Triple Helix VIII-International Conference on University, Industry and Government Linkages

20-22 October, 2010

Total Control? : The gendering of the 'Triple Helix'.

Dr Alison Parken and Professor Teresa Rees
Cardiff University, UK

Abstract

Innovation in the knowledge economy, as described by Henry Etzkowitz and Loet Leydesdorff (1997), is understood as the interaction of policy, funding, research and commercialisation activities by government, universities and businesses.

This paper considers how definitions of the knowledge economy have an impact upon the gender beneficiaries of policy, research or business funding and provides an overview of gender mainstreaming within European Commission economic development policies. It describes a policy review of the relationship between the strategic economic plans of regional development bodies and their gender priorities. It provides a political arithmetic of women's participation in knowledge economy governance, research and business enterprise in the EU. It draws upon empirical findings from recent case studies within the EC 6th Framework Programme funded project *EURODITE* on the knowledge dynamics of regional economies. From this research, we examine often unrecognised knowledge work that women are contributing to knowledge economies.

Key words: economic policy, knowledge economies, 'Triple Helix', gender mainstreaming,

Thematic Workshop 7:

Gender mainstreaming in innovation system and triple helix constellations

Introduction

Research partners from 19 countries have just completed a five year European Commission Sixth Framework Programme project called EURODITE on regional trajectories to the knowledge economy. Its focus is on knowledge transfer, within the 'Triple Helix' of economic actor locations identified by Etzkowitz and Leydesdorff (1997) as government, businesses and universities. EURODITE partners examined how knowledge generation for innovation is created and transferred across networks and sectors in territories associated with particular industries. So, for example, watch-making industries in Switzerland was studied as an example of knowledge transfer in a Knowledge Intensive Business (KIBs), tourism was considered in Sweden, where the success of *Wallender* has inspired a tourist trail associated with the settings in the novels in Skane, and automotive industries were examined in car making regions of the West Midlands in the UK, Lower Saxony in Germany and Gothenburg in Sweden.

In total, seven industry or service sectors were studied: Information and Communication Technologies (ICT), New Media, Bioscience and Food, and those listed above. In so doing, this research has covered a wider range of sectors than the technology ones more usually associated with the concept of the knowledge economy. EURODITE produced 22 case studies of knowledge dynamics in these sectors and territories, from the 19 countries. The team also produced firm 'knowledge biographies'. The 44 combined EURODITE reports are the source material for the case study data presented here[1], but our focus is on gender in the knowledge economy.

Gender in research continues largely to be viewed as relating to women as persons, not as a mode of social and economic organisation. The European Commission has recently published guidance to address this in Framework Programme Research in keeping with the *Gender Action Plan* 2005 (Yellow Window 2009). Similarly, Londa Shiebinger at Stanford University has published examples where addressing the

[1] http://www.EURODITE.bham.ac.uk/

gender dimension of research leads to innovations (Shiebinger 2008). Our role on this project as gender experts was to assist EURODITE partners to mainstream the gender dimension in their theoretical and empirical research work. This involved providing inputs on gender theory and its relevance to research work across the numerous academic disciplines of team members, such as economic geography, economics and management studies. This was quite challenging; it would appear that not all of these disciplines have as yet fully engaged with feminist critiques of their founding theories which are based on masculine subjectivities. However, all but one of the final reports produced data disaggregated by gender, even if some were examples of what Harding (1993) would describe as 'adding women in'.

We analysed these reports to produce two papers for EURODITE. The first was a synthesis of gender policy in economic development at EU and regional governance levels (Parken 2010 and Halkier et.al. 2010). The second combined a 'political arithmetic' of women in science, business and government in the EU with data from the case studies (Parken 2010a) to plot where women operate. In this paper we focus on the data yielded by the case studies on the kinds of knowledge work that women are engaged in and its contribution to the value chain. We begin with a consideration of the knowledge economy as a gendered concept and a mapping of women's contribution in the 'Triple Helix' centres of knowledge dynamics.

Knowledge Economy: A gendered concept?

The concept of a knowledge economy or economies is contested. For EURODITE, Burfitt *et .al*. (2007) identified definitions from economics, economic geography, sociology, organisational studies and social policy. These range from sociological and cultural descriptions of the shift to 'knowledge based societies' (KBS), through to the increasing application of ICT within a wide range of occupations in global economies.

A narrower view within economic geography understands knowledge economy as research and development focused upon technological innovation. Measuring progress towards the *Lisbon Treaty* vision of a dynamic knowledge economy with

quality jobs and greater social cohesion, Eurostat, the European statistical service, consider only:

> … output and employment for high-tech manufacturing activities and knowledge intensive services
>
> (Amil et. al. 2007:1).

Beyond hi-tech manufacturing and business services, the significance of education and health services to knowledge economies, where more women participate has been suggested:

> … high to medium high technology manufacturing and communications industries, finance and business services, and health and education, recreational, cultural and sporting services. (Mahdon 2007: 11).

However, the concept of knowledge economies tends to remain closely associated with technological innovation (Blake and Hanson 2005). Pettersson has previously noted the 'gender-blind' operation of innovation policies in Denmark, Finland and Sweden (2007). Given patterns of gender segregation in education and employment government investment in economic growth narrowly concentrated in Science Technology Engineering and Mathematics (STEM) academic disciplines and associated businesses, leads to a system that favours funding the work that men do.

In their series of reports on the knowledge economy (Brinkley 2008; Mahdon *et.al* 2007; Rudiger and McVery 2007) suggest the significance of intangibles such as brand values, human capital and processes for knowledge transfer (Mahdon *et. al*. 2007: 4), which may be as important as controlling land and labour in the emerging economy (Cooke 2006):

> … general purpose technologies have combined with intellectual and knowledge assets 'the intangibles' of research, design, development, creativity, education, science, brand equity and human capital to transform economies across Europe. (Rudiger and McVerry 2007: 11).

