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6. ECONOMIC RENEWAL AND THE GENDERED KNOWLEDGE ECONOMY IN WALES

Alison Parken and Teresa Rees

ABSTRACT

The Welsh Assembly Government's Economic Renewal Strategy aims to develop Wales into a 'knowledge economy'. 'Knowledge economies' depend upon close networks and effective collaboration between the members of the 'triple helix' of universities, government and industry. The Assembly Government is obliged, under the Government of Wales Act (2006), to pay due regard to equality of opportunities in all its policies, a commitment underlined by the requirements for equality impact assessments under new British equalities legislation. In this paper, we conduct a political arithmetic of the gender of key players in the 'triple helix' in Wales. Will the Economic Renewal Strategy promote equality or unintentionally reproduce already rigid patterns of gender segregation in the labour market?

INTRODUCTION

The European Union in its economic strategy, *Europe 2020*, is promoting the idea that Member States develop into a 'knowledge economy' (European Commission, 2010). It argues that the three priorities for Europe should be 'smart growth' (developing an economy based on knowledge and innovation); 'sustainable growth' and 'inclusive growth' (European Commission, 2010, p. 8). Hence, critical to this economic strategy is the aim to ensure that moving to a knowledge economy promotes social inclusion by combining welfare and child-care policies and gender employment policies alongside knowledge and innovation. An inclusive knowledge economy necessitates an ongoing analysis of the gender beneficiaries of investment and addressing the causes and consequence of gender segregation in the labour market to avoid reproducing inequalities.

The Welsh Assembly Government is also committed to developing a

knowledge economy. It could equally be expected to address attention to the inclusivity of its economic renewal strategy given the requirements of the Government of Wales Act (2006, s. 77) that Ministers pay 'due regard' to equality for all, in all that they do. Indeed, under new British statutory equality duties for gender, race and disability (cf. Equality Act, 2010), public policies, including spending cuts and investment, are now subject to equality impact assessments.[1] This should imply regular analysis of relevant gender-disaggregated statistics, particularly as there is a commitment in the Assembly Government both to promoting equality and to an evidence-based approach to developing policy. However, in practice, 'promoting equality' is an inexact science – and as policy-making processes are rarely linear, arguably, they are therefore never entirely evidence-based.

This paper seeks to offer some background gendered analysis of the labour market in Wales as a backcloth for the Economic Renewal Strategy (Welsh Assembly Government, 2010). It draws upon research conducted for EURODITE, a five-year, European Commission 6th Framework Programme research project on regional trajectories to knowledge economies, in which Wales was a case study region (Parken and Rees, 2009).[2] Strategies designed to foster knowledge economies focus on certain 'innovative' sectors. It is the knowledge created at the interface of actors in universities, business and the government sector, known as the 'Triple Helix' (Etzkowitz and Leydesdorff, 1997) that is viewed as the platform for creating knowledge intensity in a region, leading to economic growth. Good networks between these actors are crucial to facilitating investment by venture capital in new or expanding businesses and developing new markets – but policies developed to promote a knowledge economy overlay existing patterns of gender segregation, both in those sectors regarded as relevant for support and investment and among those actors playing key roles in decision-making. Here we explore the gendering of the 'triple helix' in Wales, and the challenge faced by the Welsh Assembly Government (WAG) in its aim of promoting a knowledge economy which also promotes gender equality.

Overall, the EURODITE research team investigated knowledge generation, use and transfers within twenty-two case studies in nineteen countries in the 'knowledge economy sectors' of automotive, food, information and communication technologies (ICT), new media, tourism, bioscience, and 'knowledge intensive businesses' (KIBs). The sectors that have been selected by the Welsh Assembly Government in its Economic Renewal Strategy (WAG, 2010) are those which already have some presence in Wales: ICT, energy and environment, advanced materials and manufacturing, creative industries, life sciences and financial and professional services (WAG, 2010, p. 37).[3] Employment data

for Wales illustrate that men have acquired most of the new high-quality jobs in these 'knowledge economy sectors' over the last decade, whilst women have attained two thirds of the jobs in the expansion of poorly paid care and personal services occupations. This is a difficult baseline for the Economic Renewal Strategy to build upon, especially if the Welsh government is to fulfil its obligation to pay due regard to equalities for all.

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

This paper draws upon a range of data sources, largely secondary analysis of the Office for National Statistics' *Regional Labour Market Statistics* and datasets from WAG's Statistics Wales (see 'Data sources' below) to explore the extent to which women are positioned to benefit from the Economic Renewal Strategy's focus on 'knowledge economy' sectors. To consider who Wales's 'knowledge workers' are, an innovative and indicative dataset was created in collaboration with Statistics Wales based upon gender participation by occupation in the 'knowledge phases' described above.

We further explored the gender make-up of the 'triple helix' players in Wales. This 'political arithmetic' of potential participation is measured first through an account of the presence of men and women among the various industrial sectors in recent years. Second, we examine gender participation in the 'triple helix' in universities, and beneficiaries of one of the main tools of the knowledge economy so far in Wales, the 'Knowledge Transfer Partnership Programmes'. The paper is offered as a worked example of how gender-disaggregated data can be collected and analysed for the purposes of promoting gender equality and informing public policy.

THE GENDERING OF THE LABOUR MARKET

The term 'gender' does not, of course, refer to given, fixed or biological attributes but rather is used to describe how society is stratified by a particular social and economic division, in a similar way to class, age, disability or ethnicity. It is important to understand how gender regimes operate in organizations, in

networking and in institutional systems and practices, in order to consider how such practices produce advantage or disadvantage for men and/or women.

