Mapping of women's participation within the manufacturing cluster labour market in Scotland

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June 2015

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1 Introduction

This research is funded by Close the Gap and takes place within the context of its overarching objective - to work across Scotland to promote positive activity to address the underlying causes of the gender pay gap.[1] As Table 1.1 highlights, the median and mean gender pay gap in Scotland stand currently at 7.6% and 13.3% respectively.

Table 1.1: Male and Female Full-Time Hourly Pay (excluding overtime) in Scotland (All Sectors)

Median Hourly Pay (Exclud. Overtime)			Mean Hourly Pay (Exclud. Overtime)		
Men (FT)	**Women (FT)**	**Pay Gap**	**Men (FT)**	**Women (FT)**	**Pay Gap**
£13.27	£12.26	**7.6%**	£16.27	£14.11	**13.3%**

Source: Annual Survey of Hours and Earnings (2013) - Work Region Industry SIC2007 (PROV) Table 5.6a

Whilst there is sector and industry variation around this economy-wide gender pay gap, discussions of why such a gap exists commonly identify three key and often interrelated contributory factors: occupational segregation; lack of flexible working opportunities; and pay discrimination (see Close the Gap 2013b).

Occupational segregation. Occupational segregation is the term used to describe patterns of employment where women and men tend to be clustered in different occupations and/or sectors. Occupational segregation contributes significantly to gender pay gaps in the UK (see also Mumford and Smith 2007; Olsen et al. 2010). There are two main dimensions to this segregation. **Horizontal segregation** is the clustering of women and men into gender-stereotyped occupations and sectors, and is a key cause of pay inequalities. Stereotypically, women work in the '5 Cs' of cleaning, catering, clerical, cashiering (retail) and childcare, sectors that are typically associated with low pay. **Vertical segregation**, or the 'glass ceiling', is the clustering of women into lower-grade occupations.

Lack of flexible working opportunities. The disproportionate responsibility that women have for childcare and care for sick people and older people contributes to occupational segregation and means that a lack of flexible working options impacts more on women than men. Workplace flexibility, including part-time work, is more characteristic of junior roles and/or stereotypically female occupations, and is associated with lower levels of pay.

Pay discrimination. The gender pay gap is also produced through discrimination within pay systems. This discrimination occurs, for example, where individuals are appointed to different points on a pay scale; where different job titles and grades are associated with jobs that are largely similar; where 'male' jobs have disproportionate access to bonus earnings and 'female' jobs have less access to high-paid shift and overtime work; where performance-related pay is influenced by gendered characteristics; where women do not receive the same access to training; and where sex bias in analytical job evaluation schemes grades women's jobs lower than similar jobs done by men.
These contributory factors will be considered in relation to manufacturing cluster employment in Scotland.

[1] See Close the Gap 2013a and Perfect 2011 for further details on understanding and calculating the gender pay gap.

1.1 Background

The purpose of this research project is to map women's participation within the manufacturing cluster labour market in Scotland and to identify occupational segregation, gendered skills gaps, and gender differences in participation in related Modern Apprenticeship frameworks and other skill pipelines. Moreover, the research will examine the impact of women's participation on earnings and on the gender pay gap within the manufacturing cluster.

1.2 Defining the Manufacturing 'Cluster'

The manufacturing cluster is defined in this research project in relation to the UK Standard Industrial Classification of Economic Activities 2007 (SIC 2007). Manufacturing is therefore all those Scottish business establishments/units classified under Section C Manufacturing and its component Divisions (see Appendix A for further details). The SIC 2007 is the UK's system of choice for classifying business establishments/units by economic activity generally (ONS 2009: 1) and in defining the manufacturing sector specifically (cf BIS 2010: 1). The SIC 2007 can be linked to key national surveys such as the Annual Survey of Hours and Earnings (ASHE), Quarterly Labour Force Survey (QLFS) and Annual Population Survey (APS). The SIC 2007 can also be linked to the Standard Occupational Classification System 2010 (SOC2010) to identify occupations/occupational clusters within sectors.

The SIC 2007, however, is not conducive to undertaking a detailed analysis of participation in Modern Apprenticeships because frameworks in Scotland are not broken down by industrial sector. Skills Development Scotland (SDS) does not use a SIC-based definition of manufacturing *per se* when classifying Modern Apprenticeship by industrial sector. Instead, SDS employ a broad split of Manufacturing/Engineering/Construction versus Services in, for example, its Modern Apprenticeship leavers and employers surveys. SDS supported this research by providing a table detailing this classification (see Appendix B for details). SDS's method of classifying Modern Apprenticeships by broad sectors undoubtedly assists in the analysis of developments and trends across all frameworks. This method is less helpful, however, in analysing developments within specific sectors, particularly manufacturing.

Usefully, though, the Alliance of Sector Skills Councils Scotland (ASSCS) employ a Sector Skills Council (SSC) based definition of the 'manufacturing cluster' i.e. employers that the following SSCs cover (see ASSCS 2011: 2):

- **Cogent** - chemicals, pharmaceuticals, nuclear, oil and gas, petroleum and polymer industries
- **Improve Ltd** - food and drink manufacturing and associated supply chains
- **Proskills** - printing, mineral extraction and processing, health and safety and process and manufacturing of furniture, glass, ceramics, coatings and paper
- **Semta** - science, engineering and manufacturing technologies
- **Creative Skillset** - TV, film, radio, interactive media, animation, computer games, facilities, photo imaging, publishing, advertising and fashion and textiles

Using the search by SSC function on SDS's Modern Apprenticeship statistics website, it is possible to drill down to examine the Modern Apprenticeship frameworks covered by these five SSCs (see Appendix C for full details).

