approaches in this field of knowledge and research (Trott, 2008). Marx's association of innovations with waves of economic growth, Kondratieff's (1935/51) long waves of economic activity, Schumpeter's (1934, 1939, 1942) emphasis on new products as the stimuli for economic growth and Abernathy and Utterback's (1978) model of radical product innovation followed by radical innovation in production processes then widespread incremental innovation have led to innovation becoming almost exclusively associated with new products, research and development and science and technology (Burns, 2011; Trott, 2008). Although of long standing, these key themes resonate still in contemporary thought, most recently in strategy developed to address recovery from the global recession (Europe 2020, 2010; Innovation Union, 2010; Leadbeater and Meadway, 2008).

However, understandings of innovation have widened to include process, organisational/ administrative, delivery, marketing, business model, institutions and, particularly since the dot.coms of the 1990s, service innovation (Westland, 2008; Conway and Steward, 2009). While in the past, service innovation has been largely overlooked, a growing range of new services and related business models demonstrate its importance and current relevance (Trott, 2008; Conway and Steward, 2009).

Therefore, of the many definitions of innovation available, the following more recent definitions also inform the paper and the action research project upon which it is based.

> "… an innovation is the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organisational method in business practices, workplace organisation or external relations". (OECD/European Communities, 2005)

> "Innovation is the development of new products, services and processes, which may be based on cutting edge research." (Department for Business, Innovation & Skills, 2011),

The second definition is significant in respect of the current paper in that it signalled the inclusion of non-technological innovation thereby incorporating innovative activity in areas where women are traditionally more likely to be represented (GHK/Technopolis, 2008).

Innovators, entrepreneurs, female entrepreneurs and innovators

Considerable effort has been expended in the literature in distinguishing between the members of the triumvirate: inventors, innovators and entrepreneurs. While acknowledging that creativity, invention, innovation and market opportunity spotting are closely linked, Burns (2011) contends that inventors may not be innovators; but may need an entrepreneur or entrepreneurial organization to link their invention to customer demand. Thomas, Miller and Murphy (2011) elucidate further adding that it is the entrepreneur who "takes the risk and brings together the resources to link the product or service to a market in order to make a profit."

Again, there are definitions in the literature of the term 'female entrepreneur' and for the purposes of this paper, a European Commission definition has been adopted: "a woman who has created a business in which she has a majority shareholding and who takes an active interest in the decision-making, risk-taking and day-to-day management" (European Commission, 2004). However, according to GHK/Technopolis (2008:22) "No common or consistent definition of women innovators/inventors exists in the literature." and therefore the definitions developed in their work inform the current paper. Women inventors are "…those who create the original idea or product" while women innovators are "…recognised for their ability to make a better idea or version from the original or find new arenas for application". (GHK/Technopolis, 2008:22) though it is noted that in general usage the terms are often conflated.

Recent research and policy studies, building on an ever increasing interest in women and entrepreneurship, have confirmed the significant under representation of women inventors and innovators and, consistent with traditional themes in innovation, have

focused on the under-representation of women in science, engineering and technology (SET) and related policy measures to enable women to overcome a range of contextual, economic and soft obstacles (Technopolis, 2008; Europe 2020, 2010; Innovation Union, 2010). The 3 part framework of contextual, economic and soft obstacles, the challenges each presents and the resultant impact are detailed below given their significance for the action research project and current paper.