Research within sociology and organization studies has demonstrated that jobs are not gender-neutral spaces (Acker, 1990; Adkins, 1995; Cockburn, 1985, 1988, 1991). A 'gendered presentation of self', or rather a 'hetero-gendered presentation of self' (Parken 2003, 2010a), can be assumed within the employment contract (Gheradi, 1995). Studies across occupations have considered the performance of gender as integral to the goods or services being consumed (Leidner, 1991). Indeed, both the masculinized performances of management (Collinson and Hearn, 1996) and the feminized 'sale' of services (Adkins, 1995; MacEwan Scott, 1994; Taylor and Tyler, 2000) have been mapped.

Thus, gender is an active process, 'an ongoing activity embedded in every day interactions in which we do gender' (West and Zimmerman, 1987, p. 45). We produce a performance appropriate to the dominant discourses of gender in each occupation. Through our jobs and tasks, we build our gendered identities. In these processes and social practices, we reproduce the gendering of occupations. Therefore, we are constantly, if subconsciously, studying the 'gendering of everyday life' (Horelli, 2000) at both workplace and institutional levels.

Gender segregation in the labour market remains extraordinarily robust, vertically, horizontally and contractually. The European Union Treaty of Amsterdam (1999, Article 3) committed member states to a policy of gender mainstreaming in order to reduce the impact of gender on occupational and other life chances, through promoting equality in all policies. Gender mainstreaming is defined by the European Commission as:

> mobilising all general policies and measures specifically for the purpose of achieving equality by actively and openly taking account at the planning stage of their possible effects on the respective situations of men and women. (Commission of the European Communities, 1996)

The extent to which Member States have adopted and implemented this strategy remains highly variable, however. Chaney's review of equal opportunities and human rights in the first decade of devolution in Wales (Chaney, 2009) demonstrates a much more pro-active approach to equalities by WAG than by the previous Welsh Office. While he characterizes the early years of the Assembly as 'declaratory' in relation to equalities, in later years, he argues, the range of equality dimensions included in policy-making has increased and the policy process has become more sophisticated than before in addressing equality dimensions. This suggests a context in which the gendered dimension of a knowledge economy would be on the agenda.

The knowledge economy: a gendered concept?

The concept of a knowledge economy is widely contested and how it is defined has implications for how to explore its gendered dimensions. Knowledge economy research projects funded by the Economic and Social Research Council (Hudson, 2006, table 2) are described as supporting the shift from an industrial to an information age through the application of knowledge and skills to innovation in order to gain competitive advantage. Indeed, many definitions include 'innovation' as a concept, which itself is hard to define. Blake and Hanson (2005) observe that 'innovation' has been truncated to refer to technology, while Ball argues (2010) that it should refer more widely to change or renewal of ideas within any sector or discipline. It could even refer to the application of existing innovative ideas regarding service delivery to new spatial domains (Blake and Hanson, 2005).

Sociological and cultural interpretations describe the effects of information and communication technologies (ICTs) on producing a 'knowledge based society' (Brinkley, 2006; Burfitt et al., 2007), but the United Nation Development Programme (UNDP) and the United Nations Development Fund for Women (UNIFEM) (2004) have reported upon the 'gender digital divide' in Europe. A narrower definition of knowledge economies, predominant in regional economic development and in economic geography, focuses upon technology and high-status occupations:

> technology and knowledge based industries reflecting R and D intensity, high ICT usage, and the development of large numbers of graduates and professionals and associate professional workers – the knowledge workers. (Rudiger and McVerry, 2007, p. 11)

In addition, the Work Foundation concentrates on the value of knowledge-based outputs from workers in just three occupational strata, namely Managers and Senior Officials; Professional and Associate Professional; and Technical (Brinkley, 2006). There are fewer women than men in these top three strata and those who are in the 'top three' are clustered in a narrow range of industries and occupations. Hence, relatively few women are in a position to benefit from research monies targeted in these sectors, occupations or lead researcher roles. However, the Work Foundation (Brinkley, 2006; Mahdon et al., 2007; Rudiger and McVerry, 2007) also includes older industries in its definition, where workers use ICTs both extensively and routinely in their studies (Brinkley, 2006). They also incorporate intangibles such as brand values, human capital and processes for knowledge transfer (Mahdon et al., 2007, p. 4), which some argue have become as important as controlling land and labour in the emerging economy (Cooke, 2006). Hence:

> 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, p. 11)

It is in these branding and marketing roles, where value in innovation is realized, that we find more women involved (Parken, 2010b). However, by focusing on the senior and technical occupational strata, an examination of 'knowledge work' at lower levels of the occupational hierarchies is precluded. Thus the polarization of work in Britain, into what Goos and Manning (2003) describe as 'lousy and lovely jobs', is obscured. Against this background Perrons (2004, 2005) describes the 'new economy' as an alternative frame of analysis as opposed to the knowledge economy. She demonstrates divergent gender participation between knowledge jobs and care jobs – further stratified by other social divisions such as class and income. Whilst higher-order jobs have mostly provided growth in male employment, a similar rise in poorly paid social care jobs, characterized by part-time contracts and low earnings, has been largely taken up by women. This divergence has been replicated in Wales. While social care work requires considerable *application* of knowledge, it does not conform to the idea of knowledge work as narrowly defined, and is not valued or rewarded as such.

What are the gender dimensions of these definitions of knowledge economies? A wider definition might have a broader industry base and include knowledge work in management and service delivery in the public sector. This would have the effect of including more women workers, who are primarily concentrated in public administration, educational and health jobs throughout Wales, and indeed the rest of Europe. It can be argued that the restrictive sectoral approach misses much that is both innovative and applies new technologies in traditionally female work. A wider definition goes further than the very narrow association of the knowledge economy with innovation only in technology by including, for example, knowledge transfer in food, tourism, new media and knowledge-intensive businesses, as well as automotive, bioscience and ICT. Evidence from the EURODITE case studies shows women's contribution in vital support roles in these sectors. However, rather than driving innovation from leadership roles in the triple helix, they are more likely to contribute in customer-facing administrative and marketing functions to the value chain (Parken, 2010b).