It is in these symbolic knowledge occupations that we have identified women's participation particularly. The EURODITE case studies offer an additional opportunity to consider the importance of such roles in value creation.

Diane Perrons, working within in economic geography, takes the gendering of labour markets into account to describe a shift to a 'new economy' (2004, 2005, 2007). New, 'quality' jobs have produced growth in male employment. A similar rise in poorly paid social care jobs, characterised by part-time contracts and low earnings, has accounted for most of women's increased employment in the last decade (Perrons 2005, 2007). Social care work requires considerable application of knowledge, but it does not conform to the characteristics of knowledge work as defined, and is not valued as such.

The definition of knowledge economy sectors affects the focus of investment by government in university and business commercialisation projects. A gender beneficiary assessment of funding programmes for 'Knowledge Transfer Partnerships' in Wales in 2009 revealed that women 'lead-researchers' received just 11% of the funding, totalling £413k, whilst men received £3.5m (Parken and Rees 2009).[2] Such a gender beneficiary analysis of public spending is legally required under the Gender Equality Duty 2006 in the UK, but as we shall see in the discussion of economic development policy below, these are not being routinely produced.

Investment decisions focused narrowly in male dominated sectors miss the opportunity to support innovation and the application of new technologies in areas of traditional female work (Parken and Rees 2009). Thus further work on how gender affects the composition, communication and output of knowledge work and the impact and constraint of largely segregated networks is required. What kinds of distinct ways of working and knowledge generation might women be engaged in? Do they differ from male gendered 'norms'? For example, Larner and Malloy's (2009)

[2] Source: Compiled from the Knowledge Transfer Partnership Projects database, on-line, viewed 30th June 2009. Some lead researchers had more than one project. Further Education projects were not included as lead researchers were not recorded.

discussion of women's domination of the conception and growth of a multi-million dollar niche fashion industry in New Zealand reveals significantly different values, division of labour and ways of working than characterises the male dominated global fashion industry. The gendering of knowledge economy concepts and behaviour needs to be further explored.

Women's involvement in 'Triple Helix' occupations.

Economic Development

Occupations in the 'Triple Helix' concerned with driving the knowledge economy are hard to define as there is no occupational data set for 'knowledge workers' (Brinkley 2006). They include graduates in the top three occupational strata: *Managers and Senior Officials; Professional and Associate Professional;* and *Technical* (Brinkley 2006, OECD 2006). However, analysis can begin within the sectors designated for government policy and funding support. For example, the European Union's economic strategy, *Europe 2020***:** *A strategy for smart, sustainable and inclusive growth* (EC 2010), states that:

> The Commission will draw up in 2010 a trade strategy for Europe 2020 which will include:
> …. Trade opening initiatives for sectors of the future, such as "green" products and technologies, high-tech products and services, and on international standardization in particular in growth areas
>
> (EC 2010: 22)

Although the strategy also discusses how investment in Research and Development (R&D) in new technology will benefit traditional sectors (EC 2010:9), it is clear from the first announcements of funding under the Seventh Framework Programme which sectors are seen to be at the core of the strategy:

> In health research alone, around €206 million – one-third of the overall budget for 2011 – will be spent on investigator-driven clinical trials to get new medicines on the market quicker. In nanotechnologies (€270 million), the focus will be on research that could lead to patenting and commercialisation opportunities. Around €600 million of ICT funding is earmarked for next generation network and service infrastructures, robotic systems, electronic and photonic components, and digital content technologies. More than €400 million will support research into how

> ICTs can address challenges such as a lower-carbon economy, an ageing society, and adaptable and sustainable factories. €90 million is also earmarked in 2011 for the Future Internet Public Private Partnership to make key European infrastructures "smart" … Environment research projects will get about €205 million.
>
> (EC 2010a:3) (our emphasis)

That health is included initially appears to be good news for the inclusion of women, although, the European Commission's *SHE Figures 2009* on women scientists in Europe, discussed in more detail below, demonstrate how few women professors and lead researchers there are in biotech, nano-science and genetics (EC 2006, 2009). Elsewhere, the 2020 strategy mentions women specifically, along with older persons, in relation to the need to increase their employment rates; that is with regard to increasing basic skills and obtaining entry level jobs. Discussion of women's specific inclusion within 'quality' jobs is absent. This situation is mirrored in the analysis of evidence of gender mainstreaming within economic development policy actors.

Economic Policy and Gender

All new EU policies are subject to equality impact assessment for all strands of inequality (see Parken 2010b). However, our analysis of economic development policies (for EURODITE WP8, policy synthesis) found little evidence of gender mainstreaming operating outside of the *Directorate-General for Employment and Social Affairs* (DG5) at the European level. Only one specific initiative for women was evident from an analysis of policy and programmes within the *Directorate-General for Regional Policy*. Within the newly created *Institute for Enterprise and Innovation,* there is a business 'start-up' programme for women.

For EURODITE, Halkier's (2009) website policy audit of the main economic development decision-making structures (180) in twenty two European regions (representing a quarter of all those in existence), found that 63 recorded the gender balance of their Boards in a publicly accessible manner. Eleven had attained gender balance (on the 60/40 principle), two had absolute gender balance and one was female dominated.