The range of SSCs with a remit for manufacturing activity highlights the heterogeneity of the cluster, in which a diverse range of businesses and activities are linked in terms of 'making something'.

Recognising this diversity is crucially important to understanding the different participation and experiences of women in different parts of the manufacturing sub-cluster. Important aspects of this diversity are, however, difficult to gauge given data limitations, particularly at a Scotland-level where small sample size hampers detailed analysis.

2 Manufacturing, Employment and Gender

Manufacturing gross value added (GVA) has undergone a prolonged period of decline as a result of industry restructuring through global competition, but in 2012 GVA was still 10.6% of the UK economy (UKCES 2014a: 42). Far from being in unavoidable decline, the UK manufacturing cluster has the potential to grow its share of the economy through established sub-sectors (e.g. food & drink, pharmaceuticals, aerospace, electronics and automotive) and emerging sub-sectors/ technologies (e.g. renewables, nanotechnology, digital and advanced materials) (cf BIS 2010 and PWC 2009). Manufacturing is viewed as an especially attractive vehicle for economic resilience and growth because of its 'inherent capacity for export' (FSBS 2012: 4).

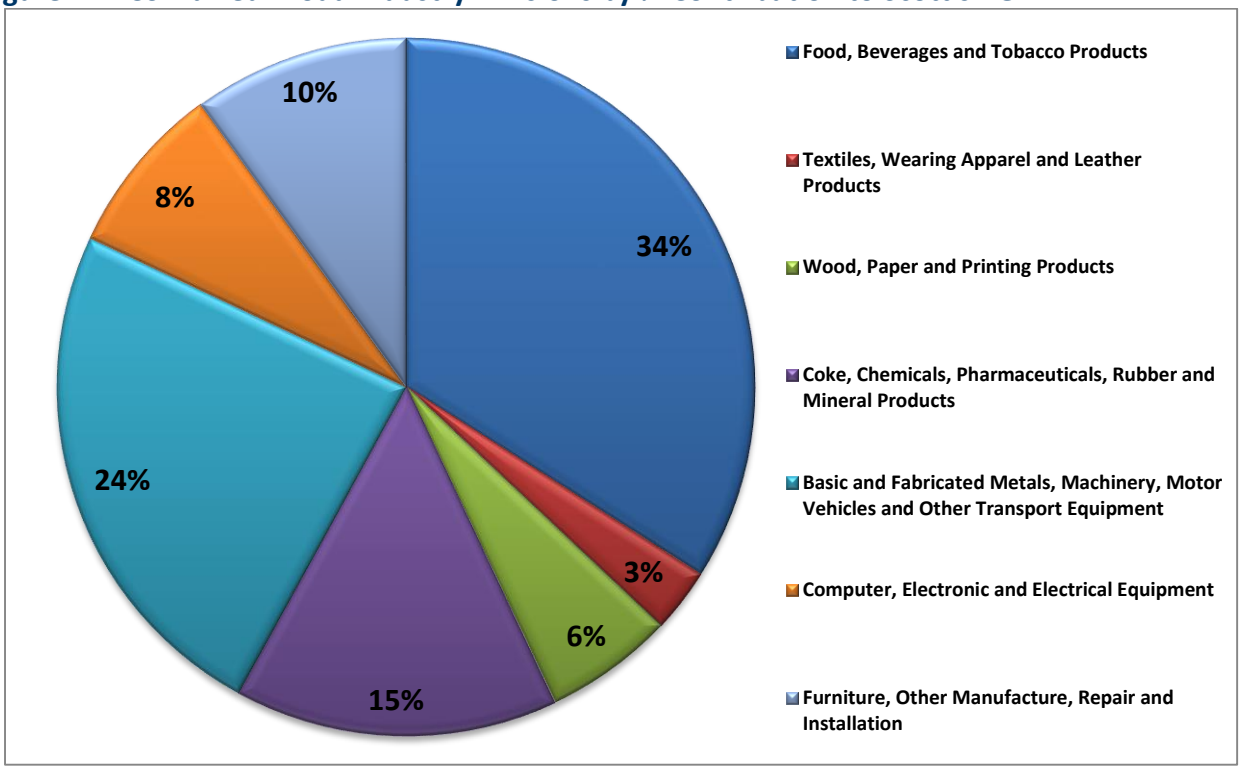
Whilst the global financial crisis which led to the economic downturn peaked in September 2008, and its reverberations across all sectors of the economy were profound (Financial Crisis Inquiry Commission 2011), recent trends point to the shoots of manufacturing recovery. UK manufacturing has, in fact, bounced back from the downturn at a quicker rate than other sectors, supported by improvements in competitiveness and productivity (EEF 2010: 2). Output growth in UK manufacturing is forecast to continue a steady rise in the period 2013-2022, albeit at a slightly lower rate than the rest of the economy (ibid: 44-45). The first 2014 quarterly UK *Manufacturing Outlook* report notes that manufacturers are 'increasingly optimistic about their prospects', with recent and forecasted growth evident in all regions - including Scotland (EEF 2014: 1 and 7).