Gender and the knowledge economy sectors in Wales

The first ten years of devolution (1999–2009) have been characterized by a commitment by the Welsh Assembly Government to creating a 'small clever

country'.[4] Since the 1970s, the economy of Wales, like those of similar regional areas within Europe, has transformed from a heavy dependence on energy and heavy industry, mining and manufacturing to a service economy. The National Assembly for Wales was set up with devolved administrative and policy powers including those covering health, the economy, transport, education, local government and the environment. In 2006 it was granted some primary legislative powers but it cannot as yet raise taxes or set welfare provision limits. Wales was part of the UK National Reform Programme for the European Employment Strategy, which had as its goal to 'make Europe the most competitive knowledge based economy in the world by 2010'.[5] The new European Union 2020 strategy is also heavily reliant on world-class research universities and research and development in leading businesses for growth (European Commission, 2010). It specifies the importance of social inclusion in the transition to knowledge economies. However, this is not emphasised in the Economic Renewal Strategy (WAG, 2010).

During the long period of deindustrialization in Wales between 1975 and 1994, there was a 61 per cent decrease in men's employment in the Standard Industrial Classification (SIC 1980) 'extraction/metal manufacture; minerals/metals', down from 103,000 to 40,000 workers (Rees, 1999, p. 9). Women's employment fell in this grouping by almost 50 per cent but from a low base of 13,000 to 7,000. Mining and manufacturing jobs have continued to fall. Manufacturing jobs decreased by 7 per cent between March 2008 and March 2009 to represent just 13 per cent of all employee jobs in Wales (Statistics Wales, 2009a, p. 7). Although the unemployment rate in Wales has been lower than that of the UK as a whole, unemployment has been high in the Valleys and West Wales, where rates of economic activity have been low. These areas have attracted Objective 3 European Structural Funds (and subsequently Convergence Funds).[6]

The significance of spatial economic geographies to gender relations has been illustrated in relation to mining. For example, Styck et al. (2008) detail how the mining companies in Limberg in Belgium historically promoted large families as a source of labour. In so doing they instituted dependency and male dominance through the mine as the source and centre of cultural and economic life, spilling over from the landscape to encompass work, family and leisure. Engineers' wives were obliged, through their husband's employment contracts, not to undertake paid work but to provide the service of a housewife, ensuring their husband's readiness for work. This type of measure was unnecessary for miners as their wages were too low to purchase household services in the (informal) market. In short, employment contracts and wage levels instituted a gender and class regime which confined women to caring and reproductive activities (De Rijck and Van Meulder, 2000, in Styck et al., 2008, p. 77). This

example illustrates the contextual constitution of gender relations, and how their legacies can operate as gender cultures (Pfau-Effinger, 1998) embedded in social practices repeated over time within communities. Gender relations, then, are influenced by employment contexts and provision of public services, and in turn shape employment choices, which are not fixed 'naturally' but change temporally and spatially. Greed (2005) shows how women's current employment 'choices' are constrained by spatial planning decisions, when cognizance of how gender roles affect daily life is not 'mainstreamed' into transport planning and city design by local planning authorities. Women more often undertake lateral journeys incorporating a series of activities rather than the journeys taken by men, which tend to influence planning – straight to and from work in peak hours (Greed, 2005, pp. 720–1).

In 2005, 'knowledge based services' represented 68 per cent of UK services exports (ONS, 2006, from Hudson, 2006), the most significant of these being in business, financial and computer services. In Wales, financial and business services constituted 16 per cent of employment in 2007 compared with 21 per cent UK-wide (Statistics Wales, 2009b). In 2007, Wales's higher education institutions (HEIs) ranked technology transfer as a significantly lower priority than HEIs in the other nations and regions of the UK, and recorded lower income from intellectual property than all other UK nations and regions apart from Northern Ireland (HEFCE, 2008, pp. 12–24). In 2007, gross value added (GVA) per head of population in Wales was £14,877, representing 75 per cent of the average for the UK regions (Statistics Wales, 2009b: 10).[7] This is the lowest GVA per head of the UK regions. This all creates a challenging context for developing a knowledge economy.

MEN AND WOMEN IN THE TRIPLE HELIX IN WALES

Who are the players in the triple helix of universities, government and industry in Wales as well as in the labour market more generally? First, Table 6.1 shows the gendered distribution of employment in Wales. Women have low levels of self employment compared with men but are over-represented in temporary employment.

In 2008, men held almost two thirds of all full time jobs in Wales (64 per cent) but just 23 per cent of part-time jobs (Office for National Statistics, 2009, table 11). Women are much more likely to work part-time and to have a second job than men. The current figures reflect a long history of women's low self-employment and lower entrepreneurial activity (Harding et al., 2007). Women's employment rates are:

Table 6.1
Employment in Wales (thousands), October 2007–September 2008

	Total	Employees	Self-employed	Full time	Part time	Second job	Temporary
All in employment	1,338	1,151	175	978	357	56	74
Men	709	577	127	625	84	24	33
Women	628	575	48	354	273	32	41

Source: Office for National Statistics (2009, table 3).

> significantly affected by the presence of dependent children, their number and ages. Overall gaps in economic activity and employment rate between women and men in Wales are 6 per cent and 5 per cent respectively (ONS, 2009b) but the employment rate gap between men and women who have dependent children under the age of 5 years in Wales is 32 per cent (LFS, 2008). Ninety per cent of these fathers of children under 5 are working, compared to only 58 per cent of mothers. (Parken et al., 2009, p. 23).