The policy profiling revealed that:

> The self-proclaimed gender neutrality of policy measures is clearly evident: for more than 70 per cent of organisations surveyed no gender strategy has been identified (calculated on the basis of the RDA survey 2007 database), while mainstreaming (Sweden) or separate initiatives (UK, Ireland) prevail in only two [three] member states.
>
> (Halkier 2009:9)

Following these findings, a purposive investigation of the websites of regional development bodies in the UK and Sweden was undertaken to assess the inter-relationship of gender and economic regional policies. In the UK, legally required gender equality strategies were not linked the regional economic strategies with the exception of the London Development Agency. Rather, UK bodies action plans focused almost exclusively on internal workforce initiatives (for example gender pay gap, flexible working). Only in basic skills and business start-up programmes designed to assist participation in paid work were women discussed. The UK bodies are operating an equal treatment approach based on presumed gender neutrality, which leaves the gender of programme beneficiaries in knowledge economy sector policy and funding unexamined.

While women run businesses across the industry spectrum, they are most likely to start them based on the knowledge and networks gained through their employment experience; hence most of women's start-ups are in personal service and lifestyle businesses (Allen *et.al* 2007:11). They are generally not found amongst the recipients of specialist start-up programmes for business owner/managers of in design, technical or knowledge intensive business services or their academic counterparts - 'academic entrepreneurs' (Cooke (2006).

The Swedish review provided the only example of a gender reflexive knowledge economy based sector policy. The initiative *Vinnova: Research and Development for Sustainable Growth* provides a programme called BEGINN:

> Programme aimed at supporting the development of the competence area of integrating gender perspectives for equality and growth and promoting the emergence of actors within the field using such means as R&D

> projects, research schools and strong milieus (Vinnova 2009): http://www.vinnova.se/In-English/Activities/Working-Life-/Needs-Driven-Gender-Research-for-Innovation/

This programme is not targeted at women but is rather an example of gender mainstreaming within sector funding. The Swedish development agencies gave more prominence to their gender mainstreaming principles, equality targets and the governance and policy machinery to facilitate structural change. More gender data was available for governing boards and senior managers but again, projects were mainly focused upon labour market participation (although addressing occupational segregation was a stated aim).

In summary, the Regional Development Agency comparison exercise revealed little gender data or policy action informing gender equality perspectives within the knowledge economy or knowledge transfer activities, innovation or research/investment grants. There was no evidence of gender reflexivity in sector policies - automotive, bioscience, ICT etc. or in the choice of sectors for funding.

Significantly EURODITE partner reports, without exception, across all sectors, reported that the lead policy actors in the knowledge transfer activities researched were men.

Of equal concern is evidence from Catalonia, where bioscience strategy has had exactly the sort of unintended consequences that gender impact assessment of new policy should highlight. Colobrans Delgado (2008) finds that the region's economic policy was based on providing highly skilled bioscience technicians at lower pay rates than other EU regions. This was achieved by increasing the number of graduates competing for these jobs, forcing salary rates down. The economic policy has had the effect of 'gendering' an occupation:

> … Therefore, we can conclude that in the case of Catalonia, the rise in the presence of women in the innovation system is due not only to their educational level but also to their willingness to accept working conditions which men have traditionally rejected. This behaviour has led to lower personnel costs. Thanks to women, then, Catalonia is competing internationally in generating low-cost knowledge. (Colobrans Delgado 2008: 105).

Such policy assumes the heterosexual breadwinner/homemaker or dual earner model with women on component wages (Siltanen 2002) described as the 'gender contract' (Pateman 1989) of household and labour market organisation. This model suppresses pay rates in 'women's work'.

Women have benefited from increased participation in higher education, and are now the majority of undergraduates in the EU (EC 2009). The question remains as to whether they are enjoying the rewards of this increase in human capital in the occupations associated with involvement in the 'Triple Helix'.

Gender segregation in quality jobs

Leaving aside the over concentration of women in low skilled, low paid work in the EU, they are 30% of full time legislators, 45% of professionals, and 47% of Associate and Technical Professions (Eurostat 2009).[3] However, health care and social services, retailing, education and public administration accounts for 48% of women's employment in the EU (Burchell *et.al.* 2007:10).

With regard to occupational and contract segregation this situation can be summarised thus:

> Women hold the majority of jobs in clerical (69%), service and sales (58%), and technical or associate professional positions (56%). Two occupational categories – professionals and unskilled workers – are gender-balanced at this level of aggregation.
>
> However, segregation is evident when a finer breakdown of occupational sub-categories is examined. A higher proportion of professionals and technicians in physical, mathematical and engineering science positions are male. Meanwhile, teaching, life science and health professionals are more likely to be women.
>
> (Burchell *et.al.* 2007: 10-12).

[3] Data extracted and analysed from Eurostat: LFS Series, Detailed Annual Survey Results, Employment by sex, age groups, and professional status and occupations (1000), extracted 4/12/09. Tables D07 - 54

Women's science careers in the academy, government and business sectors are regularly reviewed in the European Commission's *SHE figures*. In 2006, the EU25 average proportion of women researchers in these sectors was 37%, 39% and 19% respectively (EC 2009).[4] Overall, women are 59% of current undergraduates.

Women account for 19% of the academic professoriate (Grade A positions) in the EU; the designation most likely to provide lead researchers for knowledge transfer funding applications.[5] They are just 7% of Professors in engineering, 13% in natural sciences and 17% in medical sciences.[6] In the government sector there are similar numbers of men and women working as researchers in humanities but 73% of engineering researchers are men (EC 2009:4)[7].

In the EU27, women account for 17.3% of researchers in manufacturing and 38% in pharmaceuticals in the business sector, the highest proportion in all other NACE codes for manufacturing. [8] Women's participation rates in this sector remain higher in the former Soviet countries, especially in engineering and technological careers. This has been attributed to the promotion of women into science careers combined with lower status of these occupations in these countries (Genin 2009:85).