However, the UK manufacturing cluster is made up of a number of distinct sub-sectors where current and forecasted growth is variable. Some areas of the industry are expected to experience growth (e.g. transport equipment, food & drink, specialist engineering products) whilst others are expected to experience decline (e.g. machinery sector) (UKCES 2014a). Growth in many manufacturing sub-sectors is dependent on a range of factors, such as the value of Sterling and public sector spending, but a recurring theme is the need for a determined shift to higher quality, higher value goods/'niche' products to maintain competitive advantage. Even in declining sub-sectors, there are opportunities for innovation through exploring new global and product opportunities (BIS 2010: vi). Whilst the rest of the machinery sector is struggling, for instance, 'UK makers of precision instruments for industrial applications and makers of detection and security equipment are recognised as leaders in global markets' (UKCES 2014a: 44).

The global financial crisis has led some commentators to argue strongly in favour of re-balancing national economic activities away from financial services and towards industries like manufacturing (SCER & SKOPE 2014; Shanmugalingam et al. 2010). In Scotland, providing support and opportunities for innovation in sectors, markets and firms that offer the best potential for competitive advantage forms the backbone of the Scottish Government's economic strategy (Scottish Government 2011) - with energy (including renewables), food & drink and life sciences three of the key growth sectors that straddle many manufacturing sub-sectors (ibid: 45). GVA contribution varies considerably by manufacturing sub-sectors. In Scotland, as Figure 2.1 illustrates, two broad manufacturing sub-sector groupings contributed to more than half of the total manufacturing GVA of £12.7 billion in 2011: food, beverages and tobacco products (34%: SIC 2007 10-12) and basic and fabricated metals, machinery, motor vehicles and other transport equipment (24%: SIC 2007 24-25 & 28-30) (Scottish Government 2013a: 3). In the period 2010-2011, the largest GVA growth at the level of manufacturing division was in the manufacturing of beverages (SIC 2007 10) and the largest GVA decline at the level of manufacturing division was in the manufacture of chemicals and chemical

products (SIC 2007 20) (Scottish Government 2013a: 4). In the same period, Scottish-owned businesses in the Scottish manufacturing cluster contributed to 47.2% of GVA, foreign-owned businesses contributed to 35.8% of GVA and rest of UK-owned businesses contributed to 17% of GVA (ibid: 5).

Figure 2.1: Combined Broad Industry Divisions by % Contribution to Scottish GVA



Source: Scottish Annual Business Statistics 2011 (from Scottish Government 2013a: 4)

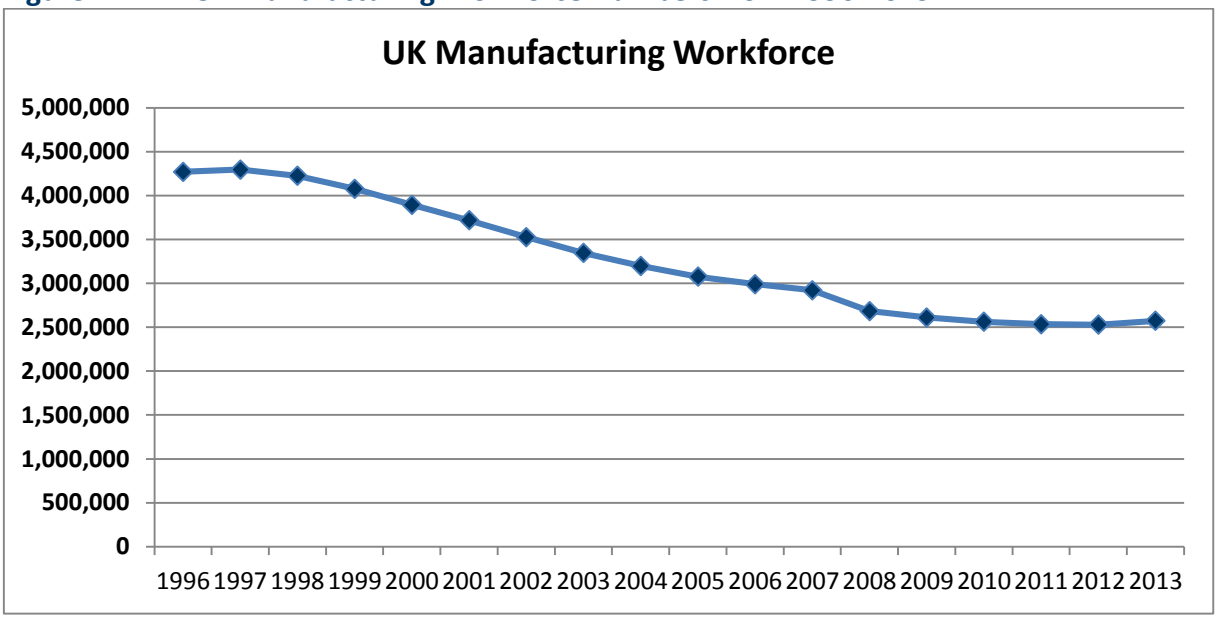
Compared to the rest of the Scottish economy, there is a higher proportion of medium-sized (50-249 employees) enterprises operating within the manufacturing cluster (ASSCS 2011: 4). Nevertheless, as the Federation of Small Businesses Scotland highlights, 89% of all manufacturing businesses in Scotland are small enterprises (less than 50 employees) (FSBS 2012: 5). Appendix D provides detailed information on the number and size of businesses within the Scottish manufacturing cluster by SIC 2007 Divisions.