The UK has a mixed economy of childcare. As elsewhere, childcare in Wales is of variable quality, but on average more expensive than in England (particularly in rural areas) and insufficient places are available (Bevan Foundation, 2005). Provision does not meet the European Union's Barcelona agreement on childcare targets, set within the European Employment Strategy (90 per cent coverage for pre-school children over three years old, and 33 per cent coverage of those under three, by 2010). Recently, the National Assembly passed the Carers Strategies (Wales) Measure (2010), which includes a child poverty duty, requiring local authorities to extend their provision of free childcare to two-year-olds in deprived areas.[8] Besides providing these children with improved education chances, the aim is to facilitate women's economic activity. However, as provision of only fifteen hours per week of care is on offer, only part-time working will be possible.

Current patterns of gender segregation by industry in Wales (horizontal segregation) are set out in Table 6.2.

Men constitute 86 per cent of workers in the 'agricultural, fishing and farming industries' category and 76 per cent of manufacturing workers (Office for National Statistics, 2009b). Gender balance is almost achieved in the very broad classification of 'distribution, transport, finance, business etc.'. Women dominate the education, health and public administration sectors, totalling 69 per cent of this category, which mostly comprises public sector jobs (Office for National

Table 6.2
Wales: employee jobs by industry (thousands), December 2008

	Totals, seasonally adjusted	Men	Women
Agriculture, forestry, fishing and farming	7,000	6,000	1,000
Mining, energy, waste supplies	7,000	5,000	2,000
Manufacturing industries	152,000	116,000	35,000
Construction	48,000	41,000	7,000
Distribution etc., transport etc., finance and business services	483,000	241,000	243,000
Education, health, public administration and other services	448,000	139,000	309,000

Source: Office for National Statistics (2009, table 5).

Statistics, 2009b). While the public sector, particularly education and health, remains excluded from knowledge economy support and investment, very few women will be in a position to participate. When considering the hierarchy of occupations, the effect of vertical gender segregation means that there are few women amongst the top three strata – the knowledge workers (Table 6.3) – and fewer still in those occupations in the growth sectors prioritized in the Welsh Assembly Government's Economic Renewal Strategy (WAG, 2010).

Men numerically dominate management and professional positions in the 'agricultural, manufacturing and construction' industries. No women senior managers were recorded in the sub-category 'energy and water', signalling that the new industries of 'renewables' may become particularly characterized by vertical gender segregation (see Cooke and De Laurentis, 2010 on the growing importance of bio-mass industries in Wales). Men also dominate in senior management positions in the 'services' category ('distribution etc.') but there is a near gender balance within the 'services' professions. However, of the 67,700 professional women employed in this category, 57,500 were working within occupations in public administration, education, health and other services. This accounts for fully 82 per cent of women professionals in the larger occupational category ('distribution etc.').

No women professionals were recorded in the 'agriculture, fishing etc.' category or in 'transport and communication'. In 'associate professional and technical' jobs, 62,500 of the 87,000 women in 'distribution and other industries' were working within 'public administration, education and health'. Overall, this is a picture of extreme gender segregation; one which has changed little over time, even with the growth of services and the substantial increase in women's percentage of employee jobs in these occupations. Indeed, recent statistical analysis from the European Commission demonstrates that, far from improving,

Table 6.3
Top three occupational strata: industry sector analysis

	Total	Men	Women
Managers and senior officials – all industries	*174,600*	*111,400*	*62,800*
Managers and senior officials – agriculture, fishing; energy and water; manufacturing; construction	47,400	39,200	8,000
Managers and senior officials – distribution, hotels, restaurants; transport and communication; banking, finance and insurance etc.; public administration, education, health and other services	127,200	72,300	54,800
Professionals – all industries	*158,300*	*87,800*	*70,500*
Professionals – agriculture, fishing; energy and water; manufacturing; construction	23,100	20,500	2,300
Professionals – distribution, hotels, restaurants; transport and communication; banking finance and insurance etc.; public administration, education, health and other services	135,100	67,400	67,700
Associate professional and technical – all industries	*172,800*	*79,300*	*93,500*
Associate professional and technical – Agriculture etc.	22,600	16,200	6,500
Associate professional and technical – Distribution etc.	150,200	63,100	87,000

Source: Annual Population Survey January 2008–December 2008. Wales. NOMIS. Data Run: 195009, extrapolated 22 July 2009.

industrial gender segregation has become even more entrenched in the last decade (European Commission, 2009).

The number of 'top jobs' in Wales grew significantly between 2001 and 2006 (Statistics Wales, 2007), with women gaining an almost equal share of the 23,000 new 'Manager and Senior Official' positions and the majority of the 13,000 'Professional' and 25,000 'Associate Professional and Technical' jobs (Statistics Wales, 2007, p. 4). So, whilst vertical segregation by gender has decreased, segregation by industry has not (Statistics Wales, 2007, p. 4).

There was little change in middle-ranking occupations ('administrative and skilled trades'), except for a large increase in 'Personal Service Occupations'. Moreover, 'plant and process, and elementary jobs' declined. However, women took over two thirds of the newly created 15,000 jobs in 'personal services' (Statistics Wales, 2007). These are mostly part time and caring related, substantiating Perrons's (2004) analysis of a gender divided 'new economy'. Without commenting on the growing gender disparity, the Statistics Wales review of job quality notes that there has been 'a shift away from machine based jobs, [and a] shift towards working with people' (Statistics Wales, 2007, p. 3).

Within the EURODITE research project, partners articulated knowledge transfer within symbolic, analytic and synthetic knowledge production (Cooke, 2006; Manniche, 2010). However, it is clear from the following analysis of

synthetic and symbolic jobs in Wales that few women are engaged in synthesizing knowledge for commercial application. More are contributing by adding value in the downstream, consumer facing, marketing and brand-building tasks of exploiting new knowledge in technologies and services.