The *SHE Figures* time series demonstrate considerable growth in the number of women PhDs and female researchers, but caution that these headcount figures will mask gender difference in employment and study contracts with many more women

[4] Source: *SHE Figures 2009*. Figure 1.7 Proportion of female researchers by sector, 2006**,** Eurostat S&T Statistics *(WiS database, DG Research for IL)*, EU-25 calculated by DG Research (2009). http://ec.europa.eu/research/science-society/index.cfm?fuseaction=public.topic&id=126

[5] Source: *SHE Figures 2009* Table 3.1: Proportion of female academic staff by grade and total, 2007 Eurostat S&T statistics, EU-25 calculated by DG Research (2009).
[6] Source: *SHE Figures 2009*, Table 3.2 Proportion of female Grade A staff by main field of science, 2007, Eurostat S&T Statistics *(WiS database, DG Research for IL)*, EU-25 calculated by DG Research (2009).
[7] Source: *SHE Figures 2009*, Table 2.8: Proportion of female researchers by economic activity (NACE) in the Business Enterprise Sector (BES), 2006, Eurostat S&T Statistics *(WiS database, DG Research for IL)*, EU-25 calculated by DG Research (2009).
[8] Source: *SHE Figures 2009*, Table 2.8: Proportion of female researchers by economic activity (NACE) in the Business Enterprise Sector (BES), 2006, Eurostat S&T statistics .EU-25 calculated by DG Research (2009) NACE refers to Statistical Classification of Economic Activities in the European Community. The abbreviation to NACE is taken from the French for this phrase

employed/studying part-time compared to men, which will have a subsequent impact on career progression. The growth of women's participation in research work, now at a faster rate than that of men, is in education subjects. Science, mathematics and computing (especially engineering, manufacturing and construction) PhDs continue to be dominated by men (EC 2009:40-41).

Vertical segregation, according to the most recent *European Commission Annual Report on Equality,* has remained unchanged or in some cases increased in recent years (EC 2009a). The effect of the gender disparity within the knowledge generation occupations that comprise the *Triple Helix i*s a source of concern for the EC:

> Women are seriously under-represented in the business enterprise sector where the EU's R&D is most highly intensive; and in senior academic grades and influential positions where strategies are set, policies are developed, and the agenda for the future is determined. (EC 2006:14).

In summary, women are significantly absent from the places where decisions about, and involvement in, the transition to knowledge economies is taking place. Social inclusion affects the pace of change to knowledge economies according to the WELLKNOW report for the European Commission (2007). Here the transition is identified as closely linked to welfare regimes. Where social protection, care provision and flexibility are greatest, in the Nordic model, transition to knowledge based societies has been faster and more inclusive. Mediterranean countries show the slowest transition, with Continental and Liberal Economic societies in an intermediate position but showing greater social divisions in participation (EC 2007).

The EURODITE case studies: Consumerism and gender reflexivity?

Within EURODITE, Cooke (2006) and Manniche (2010) have defined knowledge creation phases as exploration (broadly analytic inquiry in universities), examination (synthesising analytic knowledge with technical knowledge to engineer applications) and exploitation (use of symbolic knowledge in learning activities, commercialisation, marketing and branding). Government funding to universities and businesses are

heavily concentrated in the first two phases. However, it is in the last knowledge phase where the greater involvement of women has been identified through the EURODITE case studies. We should note that in automotive, ICT and new media, no women were identified as the lead actors, either in business, the academy or policy making, in the case studies. Women were apparent in food and tourism as business owners, and one lead policy actor was identified in Sweden but she was an entrepreneur working with government agencies. Women were the majority of laboratory technicians in the case studies but were not leading the knowledge transfer being studied. They were present in all industries in support roles: sales, customer service and marketing. It is in this last, symbolic knowledge, occupation in KIBs and automotive that the following discussion is focused. However, tourism will also be discussed as providing a further example of use of symbolic knowledge.

Diversity: women's work in the knowledge economy

Given women's employment in the narrow range of industries and occupations described above, the automotive, KIBs and tourism EURODITE case studies stand out from a gender analysis perspective for their involvement in knowledge generation. [9] They are of interest in the first instance because of the use of women in symbolic knowledge roles that required them to combine their professional knowledges with tacit 'gendered knowledges', to inform product branding and marketing. Secondly, there was recognition of some women's role as consumers in their own right - reinforcing companies' interest in 'buying' their consumer knowledge through marketing positions.

Diversity management (DM) (Kandola and Fullerton 1998, Kirton and Green 2004, Rees and Parken 1999) is an equalities strategy driven by human resource management policies. In a classic 'dual' strategy, attainment of a diverse workforce is said to bring tacit knowledge about cultures and sub-cultures to design and marketing functions. At the same time, public knowledge that the workforce is diverse lends credence to the brand. The aim is to create products with niche (but

[9] Whilst steps have been taken to anonymise the firms in the case studies we are aware that they may be identified from regions and so only country identifiers have been used here.

essentially wider) appeal for different market segments. This phenomenon of 'buying' 'outsider' knowledge by age, gender, sexual orientation (targeting the 'pink pound'), disability, religion or ethnicity is a form of knowledge generation based in diverse cultural learning and experience. Such approaches can also reveal traditional social practices based on a previously unexamined subjective male, white heterosexual 'norm'. It is however, concerning that ascriptions of 'insider' knowledge by inequality grouping can quickly turn into new stereotypes.

In the Swedish automotive case study, researchers found that the engineering knowledge networks were almost entirely comprised of men, but that a few women had established a niche in engineering occupations seemingly associated with ascribed gender roles:

> Based on several independent interviews crash-safety seems to be an exception to the general stereotype. One woman who is currently in a leading position at [FKD] Safety Research Centre estimated the share of women to be 20%, while at her former position in the Mechanics laboratory 2 out of 50 were women. One possible explanation is that the more human and "soft" values connected with safety and especially child-safety appeals to women and has over time created a working environment that is more tolerant in terms of work organisation.(Larsson, 2009a:17).