2.1 Employment and Skills

As reported in a recent UKCES (2012) study, the manufacturing cluster workforce in the UK comprises managerial staff, skilled tradespeople and production operatives, with significant numbers of professionals and fewer associate professionals. This overarching profile varies, however, by sub-sector. Higher proportions of management, professional and associate professionals are employed in manufacturing chemicals, pharmaceuticals, electronic products, beverages and scientific research and development, and higher proportions of operator and elementary occupations are employed in the manufacture of food, clothes, paper, textiles, rubber and plastics. There is strong demand for higher-level skills with 'a STEM element' and for lower-level, often labour-intensive, operative skills (UKCES 2012: xi) because manufacturing is 'a heterogeneous sector encompassing activities from those which require skill inputs of the highest order, to more mundane, more labour intensive activities' (UKCES 2012: ix).

The UK and Scottish manufacturing workforce has declined in recent decades. Figures 2.2 and 2.3 help illustrate this decline, and reveal that the total UK and Scottish manufacturing workforce at the end of 2013 was 2,574,000 and 203,000 respectively. Signs of manufacturing job recovery, however, are also evident, with an increase in manufacturing jobs in the UK and Scotland from 2012 to 2013.

Figure 2.2: All UK Manufacturing Workforce Numbers from 1996-2013



Source: Workforce Jobs by Industry (SIC2007) and Sex (unadjusted) - NOMIS 17 April 2014

Figure 2.3: All Scottish Manufacturing Workforce Numbers from 1996-2013

Source: Workforce Jobs by Industry (SIC2007) and Sex (unadjusted) - NOMIS 17 April 2014

The UKCES (2012) manufacturing sector assessment highlights that, compared with other UK sectors, manufacturing tends to have: a higher proportion of full-time workers and fewer part-time, self-employed and temporary workers; a higher proportion of the workforce in older age-bands; fewer migrant workers, although with variability in sub-sectors - most notably food and clothes manufacture; and a workforce composition that is broadly similar to the rest of the UK, although there are more higher-level occupations and fewer lower-level occupations in England. ASSCS (2011:

5) profiled the manufacturing cluster relative to all Scottish workplaces and note similar working and profile patterns to the rest of the UK. ASSCS also note, however, that, compared to all Scottish workplaces, Scottish manufacturing has a much higher proportion of process, plant and machine operatives (25% compared with 7%) and a lower proportion of elementary occupations (7% compared with 12%) (ibid: 6).

Changes in the structure of employment within UK manufacturing is linked to a number of developments. New technology within the food, beverage, electronics and motor manufacture sectors has reduced the demand for some occupations (UKCES 2014a: 45 and 60). Skilled trades occupations, process, plant & machine operatives and many elementary occupations group are expected to continue their pattern of structural decline (ibid: 61). However, it is important to remember that that whilst the relative proportion of many of these jobs is in structural decline, they are not disappearing. Replacement demand will continue to be an important feature for the manufacturing cluster, not least given the relatively ageing workforce (UKCES 2012: 165). UK replacement demand across all sectors is expected to be around 12 million jobs over the next decade and this demand can still offer good career paths for sectors and occupations in structural decline (UKCES 2014a: xii). New job opportunities are also emerging because 'the management and operation of the new technologies will require greater shares in employment for managerial, professional and associate professional occupations, including technicians of various kinds' (UKCES 2014a: 61).

The steady exit of many workers with years of experience, skill and knowledge makes addressing replacement demand through developing a new, young manufacturing workforce especially important for the survival of the sector: 'replacing this valuable resource with younger people will involve both planning for, and managing, skills succession; investment in training; and stronger efforts to make working in Manufacturing as attractive as possible to the best young talent' (UKCES 2012: 155).

Both ASSCS (2011) and UKCES (2012) assess skill demand and use in the manufacturing sector in Scotland and the UK respectively. The former report greater awareness amongst manufacturing employers of Modern Apprenticeships (56%) and a greater likelihood of staff undertaking them (12%) than is the case for Scottish employers overall, and a slightly higher proportion of recent recruits who are qualified to Degree Level (29%) or above (5%). In addition, ASSCS reports that manufacturing employers in Scotland are more likely to report skills gaps (that is, where an employee lacks the necessary skills to carry out their role with full proficiency) than employers in the rest of the economy (18% cf 15%), with particular gaps in technical and practical skills (61%), problem solving skills (55%) and planning and organising skills (52%). Around 64% of firms report that these skills gaps have an impact on establishment performance. Whilst ASSCS report that Scottish manufacturing firms are as likely as other firms in Scotland to provide training (61%), for the UK as a whole UKCES reports that employers in the sector are less likely to have supplied training to their employees than firms in general, and that they supply fewer training hours than their European counterparts.

The 2013 UK Commission's Employer Skills Survey reported on the density of skill shortage vacancies by occupation and sector, noting that manufacturing has the highest skill shortage density for professional occupations (55%) (UKCES 2014: 120). Skills shortage density for skilled trades' occupations is relatively high across most sectors but particularly high within manufacturing (41%) (*ibid*). Notably, two of the main skill pipelines into these manufacturing occupations are typically

through Modern Apprenticeships and, often STEM-related, degree programmes - two pipelines that tend to be male-dominated.

It is worth noting, however, that there is a general absence of any detailed gender analysis of employment and skills in relevant UK and Scottish manufacturing skills reports, such as those produced by UKCES and ASSCS. Any analysis tends to be limited to providing high-level data on the percentage gender split and part-time working by gender - although UKCES do provide data by SOC major group and sub-sector (cf UKCES 2012: 64-66). As a result, it is sometimes necessary to look outside the UK to better understand some developments and problems.