Part of the difficulty of analysing knowledge workers is the lack of a discrete occupational index for them across sectors (Brinkley, 2006, 2008). However, an innovative dataset was constructed by Statistics Wales, using the knowledge phases described in EURODITE and drawing upon occupations such as 'production, works and maintenance managers, ICT managers, electronics engineers, engineering technicians, and design and development engineers' for synthetic knowledge occupations, and 'solicitors and lawyers, judges and coroners, chartered and certified accountants, management consultants, actuaries, economists and statisticians, public relations officers and marketing associate professionals' in cross-sector symbolic knowledge occupations. Table 6.4 shows an overwhelming masculinization of synthetic knowledge generation and transfer processes in the UK and in Wales. Women are more evidently contributing to symbolic knowledge processes.

Given women's paucity of participation in knowledge transfer occupations in business, and in senior roles in government, we now turn to consider whether and where women are engaged in analytic knowledge phases within the university axis of the 'triple helix' of knowledge generation and use. In other words, how are women involved in the exploration for innovation and commercialization in Wales? Although preparedness for knowledge work is not confined to the study of science, technology, engineering and mathematics subjects (STEM), there has been and continues to be a view that these knowledge areas signify the locus of economic growth (Brinkley, 2006). Higher education qualifications show a gender divide between men and women, with more men in engineering and physics, while women predominate in social science, education and health-related subjects. Women continue to be the majority of graduates in Wales, constituting 57 per cent of first degree graduates in 2007/8 (Table 6.5).

Table 6.4
Synthetic and symbolic knowledge jobs by occupation group and gender (thousands)

	Wales			**UK**		
	Males	**Females**	**Total**	**Males**	**Females**	**Total**
Synthetic	71.2	10.0	81.2	1,921.6	322.8	2,244.5
Symbolic	64.4	42.9	107.3	2,011.7	1,299.7	3,311.4
All occupations	724.7	653.6	1,378.3	16,273.0	14,308.0	30,581.0

Source: Annual Population Survey Year to March 2009.

Table 6.5
Study by subject at all levels (first degree and postgraduate) by subject and gender, Wales 2009

Subject	Women	Men	Total
Subjects allied to medicine	2,865	560	3,470
Business and administrative studies	2,880	3,495	6,445
Engineering and technology	260	1,910	2,200
Social studies	1,475	900	2,395
Computer science	235	940	1,195

Source HESA: Table 7a – Qualifications obtained by students on HE courses at HEIs in the UK by location of institution, level of qualification obtained, gender and subject area, 2007/08(1).

Gendered subject choice is apparent, with men dominating 'engineering and technology and computer science', as well as within subjects. Although women dominate 'social studies' as a subject area, men dominate in 'economics and politics'. Table 6.5 shows that the biggest single subject category of study for women and men is 'business and administrative studies'. The next most popular subject for men is 'engineering and technology' – and, for women, 'subjects allied to medicine'. This category includes subjects such as anatomy, pharmacology and ophthalmology, but their domination of this subject area is due to the majority studying nursing.

The Higher Education Funding Council for England (2008) survey of university and business interaction for 2006/7 (which also provides data for Wales, Scotland and Northern Ireland) details the participation of university staff in commercialization activities. However, the data on the 170 staff engaged with commercial partners in dedicated business or community units were not gender disaggregated. Individual Welsh HEIs report their highest rates of engagement being with the automotive, manufacturing, energy and construction, transport and public administration sectors (HEFCE 2008, Annex 1, Q2). They are less engaged with the financial, property, wholesale and retail sectors.

This examination was achieved by commissioning new data from the Higher Education Statistics Agency demonstrating academic grade (professoriate) with academic subject and gender.

Table 6.6 summarizes the gender of participants in academic disciplines allied to the knowledge economy sectors studied within the knowledge economy sectors identified by EURODITE.

Gender segregation among the professoriate in Wales is clear; of the total professors in Wales, women and men account for 110 (11.7 per cent) and 840 full person equivalent positions respectively (HESA, 2009). In the disciplines selected for analysis, women are absent from several of the subjects traditionally linked to the development of a knowledge economy. In science, engineering,

Table 6.6
Gender disaggregation of Welsh HEIs professoriate in selected academic 'industrial, business and professional disciplines' (2007/8)

Discipline	Women	Men
(B2) Pharmacology, toxicology and pharmacy	0	12
(C1) Biology	1.0	23.4
(C4) Genetics	2.0	9.0
(C7) Molecular biology, biophysics and biochemistry	2.0	22.8
(C5) Microbiology	0	16.4
(F1) Chemistry	1.0	28.6
(F3) Physics	1.8	34.1
(G1) Mathematics	0	39.4
(G4) Computer science	1.0	11.3
(H2) Civil engineering	1.0	13.4
(H6) Electronic and electrical engineering	0	19.0
(K4) Planning (urban, rural and regional)	0	6.0
(M2) Law by topic	2.4	13.9
(N1) Business studies	1.0	8.0
(N2) Management studies	1.0	11.4
(N3) Finance	1.0	3.0
(N4) Accounting	0	11.0
(N5) Marketing	1.0	5.0
(N6) Human resource management	0	5.0
(P3) Media studies	0	2.0

Note: Full-person equivalent: Individuals can hold more than one contract with an institution and each contract may involve more than one activity. In analyses staff counts have been divided amongst the activities in proportion to the declared full-time equivalent (FTE) for each activity. This results in counts of full person equivalents (FPE). Staff FPE counts are calculated on the basis of contract activities that were active on 1 December of the reporting period (using the HESA staff contract population).