In another example, women's gendered knowledges had been specifically employed to create a concept car and one that might then appeal to women consumers:

> The main driver behind the project was an understanding that the knowledge of female engineers and designers inside [FKD] could contribute to new functional and design concepts as well as creating a favourable position for the company in terms of targeting the growing market of women car owners. Some of the ideas, including a focus on women as an independent "market-niche", were part of the marketing of the [ABC] model when it was introduced in 2006. (Larsson 2008: 18/19)

In the first example it is almost suggested that women have a 'natural affinity' for car safety design. Also that flexible working may be more achievable in this less male dominated area of engineering. This suggests that the gender composition of an occupation creates working cultures and practices but also that changing that composition will change them.

However, in automotive, generally women were limited to working within manufacturing production as machinists in the *'trim shop', sewing seat covers*' (MacNeill *et.al*. 2009: 67), and in support and administrative roles, including marketing:

> The industry, in common with all engineering sectors, is male dominated. Women employees tend to be concentrated in the downstream areas of marketing, branding and customer relations. (MacNeill *et.al.* 2009:14).

For the UK car firm, women's presence at marketing events, which were held both as profit ventures and to promote the premium brand, lead to a recognition that women were potential customers in their own right, as well as being influencers and opinion formers. This has lead to gender reflexive advertising, branding and media buying:

> However, while [FKD] buyers are mostly male, the events customers are mixed. This has led to a re-branding of the car via 'Lifestyle' magazines as well as the motoring/engineering press. (MacNeill et.al 2009: 21).

This suggests that new occupations within male dominated knowledge economy industries can become 'women's work; reproducing gendered segregation. Women working in safety engineering are combining gendered knowledge with professional engineering (synthetic) knowledges. In the low paid work sewing work, sewing is ascribed as a 'natural gift' and therefore not viewed as skilled (although the Ford Machinists strike in1968 attempted to address this perception and was influential in the introduction of equal pay legislation in the UK). Women in marketing are combining professional marketing (symbolic) knowledges with presumed to be 'natural' (not viewed as a skill) communications abilities.

Gendered ascriptions of skills and abilities for women have been evidenced across a wide range of occupations from tourism to retail sales, new media, printing, engineering call centres, financial services and ICT (see Acker 1990, Adkins 1995,

Cockburn 1985, 1988, 1991, MacEwan Scott 1994, McDowell 1997, Perrons 2004, Taylor and Tyler 2000, Webster 2007).

The Swiss watch-making industry is based upon a clear division of labour between men in technical and engineering functions and women in administration, sales, marketing, customer services and public relations roles. In this case educational outcomes are suited to the industry in the TKD, with many arts graduates finding employment. Educational capital is being realised by these qualified women. Women's work involves generating brand attributes, often gendered in their customer orientation, particularly the creation of quality and luxury brand associations for marketing.

The place of marketing, branding and communications in the knowledge chain has grown in importance as products have become more homogeneous technically. The symbolic knowledge work of distinguishing products and building brand value has become dominated by women, often in entrepreneurial roles in public relations, event and media management (Jeanerat et.al 2009). However, the high status and valued knowledge in the industry is the synthetic knowledge of male engineers. (Jeanerat et.al 2009:28).

The researcher noted that the women who were running these successful public relations companies did not recognise the central value of their own symbolic knowledges to the industry. Along with the example in the bioscience report from Catalonia, this is the only case study where women, albeit in support roles, are driving the knowledge dynamic.

With regard to gender equality policy, the German automotive case study noted the same patterns of gendered segregation as the UK and Sweden (Blocker and Jurgens 2009: 34). Here, public sector education and skills policies were combined with company initiatives to address skills shortages in engineering by addressing gender segregation:

> Schools/universities: In Germany there are a whole series of programmes at both the national and state levels to promote "girls and women in male occupations." Not least because of the supposed scarcity of engineers perceived by engineering professional associations, technical universities

> and universities of applied science have launched special programmes to support women in the natural and engineering sciences. However, the proportion of women has hardly increased in recent years. At the TU *(Technical University)* Braunschweig, the share of women studying electrical engineering in 2007 was 11.4% and mechanical engineering 15.1%.
>
> (Blocker and Jurgens 2009: 33)

> At [FKD] in 1980s …. was one of the first employers to promote equal opportunities for women and men. At that time, a Commission for the Advancement of Women chaired by the Board of Management member responsible for human resources was set up. As a result, the [FKD] Group is one of the organisations in the still male-dominated automotive industry with the highest proportion of women among its workforce
>
> …. 20 percent of apprentices in the manual and technical trades recruited by [FKD] have been women. … [FKD] offers young women the opportunity of comprehensive vocational orientation. Apart from the "open days" held by [part of FKD studied] especially the "Girl's Days" …
>
> (Blocker and Jurgens 2009: 35)

However, UK firms and the regional economic development body responsible for economic development and gender equality policy were not willing to address gender segregation:

> Within both the industries [second FKD was in computer games] and at a regional policy level there was a clear awareness of gender segregation but this was generally accepted as 'how things have always been'.
>
> Most interviewees thought that gender imbalances were the result of individual preferences and emphatically not the result of discrimination. Perhaps for this reason, there was little appetite for positive action to improve the gender balance in these sectors either by encouraging more women to study for engineering/maths/computer programming qualifications or more direct measure to favour women. This is despite the fact that interviewees in both automotive and computer game firms said that they faced skills shortages.
>
> It is also in spite of the fact that public bodies have clear gender equality targets and official policies in place.
>
> (MacNeill 2009: 68).