2.2 Women in Manufacturing

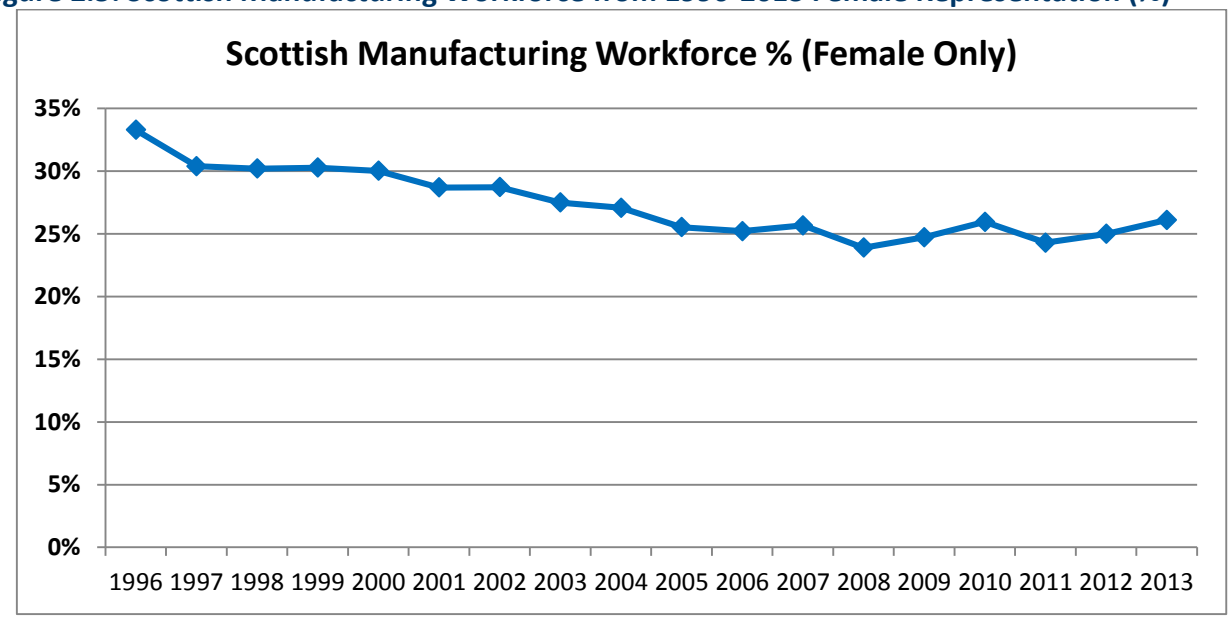
Despite recent signs of global manufacturing recovery, this recovery may not benefit women and men equally. The US Congress Joint Economic Committee, for instance, reports that although US manufacturing jobs have increased by 554,000 jobs since 2010, this figure is the product of the 565,000 jobs gained by men and 11,000 jobs lost by women (US Congress Joint Economic Committee 2013: 6). The Committee note that women's representation within the US manufacturing cluster is now at its lowest since 1971 (at 27%) and there should be a determined push to 1) increase 'STEM education participation and proficiency for girls beginning as early as elementary school, and equipping women with the skills and knowledge desired by manufacturing employers', and 2) increase the proportion of women in manufacturing leadership roles (Ibid). The National Women's Law Centre (2013: 2) argue that a range of key stakeholders (employers, training providers, unions, policymakers) must work together to increase women's participation in US manufacturing and that there should be greater regulation to combat key participation barriers - such as gender stereotyping and discriminatory employment practices.

Female representation within the UK and Scottish manufacturing cluster is actually lower than this recent US figure, at 24% (UK) and 25% (Scotland) (UKCES 2012: 64). Figure 2.4 shows the total manufacturing workforce numbers in Scotland by gender in the period 1996 to 2013, highlighting that there were 150,000 male and 53,000 female jobs in 2013 and that the industry has been male-dominated for some time. Figure 2.5 shows the proportion of female workers only in the cluster over the same period, and it is clear that women's participation within the Scottish manufacturing cluster has gradually declined. Unlike the US, however, the recovery shows very early, and tentative, signs of a slight increase in female participation. Notwithstanding this increase, a more significant upward shift will be required to reach the 1996 level of 33%.

Figure 2.4: Scottish Manufacturing Workforce Numbers from 1996-2013 by Gender

Source: Workforce Jobs by Industry (SIC2007) and Sex (unadjusted) - NOMIS 17 April 2014

Figure 2.5: Scottish Manufacturing Workforce from 1996-2013 Female Representation (%)



Source: Workforce Jobs by Industry (SIC2007) and Sex (unadjusted) - NOMIS 17 April 2014

It is important to consider not only women's participation in manufacturing employment but also the types of jobs that women do, and whether there are patterns of occupational segregation. STUC report that 'women are concentrated in the relatively low-paid sub-sectors of manufacturing (horizontal segregation), like food and textiles, and in more junior roles within all sub-sectors (vertical segregation)' (STUC 2011: 16). These patterns of horizontal and vertical segregation, they suggest, go some way to explain the relatively high gender pay gap in Scottish manufacturing (ibid). UKCES (2012: 66) reiterate some of these occupational segregation patterns - highlighting women's relative under-representation in professional occupations and over-representation in process, plant and machine operative occupations in particular. Under-representation of women within professional occupations is interesting given the increasing numbers of female STEM graduates. However, a recent report from the Royal Society of Edinburgh (2012: 18) reveals that just 27% of female compared to 52% of male STEM graduates move into STEM jobs. Despite the shortage of

female professionals in the manufacturing and other key sectors, they note that female STEM graduates are more likely to be economically inactive and that the female attrition rate in STEM careers is much higher than the male attrition rate. The higher female attrition rate may well relate to the relatively inflexible work patterns within the UK and Scottish manufacturing cluster (e.g. low levels of part-time workers), as highlighted in the previous section.