Source: Higher Education Statistics Agency, *Gender disaggregation of Welsh HEIs professoriate*, commissioned data run, 21 August 2009, from the HESA staff record.

technology and mathematics (STEM), there are fewer than three women professors of physics in Wales, and none in mathematics or electrical engineering (HESA, 2009).[9]

Historical vertical gender segregation in the physical sciences persists, especially in disciplines related to biosciences where we might expect to find more women given their dominance of related subjects at undergraduate level. However, shifting gender composition has been shown to affect the valuing of several occupations over time, for example in printing, radiography and

clerical work (Cockburn 1983, 1985, 1988; Savage and Witz, 1992). Evidence from EURODITE case studies suggests women predominate as 'lab rats' in biosciences. In Catalonia, government competition policy aimed at reducing wage costs in biosciences had a direct effect on gender composition (Colobrans Delgado, 2008).

Decision making

The necessity to involve women in decision-making structures and networks has long been a goal of equality mainstreaming strategy within WAG and the National Assembly for Wales (NAW, 2004). The impetus is both social justice and the 'business case' for promoting equality. A recent account of the latter demonstrates the continuing need for focus in this area:

> In 2007, both McKinsey's and Catalyst's analyses made a significant contribution to the business case for women leaders. Both reports demonstrated a correlation between women's representation at board level and the financial performance of companies worldwide, pin-pointing a 30 per cent turning point at which women's representation has a significant impact across a set of corporate performance indicators. (Lewis and Rake, 2009, p. 4)

Wales has had near gender balance amongst members of the National Assembly and currently (May 2011) has six male and three female Ministers in the WAG Cabinet. Such a gender balance in elected assemblies is rare. However, not all areas of Welsh life are as gender balanced as the National Assembly or previous Cabinets have been. For example, Table 6.7 lists Boards and Committees that have influence over economic policy and investment in economic growth in Wales shows how women's representation at economic decision-making level does not meet the 40/40 gender balance 'ideal' (Lewis and Rake, 2009).

A survey of regional development agencies through Europe shows that this pattern of under-representation of women in economic policy making is replicated (Parken, 2010c).The Equality and Human Rights Commission's annual review of *Who Runs Wales*? reports that men in Wales constitute 100 per cent of University Vice Chancellors, 84 per cent of Heads of Further Education Colleges, 84 per cent of secondary school head teachers (although in the last category they are only 26 per cent of overall teaching staff) and 100 per cent of chief executives of the top 100 private companies (Equality and Human Rights Commission, 2009, pp. 9–11).

This review has shown that the majority of participants in the 'valued' areas of knowledge transfer activities, and the key decision-makers in the economy, business, government and the universities are men. This suggests the incorporation

Table 6.7
Gender balance in public bodies in Wales

Body	Men	Women	Total
Ministerial Advisory Group for Children, Education, Lifelong Learning and Skills	3	4	7
Economic Research Advisory Panel	6	1	7
Welsh Industrial Development Board	4	2	6
Wales Employment and Skills Board	9	3	12
Economy and Transport Ministerial Advisory Group	4	0	4
Design Commission for Wales	4	1	5
South Wales Sea Fisheries Committee	9	0	9
North West and North Wales Sea Fisheries	7	0	7
Social Enterprise Ministerial Advisory	5	2	7
Child Poverty Expert Group	2	2	4
Welsh Financial Inclusion Strategy Group	0	4	4

Source: Public Appointments Division, Welsh Assembly Government, August 2009.

of subjectivity into systems and structures where judgements are made relating to where 'value' lies in the economy, and potentially a lack of reflection on the different lives and social divisions which shape participation. Such reflection, and a wider view of the value of women's predominately customer-facing businesses, might be more likely with a more diverse range of decision makers.

Knowledge transfer partnership projects

The Welsh Assembly Government has invested heavily in a new group of economic programmes designed to stimulate exploratory knowledge in universities that might have commercial application. Under the banner Academy for Business (A4B), this includes fostering collaboration between universities and establishing the infrastructure they need to communicate with businesses (Department for Economy and Transport, 2009).

The Welsh Assembly Government contributes funding to the National Knowledge Transfer Partnership. This body decides policy and allocates its own – and, in partnership, Technology Strategy Board – funding to knowledge transfer partnership between academies and commercialization partners. An indicative analysis of named lead researchers for project in Wales (Table 6.8) demonstrates the effect of having so few women in universities in positions where they can compete for research funds.

Not all monies went to Welsh HEIs: some supported projects in English HEIs. However, in Wales, women academics received just 11 per cent of the

Table 6.8
Welsh funding to knowledge transfer partnerships in higher education allocated between 2003 and 2007

Knowledge/technology	Total projects	Project lead men	Project lead women
Environmental sustainability/sustainable technologies	2	2	0
Services	4	3	1
Creative industries	2	1	1
ICT	11	11	0
Design	8	8	0
Agriculture	1	1	0
Food processing	3	1	2
High-value services	4	2	2
Built environment	1	0	1
Chemical science	2	2	0
Medicine and healthcare	2	2	0
Electronics, photonics, electrical technology	1	1	0
Bioscience	4	3	1
Advanced materials	1	1	0
High-value manufacturing	3	3	0
Totals	49	41	8

Source: Compiled from the Knowledge Transfer Partnership Projects Database, online, viewed 30 June 2009. Some lead researchers had more than one project. Further education projects not included as innovation project administrator was recorded, not lead researchers.

funding allocated between 2003 and 2007, totalling £413,000. Men received £3.5 million.

There were no knowledge transfer partnerships (KTPs) led by women in ICT, design or high-value manufacturing, and just one woman led a bioscience KTP – despite the preponderance of women in technician roles in biosciences throughout the EU (European Commission, 2009). There appeared to be a number of women running KTPs in management science within one further education college in Wales. However, following enquires, it became apparent that the administrator for innovation had been listed as the contact rather than the lead researcher.

In short, the current distribution of funding for KTPs further contributes to reproducing patterns of gender segregation. An interview with a knowledge transfer partnership manager working for the Welsh Assembly Government revealed that projects in retail, charity and the third sector are coming on stream. More women may be in position to bid for these.