Here, rather than 'natural' skills seen to suit women for women's work, the discourse around not working in male dominated occupations is one of personal, individualised 'choice'. Diversity management is not being driven in the UK by the business case regarding skills shortages or by the social and economic justice underpinning of equalities legislation in relation to public policy. In these respects the equal treatment or gender-blind equalities approach was operated. Diversity management is driven from within firms, by consumerism. Evidence of gendered product preferences was changing components and design:

> Nonetheless women make up a small but increasing proportion of owners and the firm recognises that their classic models are more appealing to women. Importantly, female partners were said to have a critical influence on purchase decisions which are usually made by couples. …. The newer models, for example, have lighter steering and clutches and the seats can be adjusted to suit female drivers who are likely to be shorter, etc. Female customers' feedback is therefore channelled into the development team.
>
> (MacNeill *et.al* 2009a: 36/37)

This knowledge is useful too, presumably, for those shorter men on the overlapping bell curve of height and sex (Birke 1992). Although the private sector has long created and used gender preferences as marketing tools, this example illustrates the inability of DM as an equalities approach to addressing systemic inequalities. Resistance from firms and policy makers is evident when gender reflexivity might suggest different targeting of training or changing cultures should encourage women in – even though this might challenge the gender 'norm'. But in consumerism, when the 'norm' for whom the brand has been built is consciously identified, changing that 'norm' to accommodate difference can be incorporated for a niche market. This does not affect the 'norm' but extends the potential pool of customers.

In relation to knowledge products, these case studies raise the increasing significance of women as consumers, along with the question of whether current designs meet their preferences. The idea of diverse teams, with market knowledge or at least the ability to use tacit knowledge to inform marketing and customer survey or research work seems attractive. Multi-national companies have attributed diversity

within teams as producing better decision making and enhanced creativity, leading to increased competitiveness (EC 2003).

The significance for women working in the knowledge economy in symbolic knowledge roles (marketing and branding) is the effect of a gendered value chain. The engineering and marketing functions are interdependent for the success of the companies: no product - nothing to market, no marketing - nothing to make. However, in both the automotive sector and in watch-making, the status and value in the knowledge generation phases are seen to rest almost entirely with the engineers and designers. Engineers need the knowledge captured in the marketing function from customers (symbolic knowledges), so that they can apply this market intelligence to design (synthetic knowledges), but this interdependence does not impinge upon the image of the male engineer/technician as pivotal.

Finally an example from the Turkish tourism market demonstrates the purchase of women's symbolic knowledge in service industries. Briefly, Russian tour operators, have acquired a considerable amount of the available holiday accommodation in a particular area of Turkey through a system of electronic reservation, marketing in Russia and the Baltic States, and resort acquisition. Whilst the business owners and regional municipal and regional actors creating the knowledge transfer are all men, large numbers of women from Russia and the Baltic States are employed to create a 'home from home' experience for the tourists (Dulupçu 2009).

Employed primarily in low paid work in occupations such as administration, reception, personal care, childcare, cleaning and house-keeping roles in hotels and resorts, women were utilising symbolic knowledges by offering guests communication in their own languages and recreating the cuisine, traditions, culture and customs of 'home' through their performance of work identities. This is the generation of symbolic knowledge via economic migration.

This kind of service work in tourism has been described as involving both routine sexualisation and harassment of women workers (Adkins 1995, Taylor and Tyler 2000), and women providing emotional labour as part of the service experience (Kanter 1977, Adkins 1995). It has been described as 'buying the person for a

moment in time' (Skidmore 1999) as an integral part of the goods or services purchased. A convincing hetero-gendered presentation of self (Parken 2003), is required to enhance the appeal of the product/service (Adkins 1995; 2000).

In the transition to the knowledge economy, some niche areas of work are created where women can make a significant contribution, particularly in symbolic knowledge and customer facing roles. However, the transition is also reinforcing the higher status of men's work in the sectors of analytic and synthetic knowledge deemed to be worthy of investment in the knowledge economy.

Conclusion

In liberal economies, where the transition to the knowledge economy has been slower and less inclusive than in the Nordic countries, the ideal of meritocratic individualism is supported in public policy, despite legal duties to promote gender equality systemically. Women, in symbolic knowledge roles are being asked to raid their gendered knowledges and the gender stereotypes they hold, and combine this with symbolic knowledges in marketing for the sale of consumer goods. Will this elevate them to the status of the individual self-interested rational actor of liberalism? Is this as far as gender equality can go in liberal states?

In these roles, and in bioscience laboratories, women were driving the knowledge dynamic but from subordinated positions. There may be more injustices, such as the one suffered by Rosalind Franklin when Crick and Watson used her data to identify DNA and were awarded a Nobel Prize. Without women's substantive representation in the areas of the knowledge generation in the 'Triple Helix', the academy, government and business, where they can collectively influence the direction of science, policy and innovation, a version of the future based in male subjectivities is being created.

Funding and investment is to be targeted in areas of science and sectors of technological innovation where there are few women, and a tiny proportion of women in leading actor positions might benefit and contribute. Perhaps it is an unconscious

act of rebellion that the spell checker on my word processor has had to replace each instance where I have inadvertently typed knowledge *genderation* instead of generation; for that is what current strategy and funding targets will do – create increasing gender disparity as a *genderation* of male subjectivities control the transition to knowledge economies.