Figure 2: Obstacles and challenges encountered by women innovators/inventors in entrepreneurship (adapted from Technopolis, 2008:3-4

Contextual obstacles

Challenges

Women's educational choices; Women's horizontal and vertical segregation in employment

Results

Fewer women with potential to set up a business in science or technology;Fewer women with potential to bring an invention to a profitable market

Challenges

Male domination and association in science, technology, innovation and invention

Results

Science, technology, innovation and invention less attractive to women; Areas more associated with female invention and innovation of less business value

Challenges

Stereotyping about women

Results

Women in science, technology, innovation and invention perceived by stakeholders as less credible or less professional; Women may have to be more persistent to prove their knowledge, skills and capacities to potential clients, suppliers and business partners

Challenges

Traditional views on the role of women in society

Results

Real or perceived greater difficulties of women in balancing family responsibilities with work, especially in fast-moving, competitive sectors that demand long and non-standard working hours, constant training and updating to keep pace with technological advances and associated market opportunities

Economic obstacles

Challenges

Difficulties in accessing finance

Results

Beyond the challenges generally in entrepreneurship, as a result of the more substantial investment required in science and technology sectors; Exacerbated by women perceived less credibly by financial stakeholders and investors

Soft obstacles

Challenges

Lack of access to relevant networks

Results

Less access to and accumulation of human and social capital, including market intelligence

Challenges

Lack of business training

Results

Lack of entrepreneurship training and presentation of entrepreneurship as a viable option for women within technical and science studies

Challenges

Women's perception of deficit in relation to entrepreneurial skills, e.g. self confidence, assertiveness and risk taking; Higher degree of impact in sectors which are male dominated and with higher levels of risk and uncertainty

Challenges

Lack of female role models

Results

Lack of positive images and reinforcement that women can be successful in science and technology sectors; Lack of opportunity for female mentors and advisers

More recently still, in parallel to developments within entrepreneurship, gender and innovation research suggests limitations resulting from (male) normative thinking within innovation. An overemphasis on research-based innovation and technological infrastructure has acted to the detriment of women's involvement in innovation, particularly given the horizontal segregation of labour markets (Danilda and Thorslund, 2011). While it is important to integrate women into science, technology, engineering and manufacturing sectors, it is equally important to recognise the potential of service sectors where women dominate, especially with predicted increases in these areas (Europe 2020, 2010) and growing interest in social innovation (Danilda and Thorslund, 2011).

The innovation milieu

Recent research originally conducted in agri food, health and energy, may find resonance in the wider context. A number of strategies are proposed for supporting innovation including the need for a coherent framework of knowledge transfer, training, information and advisory services. More specifically, in discussing the importance of the creation of an environment supportive to innovation, highlight: identifying and adopting best practice, benchmarking and 'best in class'; and the use of branding to establish local/indigenous products or services and to attract a local market. Thomas, Miller and Murphy (2011),

In parallel, in critiquing traditional support approaches within innovation systems, Danilda and Thorslund (2011).focus on the creation of innovation milieus fostering collaboration between public and private actors, improved opportunities for information, experience and technology transfer aiming towards greater international competitiveness and sustainable development. In addition, they suggest male normative thinking in innovation limits the involvement of women and hence the potential of a gender perspective is missing.

As summarised by Brogren, Ovesen and Lugnet (in Danilida and Thorslund, 2011):

> "We can continue with business and innovation as usual if we want to produce 'more of the same' and take the high-risk track associated with a lack of a gender perspective. If, on the other hand, we would like to communicate images of modern industries, clusters and companies to attract human resources, capital and investments we need to improve existing practices and sometimes also break with the existing order".

Research approach

In this section the action research methodology which underpins the empirical research is discussed together with the methods of data collection and analysis.

The project is framed as long term action research given that it is predicated upon the diagnosis of a situation where change through practical action is required (Rowley, 2003). The situation requiring change is the gender gap in invention, innovation and entrepreneurship where, as has been widely acknowledged, women have long been and continue to be under-represented (Wynarczyk and Marlow, 2010). The practical action required relates to the need for inclusive, gender aware approaches to promoting, encouraging and supporting women innovators and innovation in women-led businesses (Danilda and Thorslund, 2011).