CONCLUSION

This paper has described the recent and current patterns of gender segregation in higher education, employment and government related to the developing strategy for a knowledge economy in Wales. Women are much more likely to be working and learning in sectors not typically considered to be part of the 'knowledge economy'. They are not found in senior roles in universities or among the professoriate in those disciplines identified as crucial to knowledge economy sectors in Wales. There is little evidence of women's participation in or deriving direct benefit from participation in knowledge networks in the 'triple helix' of partners in government, education and business, where decisions are made concerning the focus of knowledge economy development, and the allocation and expenditure of resources. Women are largely absent from the sectors and knowledge types that are supported for 'growth' and 'competitiveness'.

Regional policy designed to promote a knowledge economy needs to capitalize on the potential of the available workforce. Women, as the majority of graduates from Welsh HEIs and as participants in the labour force in jobs that explore, examine and exploit knowledge, need to be included in policies designed to promote knowledge economies. Gender-blind policies are likely to reproduce the status quo, undermining the impact of investment. Indeed, non-compliance with statutory duties to promote equality, which require the government to address such inequalities in their economic strategies, policies, programmes and distribution of funds and investment, may simply reproduce gender segregation in the labour market, with all the waste that that implies. Gender-disaggregated statistics on the labour force, in particular those sectors designated as key players in the knowledge economy, as well as among the participants in the triple helix and beneficiaries of knowledge economy initiatives should play a major role in the Economic Renewal Strategy.

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NOTES

[1] This will remain the case under the forthcoming Public Sector Equality Duty (Equality Act 2010) when it is implemented.

[2] http://www.eurodite.bham.ac.uk/

[3] As an aside, the EURODITE analysis found that this strategy of clustering of knowledge-intensive businesses, patents, education levels, science and research and development intensity in a region did not necessarily lead to regional economic growth (Carrincazeaux and Gaschet, 2010, slide 10).
[4] http://wales.gov.uk/topics/international/news/smallclever/?lang=en
[5] http://www.eurofound.europa.eu/areas/industrialrelations/dictionary/definitions/europeanemploymentstrategy.htm
[6] http://ec.europa.eu/regional_policy/policy/object/index_en.htm
[7] Figures have been rounded up to the nearest full percentage point.
[8] http://www.legislation.gov.uk/mwa/2010/5/enacted
[9] HESA Full Person Equivalent figure for women professors of physics in Wales is 1.8. Owing to the rounding methodology HESA prefers the phrase 'fewer than three'.

REFERENCES

Acker, J. (1990) 'Hierarchies, jobs, bodies: a theory of gendered organisations', *Gender and Society*, 4, 2, 139–58.
Adkins, L. (1995). *Gendered Work: Sexuality, Family and the Labour Market*, Milton Keynes: Open University Press.
Ball, J. (2010). 'Improving what we already do', *Agenda*, 40, Spring, 49–50.
Bevan Foundation (2005). 'A childcare revolution in Wales', Policy Paper 6, February, by Anthea Symonds and Anne Kelly.
Blake, M. and Hanson, S. (2005). 'Rethinking innovation: context and gender', *Environment and Planning A*, 37, 681–701.
Brinkley, I. (2006). *Defining the Knowledge Economy*, report, The Work Foundation, http://www.theworkfoundation.com/research/publications/publicationdetail.aspx?oItemId=65&parentPageID=102&PubType= (accessed 16 June 2009).
Brinkley, I. (2008). *Knowledge Economy and Enterprise: A Knowledge Economy Working Paper*, London: Work Foundation.
Burfitt, A., Collinge, C. and Staines, A. (2007). 'Knowledge and the economy: cross-disciplinary perspectives and the knowledge economy thesis', research paper for Eurodite.
Carrincazeaux, C. and Gaschet, F. (2010). 'Knowledge and regional diversity: a comparative analysis of European regions', speech to Conference of European Association of Regional Development Agencies, 6 May, Brussels, http://www.eurodite.bham.ac.uk/ (accessed 15 December 2009).
Chaney P. (2009). *Equal Opportunities and Human Rights: The First Decade of Devolution in Wales, Executive Summary*, Cardiff: Equality and Human Rights Commission.
Cockburn, C. (1983). *Brothers: Male Dominance and Technological Change*, London: Pluto Press.
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.

Collinson, M. and Hearn, J. (1996) *Men as Managers, Managers as Men*, London: Sage.

Colobrans Delgado, J. (2008). *Territorial Knowledge Dynamics for Catalonia Region and Bio Sector*, Final WP5 final and including WP6 synthesized findings, University of Barcelona, EURODITE: Regional Trajectories to the Knowledge Economy: A Dynamic model, Project no. 006187.

Commission of the European Communities (1996) *Incorporating Equal Opportunities for Women and Men into All Community Policies and Activities*, Communication from the Commission, COM(96) 67 (final), Luxembourg: Office for Official Publications of the European Communities.

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.

Cooke, P and De Laurentis, C. (2010). *Work Package 6: Final Firm Knowledge Dynamic Report*, EURODITE: Regional Trajectories to the Knowledge Economy: A Dynamic model, Project no. 006187.

Department for Economy and Business (2009). 'Academic expertise for business, Cardiff: Welsh Assembly Government', http://new.wales.gov.uk/topics/businessandeconomy/a4b/?lang=en (accessed 21 August 2009).

Equality Act (2010).

Equality and Human Rights Commission (2008). *Who Runs Wales? The Road to Equality for Women*, Cardiff: EHRC.

Etzkowitz, H and Leydesdorff, L. A. (1997). 'Universities and the global knowledge economy: a triple helix of university–industry–government', *Research Policy*, 29, 2, 109–23.

European Commission (2009). *SHE Figures: Statistics and Indicators on Gender Equality in Science*, Luxembourg: Publications Office of the European Union.