Under-representation of women in the manufacturing cluster is widely recognised and 62% of manufacturing businesses in Scotland report having an explicit equality & diversity policy to address this (ASSCS 2011). This figure compares favourably with some international figures: for example, in the US less than 25% of manufacturers report gender and diversity as an area of focus (Giffi and McNelly 2013). There has also been active debate around women on boards and in other leadership roles in the cluster and some impressive examples of women leaders in some firms (cf Institute of Mechanical Engineers publication 'Women in Manufacturing'; EEF 2013). Notwithstanding the presence of women at the highest levels in some manufacturing firms, women's relative absence is in part explained by what some perceive as a lack of work flexibility in the cluster (EEF 2013; Giffi and McNelly 2013).

It is evident, therefore, that the manufacturing cluster in Scotland (and elsewhere) has some way to go to equalise gender participation and pay. There are sound business, as well as legislative, reasons for rebalancing the sector and harnessing the talent of the current and potential future workforce - particularly in light of the sector's relatively high skill gaps in Scotland (cf ASSCS 2011; UKCES 2014b). In order to begin to redress this imbalance, however, it is necessary to establish exactly what is happening within the manufacturing cluster labour market in Scotland by mapping women's participation, identifying levels, occupations and sub-sectors where segregation is most prominent and identifying gendered skills gaps. It will also be important to examine the education and training routes into the sector given that occupational gender segregation is linked to education/training gender segregation. Certainly, participation in related Modern Apprenticeship frameworks will be of particular interest - not least because Modern Apprenticeships are a key route into skilled trades and some technical occupations. The Scottish manufacturing sector, moreover, is second only to the construction sector in its uptake of Modern Apprenticeships and has the highest proportion of non-participating employers who plan to offer an apprenticeship in the future (SDS 2013: 32 and 37).

Given the above, it is clear there is both opportunity and high quality employment available in the manufacturing sector. Manufacturing continues to generate a significant number of jobs to meet new and replacement demand. Most of these jobs are permanent and relatively secure. The industry has a wide skills mix albeit with sub-sector variation. Whilst there are areas of low pay in the industry, there are also areas where financial rewards are good. Firms in the sector invest in training and skills development, particularly in relation to skilled trades. Existing data suggests, however, that women are not accessing high quality jobs in the sector on the same terms as men, despite emerging evidence that some employers in the sector are paying increased attention to issues of equality and diversity.

3 Research Objectives and Methodology

This research had one overarching objective: to map women's participation within the manufacturing cluster labour market in Scotland. Within the overarching objective were a number of discrete objectives:

1. Analysing patterns of employment within and across the manufacturing cluster, enabling an analysis of occupational segregation (horizontal and vertical) within the cluster and across sub-clusters.
2. Analysing pay by gender within and across the manufacturing cluster.
3. Analysing the distribution of skills and qualifications across and within the cluster by gender, with a particular focus on how Modern Apprenticeships are used and differentially distributed by gender within and across the cluster.
4. Analysing training activity within the cluster by gender, and exploring training as a possible proxy for job progression potential.

The research methodology comprised secondary data and a literature review, analysis of existing national datasets and some primary data collection and analysis. Whilst the focus of this research is on quantitative data analysis, some qualitative data was generated from industry stakeholders to place the quantitative research findings in context and to assess stakeholder perceptions of the research findings, and to examine stakeholder perceptions and priorities for the manufacturing sub-cluster. The research was undertaken in three key stages:

Stage I involved reviewing and evaluating the extant literature on the participation of women in manufacturing employment and defining the manufacturing cluster for the purposes of the Stage 2 analysis.

Stage 2 involved analysis of existing national datasets to address the overarching research objectives and the four distinct objectives. Preliminary consideration suggested that the most relevant national datasets for analysis were the Annual Survey of Hours and Earnings (ASHE) and the Annual Population Survey (APS) which combines results from the Labour Force Survey (LFS) and the English, Welsh and Scottish LFS boosts. The survey covers 155,000 households and 360,000 people per dataset and comprises 41,853 responses for Scotland.

ASHE data is a particularly useful source of UK earnings data and is based on a one per cent sample of HM Revenue & Customs (HMRC) PAYE records. ASHE collects information from approximately 280,000 employers. Standard tables include information on hours and earnings by sex and full-time/part-time employment. Breakdowns include by region, occupation, industry, region by occupation and age groups. The larger sample size in ASHE results in smaller error bands and employer data may have greater reliability for some variables such as pay. Hence, ASHE is the data source of choice for analysing gender pay gaps.

However, APS/QLFS contains a broader range of questions and some variables (e.g. number of hours of unpaid overtime worked) where employers may not be the most reliable source. Analysis using both APS (July 2012 to June 2013, Special Access) and ASHE (2013, Provisional Results) allowed a fuller picture of the manufacturing cluster workforce to emerge. The Workforce Jobs series (WFJ) series latest release (2014) was also a useful source of higher-level data on manufacturing sector

employment, and patterns of change over time (see ONS 2013 for more details), and the 2013 UKCES Employer Skills' Survey (see UKCES 2014) results provided important supplementary skills data.