The action research process becomes progressively more specifically focussed through a spiral of steps (Dick, 2002; McNiff, 1988) of planning, data gathering, action taking, reviewing, planning and further action taking cycles (Rowley, 2003). In the case of the action research project which is the subject of this paper, the first

cycle in the action research spiral involved 32 women inventors and innovators who took part in. 'Together We Win'. This was a year long initiative of support and training interventions interspersed with group interviews to explore the perceptions of women inventors and innovators of obstacles they experience and support they need to access. The findings from group interviews held in January – July 2009 are reported ahead. As envisaged in the action research process, these findings were then reviewed and used to plan and action a second cycle of activity.

The second cycle was part of a wider EU project investigating teaching and learning approaches relevant to women entrepreneurs from 2008-2010. A specific aspect of the project focused upon exploring the learning and support needs of women in relation to creativity and innovation. This phase of the research project involved parallel group interviews in Wales, France and Lithuania with 59 women (25 of whom took part in the Welsh group interviews in April 2009). The research sample comprised two groups of women entrepreneurs. 'Aspiring' women entrepreneurs were those who had expressed the intention of setting up a business or who had been in business for up to 2 years. 'Existing' women entrepreneurs were those who had been in business for 2 years or more. The group interviews were supplemented by subsequent individual interviews and case studies to provide a greater depth of data and to access the experience of some leading women entrepreneurs in each country.

.The findings from the Welsh interviews are presented ahead with reference to the French and Lithuanian data where relevant also.

Barriers identified have been grouped together using the 3-part framework of analysis developed GHK/Technopolis (2008) which distinguishes between contextual, economic and soft obstacles. Barriers and support needs are also related to the 5M gender aware framework developed initially in the context of women's entrepreneurship by Brush, de Bruin and Welter (2009) to describe the social, economic and political contexts which impact upon the entrepreneurial opportunities, choices and restraints of individual women. The 5 elements of the framework comprise the traditional 3 Ms of management, money and market to which are added gender specific elements relevant to women: motherhood (micro environment or family embeddedness) and Meso/macro environment (spatial and institutional embeddedness).

The findings from the second cycle of action research are currently being used to develop a third cycle in the spiral, 'Engendering Innovation: Growth Programme for Women-Led Businesses, which will further develop and pilot some of the proposals outlined in the final sections of this paper.

Findings and discussion

In this section, the findings or results of the first two cycles in the action research project are presented and discussed. The findings from the first cycle provide data on obstacles and support needs perceived by women inventors and innovators in Wales.

The findings from the second cycle relate to obstacles, support needs and 'best in class'/benchmarking examples (Thomas, Miller and Murphy, 2011) also reported by aspiring and existing women entrepreneurs in Wales

Barriers, challenges, obstacles

Barriers identified in group interviews are indicated below. The individual barriers have been grouped using the categories established in the GHK/Technopolis (2008) report on women innovators and entrepreneurship to the European Commission: Contextual, Economic and Soft obstacles. Arising from **the first cycle** in the action research project, participants in the group interviews were asked:

What barriers have you encountered, or what is holding you back from realising your idea?

Contextual obstacles
Lack of computer knowledge; Educating a market; Product design; What materials to choose; Who can produce it – sourcing

Economic obstacles
Lack of funding to some extent; Funding; Financing

Soft obstacles
Lack of contacts; Difficulty in communicating the concept of the business/marketing; How to understand the process and plan of how to seek help from the agencies who are there; Confidence; Time management; Marketing; When to cut off (how to know when it's not going to work out and it's time to let go).

The **contextual obstacles** identified, centring on marketing and the innovation process, may be seen to highlight the impact of lack of educational or work experience in science and technology sectors. **The economic obstacles** identified align with previous research in relation to women and entrepreneurship as well as women's experience in innovation and invention. **The soft obstacles** identified appear to relate to previously noted areas such as lack of access to relevant networks and role models, women's negative self-perception regarding relevant personal and entrepreneurial skills but particularly may suggest the significance of lack of entrepreneurship training.