European Commission (2010). *Europe 2010: A Strategy for Smart, Sustainable and Inclusive Growth*, Communication from the Commission, Brussels, 3 March, COM(2010) 2020, http://ec.europa.eu/europe2020/index_en.htm (accessed 20 May 2010).

Gheradi, S. (1995) *Gender, Symbolism and Organizational Culture*, London: Sage.

Goos, M. and Manning, A. (2007). 'Lousy and lovely jobs: the rising polarization of work in Britain', *Review of Economics and Statistics*, 89, 1, 118–33.

Government of Wales Act (2006).

Greed, C. (2005). 'Overcoming factors preventing gender mainstreaming in spatial planning', *Urban Studies*, 42, 719–48.

Harding, R., Hart, M., Jones-Evans, J. and Levie, J. (2007). *Global Entrepreneurship Monitor: UK 2007 Monitoring Report*, n.p.: GEM.

Higher Education Funding Council for England (2008). *2007 Higher Education: Business and Community Interaction Survey for UK Higher Education Institutions*, Bristol: HEFCE.

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, 7 April.

Hudson, J. (2006). 'Inequality and the knowledge economy: running to stand still?', *Social Policy and Society*, 5, 2, 207–22.

Leidner, R. (1991) 'Serving hamburgers and selling insurance', *Gender and Society*, 5, 2, 154–77.

Lewis, R. and Rake, K. (2009). *Breaking the Mould for Women Leaders: Could Boardroom Quotas Be the Key?* London: Fawcett Society.

MacEwen Scott, A. (1994) 'Gender segregation in the retail industry', in A. MacEwen Scott (ed.) *Gender Segregation and Social Change*, Oxford: Oxford University Press.

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

Manniche, J. (2010). 'Types of knowledge and learning', in H. Halkier, M. Dahlström, L. James, J. Manniche and L. Smed Olsen (eds), *Knowledge Dynamics, Regional Development and Public Policy*, Aalborg: Department of History, International and Social Studies, Aalborg University.

National Assembly of Wales (2009). *The Economic Contribution of Higher Education in Wales*, report from the Enterprise and Learning Committee, http://www.assembly-wales.org/cr-ld7730 (accessed 18 July 2011).

Office for National Statistics (2009). *First Release, Regional Labour Market Statistics, Annual Population Survey*, Newport: UK Statistics Agency.

Parken, A. (2003). 'Gender mainstreaming: "outing" hetero-sexism in the workplace', unpublished PhD thesis, University of Wales, Cardiff.

Parken, A. (2010a). 'A multi-strand approach to promoting equalities and human rights in policymaking', *Journal of Policy and Politics*, 38, 1, 79–99.

Parken, A. (2010b). *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. (2010c). 'Gender, knowledge dynamics and regional policy', in H. Halkier, M. Dahlström, L. James, J. Manniche and L. Smed Olsen (eds), *Knowledge Dynamics, Regional Development and Public Policy*, Aalborg: Department of History, International and Social Studies, Aalborg University, http://vbn.aau.dk/files/20055382/knowledge_dynamics_regional_development_public_policy.pdf (accessed 14 July 2011).

Parken, A. and Rees, T. (2009). *Gender and the Knowledge Economy in Wales*, a 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.

Perrons, D. (2004). 'Understanding social and spatial divisions in the new economy: New Media clusters and the digital divide', *Economic Geography*, 80, 10, 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, 389–411.

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*, 11, 2, 147–66.

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

Rudiger, K. and McVerry, A. (2007). *Exploiting Europe's Knowledge Potential: 'Good Work' or 'Could Do Better'*, a report prepared for the Knowledge Economy Programme, London: Work Foundation.
Savage, M. and Witz, A. (1992) 'Theoretical introduction: the gender of organisations', in M. Savage and A. Witz (eds.), *Gender and Bureaucracy*, Oxford: Blackwell.
Styck, K., Luyten, S., Kesteloot, C., Meert, H., and Peleman, K. (2008). 'A geography of gender relations: role patterns in the context of different regional industrial development', *Regional Studies*, 42, 1, 69–82.
Taylor, S. and Tyler, M. (2000) 'Emotional labour and sexual difference in the airline industry', *Work, Employment and Society*, 14, 1, 77–95.
United Nations Development Programme Regional Centre Europe and UNIFEM Europe (2004). *Bridging the Gender Digital Divide: A Report on Gender and ICT in Central and Eastern Europe and the Commonwealth of Independent States*, Bratislava: UNDP and UNIFEM.
Welsh Assembly Government (2010). *Economic Renewal: A New Direction*, Cardiff: Department for Economy and Transport, Welsh Assembly Government.
West, C. and Zimmerman, D. (1987). 'The social construction of gender', *Gender and Society*, 1, 2, 125–51.

Data sources

National Assembly for Wales (2004). *Mainstreaming Equality Policy Review*, final committee report of the Equality of Opportunity Committee, July, Cardiff: National Assembly for Wales, http://www.assemblywales.org/bus-home/bus-committees/bus-committees-second/bus-committees-second-eoc-home/bus-committees-second-eoc-policy/bus-committees-second-eoc-policy-sub2.htm (accessed 14 July 2011).
Office for National Statistics (2009). *First Release, Regional Labour Market Statistics*, NOMIS: Newport, Wales.
Statistics Wales (2007). *Statistics on Job Quality in Wales: Statistical Article*, 27 October, Cardiff: Welsh Assembly Government.
Statistics Wales (2009a). *Key Economic Statistics for Wales*, Statistical Bulletin, SB 48/2009, 14 August, Cardiff: Welsh Assembly Government.
Statistics Wales (2009b). *Workplace Employment by Industry in Wales 2001–2007*, Statistical Bulletin SB45/30 July, Cardiff: Welsh Assembly Government.