Profiling the manufacturing cluster workforce required descriptive statistics alone rather than any multivariate analysis. In profiling the manufacturing cluster, women's participation was compared with men's participation in manufacturing and with women's employment across the Scottish economy. Table 3.1 indicates the type of questions that supported the data analysis in relation to the four distinct research objectives.

Table 3.1: Research Objectives and Indicative Research Questions

Research Objective	Indicative Research Questions
Analysing patterns of employment within and across the manufacturing cluster, enabling an analysis of occupational segregation (horizontal/vertical) within the cluster and across sub-clusters	• How many women work in manufacturing in Scotland? • Where in the manufacturing cluster do women work? Is women's participation higher in some clusters than others? • Is women's participation in manufacturing related to firm/ workplace size? • What level of activities/occupations do women undertake in manufacturing?
Analysing pay by gender within and across the manufacturing cluster	• How does women's pay and compare with that of men? • Are women equally likely to receive bonus earnings? Does this differ by type of bonus earnings? • How do hours of work compare between women and men? • How prevalent is the use of flexible hours and is this differentially reported by gender? • Are women equally likely to work overtime? • Are women more likely than men to work part-time in manufacturing? Would women in manufacturing prefer to work shorter hours?
Analysing the distribution of skills and qualifications with a particular focus on the possession and impact of Modern Apprenticeship qualifications	• How do patterns of participation in manufacturing Modern Apprenticeships compare between women and men? • How do the level of qualifications of women and men compare in manufacturing? • How do the nature of qualifications of women and men compare in manufacturing? • Is there any relationship between level/nature of qualification and earnings for men and women?
Analysing training activity within the cluster by gender, and exploring training as a possible proxy for job progression potential.	• How often is training (both on and off the job) reported by men and women? • What type of training is most commonly undertaken? • Is training being undertaken in working hours?

Stage 3 comprised a small number of interviews (n=7) and one focus group with relevant employer, employee/union, public agency and government stakeholders. These stakeholders were purposively selected to ensure relevant knowledge and coverage of key subsectors. The purpose of these interviews was twofold: to add a contemporary Scottish context to the discussion of the Stage 2 findings, and to use the findings to examine stakeholder perceptions and priorities for the manufacturing sub-cluster.

4 Employment and Patterns of Occupational Segregation

Analysis of employment patterns and occupational segregation trends drew primarily on the APS 2012-2013 (with special user licence access).

APS data indicates that manufacturing is the fourth most significant industry in Scotland behind (i) public administration, education and health, (ii) distribution, hotels and restaurants and (iii) banking and finance. Manufacturing is almost exclusively located in the private sector (98.9% of employment is in private sector) and men are significantly more likely to work in the private sector than women (81.1% male, 62.1% female). As highlighted earlier, the manufacturing sector in Scotland is male-dominated and women account for just over 26% of the total workforce. Only 4.7% of women are employed in manufacturing compared with 12.8% of men. Almost all men (96.1%) and women work in permanent jobs in manufacturing (96.1%). The number of dependent children under 16 in the respondent's family was not related to employment in the sector for women or for men.

The proportion of women and men aged under 25 is broadly similar (8.9% male, 7.7% female), although a slightly higher proportion of men is aged 50 and over (39.4% males, 35.6% female). Similar proportions of men and women in the cluster have a disability (87%), although slightly more women are DDA disabled. There is little gender difference in the ethnic composition of the manufacturing workforce, which is predominantly white (98.5% male and 98.4% female white). There are slightly more Asian/Asian Scottish/Asian British women than men in manufacturing but overall their numbers are small.

Women are more likely than men to be employed in manufacturing workplaces with fewer than 20 employees (21.5% cf 17.4%). There is no clear gendered pattern in employment tenure in manufacturing in Scotland, and no gender difference at all in employment tenure of five years or more.

A gender breakdown of manufacturing employment in Scotland by occupation (SOC2010 major group) is shown in Table 4.I.