References

Acker, J. (1990) 'Hierarchies, Jobs, Bodies: A Theory of Gendered Organisations', *Gender and Society*, Vol. 4, No. 2, pp. 139 -158

Adkins, L. (1995) *Gendered Work: Sexuality, Family and the Labour Market*, Milton Keynes: Open University Press

Adkins, L. (2000) 'Mobile Desire: Aesthetics, Sexuality and the 'Lesbian' at Work', *Sexualities*, Vol. 3, No. 2, pp. 201 – 218

Allen, I. E., Elam, A., Langowitz, N., and Dean, M (2007) *Global Entrepreneurship Monitor: Women and Entrepreneurship*, (no place): Global Entrepreneurship Association

Amil, D., Giannoplidis, A., Lipp-Lingua, C. (2007) 'Evolution of high-technology manufacturing and knowledge-intensive services', *Statistics in Focus,* 68/2007, Eurostat: European Communities ISSN 1977-0316

Birke, L. (1992) 'Transforming Biology' in Crowley, H. and Himmelweit, S. (eds.) *Knowing Women: Feminism and Knowledge* Milton Keynes: Polity Press

Blake, M and Hanson, S. (2005) 'Rethinking Innovation: Context and Gender', *Environment and Planning A*, volume 37, pages 681 - 701

Brinkley, I. (2006) *Defining the Knowledge Economy,* The Work Foundation, (Accessed 16th June 2009)

Brinkley, I. (2008) *Knowledge Economy and Enterprise: A knowledge economy working paper,* London: Work Foundation.

Burchell, B., Fagan, C., O'Brien, K., and Smith, M. (2007) *Working Conditions in the European Union, European Working Conditions Survey*, European Foundation for Improvement in Living and Working Conditions, Luxembourg: Office for Official Publications of the European Communities, 2007

ISBN 978-92-897-0814

Burfitt, A., Collinge, C. and Staines, A. (2007) 'Knowledge and the Economy Cross-Disciplinary Perspectives and the Knowledge Economy Thesis' research paper for EURODITE

Cockburn, C. (1985) *Machinery of Dominance: Women, Men and Technical Know- how* London: Pluto

Cockburn, C. (1988) 'The gendering of Jobs' in S. Walby (ed.) *Gender Segregation at Work,* Milton Keynes: Open University Press

Cockburn, C. (1991) *In the Way of Women: Men's Resistance to Sex Equality in Organizations,* Basingstoke: Macmillan

Cooke, P. (2006) 'Markets and networks in the knowledge value chain', Research paper, EURODITE: Regional Trajectories to the Knowledge Economy: A Dynamic model, Project no: 006187

Etzkowitz, H and Leydesdorff, L.A. (1997) *Universities and the Global Knowledge economy: A Triple Helix of University-Industry-Government*, Continuum International

European Commission (2010) *EUROPE 2020: A strategy for smart, sustainable and inclusive growth,* COM (2010) 2020, Brussels, 3.3.2010

European Commission (2010a) *€6.4 billion for smart growth and jobs – Europe's biggest ever investment in research and innovation,* (MEMO/10/339) IP/10/966 Brussels, 19th July 2010, Commissioner Máire Geoghegan-Quinn

European Commission (2009) *SHE Figures: Statistics and Indicators on Gender Equality in Science* Luxembourg: Publications Office of the European Union, 2009 ISBN 978-92-79-11388-8

European Commission (2009a) *Equality between women and men, Report from the Commission to the Council, the European Parliament, the European Economic and Social Committee and the Committee of the Regions.* {SEC(2009) 165}, Brussels, 27.2.2009, COM(2009) 77 final

European Commission (2007) *From Welfare to Knowfare. A European Approach to Employment and Gender Mainstreaming in the Knowledge Based Society (WELLKNOW) Final report, HPSE-CT-2002-00119*, DG Research, Luxembourg: Office for Official Publications of the European Communities, ISBN 978-92-79-07790-6

European Commission (2006) *SHE Figures: Statistics and Indicators on Gender Equality in Science,* Luxembourg: Office for Official Publications of the European Communities, ISBN 92-79-01566-4

European Commission (2003) *The Costs and Benefits of Diversity: A study on the methods and indicators to measure the cost-effectiveness of diversity policies in Enterprises*, Luxembourg: Office of Official Publication of the European Communities

Genin, A.S.G. (2009) 'Women's academic careers in technology: A European comparative perspective', Equal Opportunities International, Vo 28 (1), pp. 80-9

Halkier, H. (2009) Regional Policy in European Regions: A Survey of Regional Development Agency Policies and their knowledge implications, EURODITE, EURODITE: Regional Trajectories to the Knowledge Economy: A Dynamic model, Project no: 006187.

Harding, S. (1993) 'Rethinking Standpoint Epistemologies' in L. Alcoff and E. Potter (eds.) *Feminist Epistemologies*, London: Routledge

Horelli, L. (2000) 'Creating the infrastructure of everyday life in the context of European, local and regional development'. Paper presented to the ESRC Seminar Series: The Interface between Public Policy and Gender Equality. Seminar 5: Women in local and regional development: gender equality issues in participation and consultation. Sheffield Hallam University, 7th April 2000

Kandola, R. and Fullerton, J. (1998) *Diversity In Action: Managing the Mosaic*, London: Chartered Institute of Personnel and Development

Kanter, R. (1977) *Men and Women of the Corporation.* New York: Basic Books

Kirton, G. and Greene**,** A. (2005) *The Dynamics of Managing Diversity: A Critical Approach*, Elsevier Butterworth-Heinemann, London

Larner, W and Molloy, M. (2009) 'Globalisation, the 'new' economy and working women', *Feminist Theory,* Vol. 10 (1) p35-59

Leidner, R. (1991) 'Serving Hamburgers and selling insurance' *Gender and Society* No.5, pp. 154 -77

Mahdon, M., Rüdiger, K., Brinkley, I., Coats, D. (2007) *Intangible Assets and the Knowledge Economy,* London: The Work Foundation

MacEwen Scott, A. (1994) 'Gender Segregation in the Retail Industry' in MacEwen Scott (ed.) *Gender Segregation and Social Change* (SCELI) Oxford: Oxford University Press

McDowell, L. (1996) 'Body Work: Heterosexual gender performances in 'City' workplaces', in D. Bell and G. Valentine (eds.) *Mapping Desire*, London: Routledge