The challenges reported by existing and aspiring women entrepreneurs in respective group interviews in **the second cycle**, of the action research project are presented below. Again, the individual barriers have been grouped using the categories established in the GHK/Technopolis (2008) report on women innovators and entrepreneurship to the European Commission. The Existing (E) entrepreneurs group was asked: **What challenges did you encounter, if any, in introducing innovations in your businesses?** The Aspiring (A) entrepreneurs group was asked: **What do you think can prevent, constrains or limits creativity and innovation (internally) in businesses?**

Contextual
Time (E); Technology (E); Negative people (E); Technology/equipment (E); attitudes (A); staff (A); time (A); stress (A); people (A); negativity (A); tradition – unwillingness to change/fear.

Economic
Money (E); Costs (A); money/finance (A);.

Soft
Health and Safety (A); lack of support (A).

Other(which may be non-gender specific challenges)
Language barriers (E); Co-ordinating diaries (E); admin (A).

The **contextual obstacles** identified by Existing and Aspiring women entrepreneurs indicate quite similar difficulties with an emphasis on lack of time and stress (both of which were repeated several times by the research participants) and may indicate issues described in the GHK/Technopolis (2008) framework as 'Traditional views on the role of women in society'. This supported by the individual interviews and case studies and is congruent with research in women's entrepreneurship that identifies work-life balance issues and lack of time among the key inhibitors to women achieving their entrepreneurial potential. The following extract is from a case study undertaken with Carrie Shapiro-Riggs, Director of Carrie Elspeth Ltd, Winner of World Young Business Achiever Award for Excellence in Business Innovation and Creativity 2004:

> "The biggest challenge for me has been time management and balancing the work/life ratio -which has been the hardest aspect from the beginning- but it has got harder since having children. In the first few years I had no work/life balance – I only worked. Having kids made me question our work/life balance: there's no point having kids and never seeing them! I had to change the business so it could still grow without me being involved in every single decision." Carrie Elspeth Ltd, Case Study, WEEU project 2008-2010.

Further emphasis is given to issues around people and attitudes which is also supported in the interviews and case studies. Again, Carrie Shapiro-Riggs reported:

> "Getting people to take me seriously was difficult at first. I was 24 when I started and I did feel, especially when trying to get suppliers, that I was treated like a little Welsh girl! But I persevered and now we get suppliers coming to us, which is satisfying. It wasn't a hobby and even today I get people who think I'm just playing with beads! I don't bother trying to convince people anymore: I'm just quietly confident". Carrie Elspeth Ltd, Case Study, WEEU project 2008-2010.

The **economic obstacles** identified again align with previous research in women's entrepreneurship and innovation where lack of access to finance is a major and

complex issue involving demand and supply side factors (Carter, 2006). The resultant restricted start-up capitalisation inhibits women from achieving their full potential in the long as well as short term which is reflected in these findings reported by both groups of respondents.

In the second cycle, **soft obstacles** appear to be less significant but may suggest that the research participants were already involved in relevant networks and had thus begun to overcome some potential barriers. This is clearly an area for further investigation.

Support needed

Participants in the **first cycle** of the action research project were asked **What support do you feel you need?**

The majority of research participants used this question to describe their experience to date of support for embryonic inventors and innovators resulting in a negative picture of a system that was [in 2009] confusing, circuitous and time wasting with comments such as 'circular route, vicious circle and 6 months lost along with the will to live!', 'A key difficulty experienced in accessing support is the need to be able to prove that you can have a turnover of £90k in the first year when actually all you have is a concept'.

What support would you like from a targeted initiative to encourage women inventors and innovators?

Help with sourcing; Money for prototyping; A business plan template for use in preparing to pitch to investors; Marketing advice on product placement; Funding; How to obtain licenses for business; Information and advice on intellectual property rights; Help with money, materials, product design; A confidentiality agreement; How to find contacts; Introductions to the right person for the right thing; Venture capital, business angels; Interim funding.

Participants in the **second cycle** of the action research project were asked to identify leading innovative companies in their respective fields ('best in class') for benchmarking purposes. These included, for example, Michon de Reya, a law firm founded in London in 1937 and now operating in London and New York. The company has received numerous awards within the legal profession but also is accredited by Investors in People and has been named four years running in the Sunday Times 100 Best Companies to Work For. Another company mentioned was Haagen-Dazs, well known for innovation and with the accolade of being the first ice cream company in the world to introduce ice cream bars for an adult market.

The group interviews were supplemented by individual interviews and cases which revealed the importance of determination, resilience and expertise, the significance of introducing relevant ICT processes and the critical importance of obtaining appropriate and relevant support, particularly from well networked mentors.

> "… having a business mentor was also a great help. The very first meeting I had was invaluable because my mentor helped me to get my prices right – it's such a fundamental issue and incredibly relevant to my business success that I got it right so early on. … I'm very much in favour of mentors as well as business networks, which are crucial in the early stages". Carrie Elspeth Ltd, Case Study, WEEU project 2008-2010

Within the findings in the section on support needed there are echoes of the contextual, economic and soft obstacles framework discussed above. However, these findings are also congruent with the 5M gender aware framework: management, money, market, micro environment and meso/macro environment (Brush, de Bruin and Welter, 2009) describing the social, economic and political contexts which impact upon the entrepreneurial opportunities, choices and restraints of individual women. Clear information, advice and education/training needs emerge together with useful support strategies. These will be commented upon further in the final section on conclusions and implications.

Conclusions/Implications

The results from the action research project to date are consistent with previous work and extend extant understanding of the barriers women innovators may encounter and the support interventions they need. The findings support the 3 part framework of contextual, economic and soft obstacles identified in recent EU research on the promotion of women innovators and entrepreneurship (GHK/Technopolis, 2008). However, it was noted that the model does not allow for non-gender-specific obstacles, some of which were reported by research participants. Equally, the identification of barriers, support needed and relevant support strategies is congruent with the 5M gender aware framework initially developed in the context of women's entrepreneurship (Brush, de Bruin and Welter, 2009).

Arising from **the first cycle**, overt key needs may be summarised as: networking skills, marketing and product placement skills; understanding of the invention and innovation process and frameworks of support; time management skills; access to finance, interim funding and financial skills, help with product design, sourcing; preparation to pitch to investors; information and advice on licenses, intellectual property rights and confidentiality agreements; access to role models, professional contacts and mentors; knowledge about and access to venture capitalists and business angels.

Arising from **the second cycle**, key findings in addition to those above may be summarised as women's reluctance to believe in their own creative ability, lack of confidence in presenting their ideas, less experience in science, engineering and technology and less experience of invention and innovation (less in relation to the

former than the latter) and lack of knowledge about achieving investment to take their ideas forward and lack of entrepreneurial and management skills.

In order to meet these needs, a dual approach is proposed involving both targeted initiatives for women innovators which would also prepare and support them to access mainstream support. At the same time, it is proposed that the mainstream support for innovators, the innovation milieu, is developed to become more gender aware, sensitive and above all, responsive. Targeted initiatives should include learning programmes to enable individual women innovators to develop relevant knowledge and skills. However, they should also be underpinned with awareness raising to enable women to better understand the gendered contexts within which they operate. The value of networking, mentoring, benchmarking (or 'best in class') has been demonstrated in the findings and such initiatives should also be promoted. Although it does not emerge directly from research participant responses, secondary sources indicate also the necessity to engage with internationalization. In addition to 'gender-proofing' the innovation milieu, it must become easier to access and must be developed to become more efficient and effective in providing bridges between innovators and the specialist support they need from initial idea to investment and delivery to the market.

The results will inform the third cycle in the action research project which, in line with the proposals outlined above, will challenge the orthodoxy of current business and innovation support and build a demonstration programme of intensive support designed around the diverse needs of women-led businesses.

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