McDowell, L. (1997) *Capital Culture: Gender at work in the 'City,* Cambridge: Blackwell

Mahdon, M., Rudiger, K,. Brinkley, I., and Coats, D. (2007) 'What You Get Is Not What You See: Intangible Assets and the Knowledge Economy', London: The Work Foundation

Manniche, J. (2010) 'Types of Knowledge and Learning' in Halkier, H., Dahlström, M., James, L., Manniche, J., and Smed Olsen, L. (2010) (eds.) *Knowledge Dynamics, Regional Development and Public Policy,* Department of History, International and Social Studies, Aalborg University. ISBN 978-87-92305-04-6. Published on behalf of the EURODITE project sponsored by the Sixth Framework Programme of the European Union (Contract no. 006187)

Parken, A. (2010) 'Gender, Knowledge Dynamics and Regional Policy' in Halkier, H., Manniche, J., Dahlstrom, M., and Smid-Olsen, L. (eds.) *Knowledge Dynamics, Regional Development and Public Policy*, Denmark: University of Aalborg Press, Published on behalf of the EURODITE project sponsored by the Sixth Framework Programme of the European Union (Contract no. 006187). ISBN 978-87-92305-04-6

Parken, A. (2010a) *Syntheses of gender data from EURODITE partner's research reports, EURODITE*: Regional Trajectories to the Knowledge Economy: A Dynamic model, Contract no. 006187

Parken, A. (2010b) 'A Multi-strand approach to promoting equalities and human rights in policymaking', *Journal of Policy and Politics*, Vol. 38 (1) p79-99

Parken, A. and Rees, T. (2009) *Gender and the Knowledge economy in Wales*, case study for EURODITE: Regional Trajectories to the Knowledge Economy: A Dynamic model, Project no: 006187

Parken, A., Rees, T. and Baumgardt, A. (2009) *Options for an Equal Pay Duty in Wales.* Research report for the Welsh Assembly Government; Cardiff: Welsh Assembly Government

Pateman, C. (1988) *The Sexual Contract* Cambridge: Polity Press

Perrons, D. (2004) 'Understanding social and spatial divisions in the new economy: New Media clusters and the digital divide', *Economic Geography*, 80 (10 pp 45 - 64

Perrons, D. (2005) 'Gender Mainstreaming and Gender Equality in the New (market) Economy : An analysis of contradictions', *Social Politics: International Studies in gender state and society*, 12 (3) pp 389 – 41 ISSN: 1072 –

Petterson, K. (2007) *Men and Male as the Norm?: A gender perspective on Innovation policies in Denmark, Finland and Sweden*, NORDIC research programme 2005 – 2008: Internationalisation of regional development policies – Needs and demands in the Nordic Countries, Report 4, Stockholm: NORDREGIO

Pfau-Effinger, B. (1998) 'Gender Cultures and the Gender Arrangement -- A Theoretical Framework for Cross-National Gender Research', *Innovation: The European Journal of Social Sciences*; Vol. 11 Issue 2, p147-166

Rees, T. (1999) *Women and Work: Twenty Five Years of Gender Equality in Wales* Cardiff: University of Wales Press

Rees, T., and Parken, A. (1999) *Project Mosaic: Innovative Research towards Mainstreaming Equality*, A European Commission: Leonardo da Vinci Surveys and Analysis Project (DGXX11)

Schiebinger, L (ed) (2008) *Gendered Innovation in Science and Engineering* Stanford: Stanford University Press

Siltanen, J. (2002) 'Full wages and component wages' in S. Jackson and S. Scott (eds.) *Gender: A Sociological Reader*, London: Routledge.

Skidmore, P. (1999) 'Dress to Impress: Employer regulation of gay and lesbian appearance', *Social and Legal Studies* Vol. 8, No. 4, pp. 509 529

Taylor, S., and Tyler, M. (2000) 'Emotional Labour and Sexual Difference in the Airline Industry', *Work, Employment and Society* Vol.14, No. 1, pp77-95

Walby, S (2002) 'Gender and the New Economy: Regulation or deregulation?' Presented to ESRC seminar 'Work, life and time in the new economy' LSE October 2002

Webster, J. (2007) *Changing European Gender Relations: Gender Equality Policy Concerning Employment and the Labour Market,* Policy Synthesis of EU Research Results Series no 6, Luxembourg: Office for Official Publications of the European Communities, ISBN 978-92-79-07571-1

Yellow Window (2009) *Toolkit: Gender in EU funded research*, Directorate-General for Research, EUR 23857 EN. Luxembourg: Office for Official Publications of the European Communities, 2009 ISBN 978-92-79-11290-4

EURODITE Work Package Reports:

Colobrans Delgado, J. (2008) *Territorial Knowledge Dynamics for Catalonia region and bio sector*, Final WP5 final and including WP6 synthesised findings, University of Barcelona

Dulupçu, M.A. (2009) *Final WP6 Report,* Turkey, EURODITE: Regional Trajectories to the Knowledge Economy: A Dynamic model, Project no: 006187.

Jürgens,U. and Blocker, A. (2009) *Final reports Work Packages 5 and 6*, WBZ, Social Science Centre, Berlin

Kaiser, R., Liecke, M., Kripp, M., and Maximillian, L (2009) *Final WP5 report, including WP6 synthetic reports*, University of Munich

Larrson, A. (2009) *Final Report WP5*: *Territorial Knowledge Dynamics for C*rash safety, University of Gothenburg

Jeannerat, H., Kebir, L. and Crevoisier, O (2009) *WP6 FKD report: Including Outline reports on WP5 Regions and Knowledge Dynamics*, University of Neuchâtel

MacNeill, S., James, L., Collinge, C. and Staines, A. (2009) *WP5 and WP6 Final Reports: Automotive and New Media Sectors*, University of Birmingham