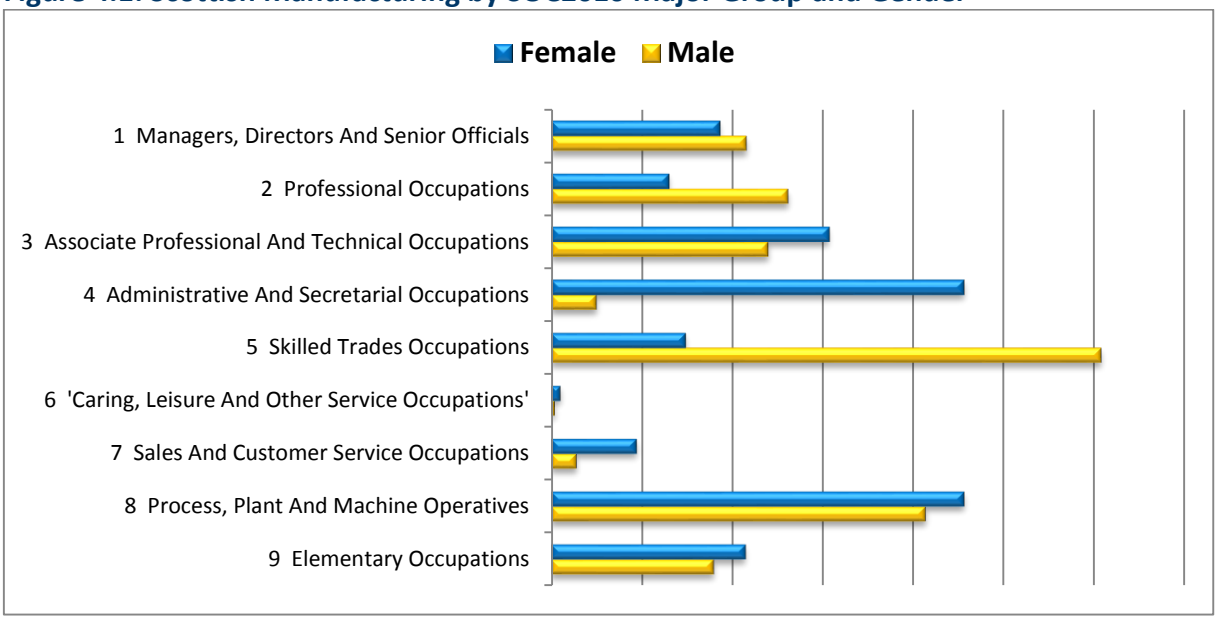
Table 4.1: Scottish Manufacturing by SOC2010 Major Group and Gender

SOC2010 Major Groups		Male	Female	Total
1 Managers, Directors and Senior Officials	% within Major occupation group (main job)	76.0%	24.0%	100.0%
	% within Sex of respondent	**10.8%**	**9.3%**	10.4%
2 Professional Occupations	% within Major occupation group (main job)	84.6%	15.4%	100.0%
	% within Sex of respondent	**13.1%**	**6.5%**	11.3%
3 Associate Professional and Technical Occupations	% within Major occupation group (main job)	68.1%	31.9%	100.0%
	% within Sex of respondent	**12.0%**	**15.3%**	12.9%
4 Administrative and Secretarial Occupations	% within Major occupation group (main job)	23.4%	76.6%	100.0%
	% within Sex of respondent	**2.5%**	**22.8%**	8.0%
5 Skilled Trades Occupations	% within Major occupation group (main job)	91.8%	8.2%	100.0%

	% within Sex of respondent	**30.4%**	**7.4%**	24.3%
6 Caring, Leisure and Other Service Occupations	% within Major occupation group (main job)	50.0%	50.0%	100.0%
	% within Sex of respondent	**.2%**	**.5%**	.2%
7 Sales And Customer Service Occupations	% within Major occupation group (main job)	44.4%	55.6%	100.0%
	% within Sex of respondent	**1.4%**	**4.7%**	2.2%
8 Process, Plant and Machine Operatives	% within Major occupation group (main job)	71.3%	28.7%	100.0%
	% within Sex of respondent	**20.7%**	**22.8%**	21.3%
9 Elementary Occupations	% within Major occupation group (main job)	69.7%	30.3%	100.0%
	% within Sex of respondent	**9.0%**	**10.7%**	9.4%

Source: The Annual Population Survey, July 2012 to June 2013 (Special Access)

Figure 4.1: Scottish Manufacturing by SOC2010 Major Group and Gender



Source: The Annual Population Survey, July 2012 to June 2013 (Special Access)

The data presented in Table 4.1 and Figure 4.1 is interesting in a number of respects. On a positive note, and within the confines of low overall participation in total manufacturing employment (24%), women are proportionately represented in the highest occupational category of managers, directors and senior officials and more than proportionately represented in associate professional and technical occupations. These findings require further consideration, although national datasets shed little additional light: the level of granularity required to identify respondents in Scotland in different occupations within manufacturing by gender renders results meaningless due to small respondent numbers. In particular we would be interested in the specific jobs, and routes into these jobs, women undertake at managerial/director level and associate professional/ technical level. For example, women are somewhat more likely to occupy production management positions than their relative weight of numbers would suggest. This may be related to the disproportionately large numbers of women in routine operation and assembly roles, some of whom progress through production management. Of greater concern, women are significantly under-represented in professional occupations overall and are segregated within professions: for example, women are

under-represented in the engineering professions but more likely than men to be sales professionals. Women are under-represented in skilled trades, whilst being over-represented in administrative and secretarial and sales and customer service occupations.

Table 4.2 gives an illustration of the occupations in which women and men are present in the greatest number in the manufacturing cluster.

Table 4.2: Top Female and Male Occupations in Scottish Manufacturing

Top Female Occupations	Top Male Occupations
General office assistants/clerks	Metal working production & maintenance fitter
Packers, bottlers, canners, fillers	Production works & maintenance managers
Food, drink & tobacco process operators	Food, drink & tobacco process operators
Sewing machinists	Electricians, electrical fitters
Account wages clerk, bookkeeper	Other good handing & storage occupations n.e.c.
Sales representatives	Marketing and sales managers
Production works & maintenance managers	Welding trades
Assemblers (electrical products)	Metal machine setter & setter-operator
Marketing and sales managers	Engineering technicians

Source: The Annual Population Survey, July 2012 to June 2013 (Special Access)

In some occupations (for example, welding and machine setting) there are no women in Scotland represented in the APS dataset. Women are also scarcely represented in a range of manufacturing occupations: maintenance works, engineering technicians, chemical and related storage activities, goods handling and storage. Similarly, there are few women electricians or electrical fitters.

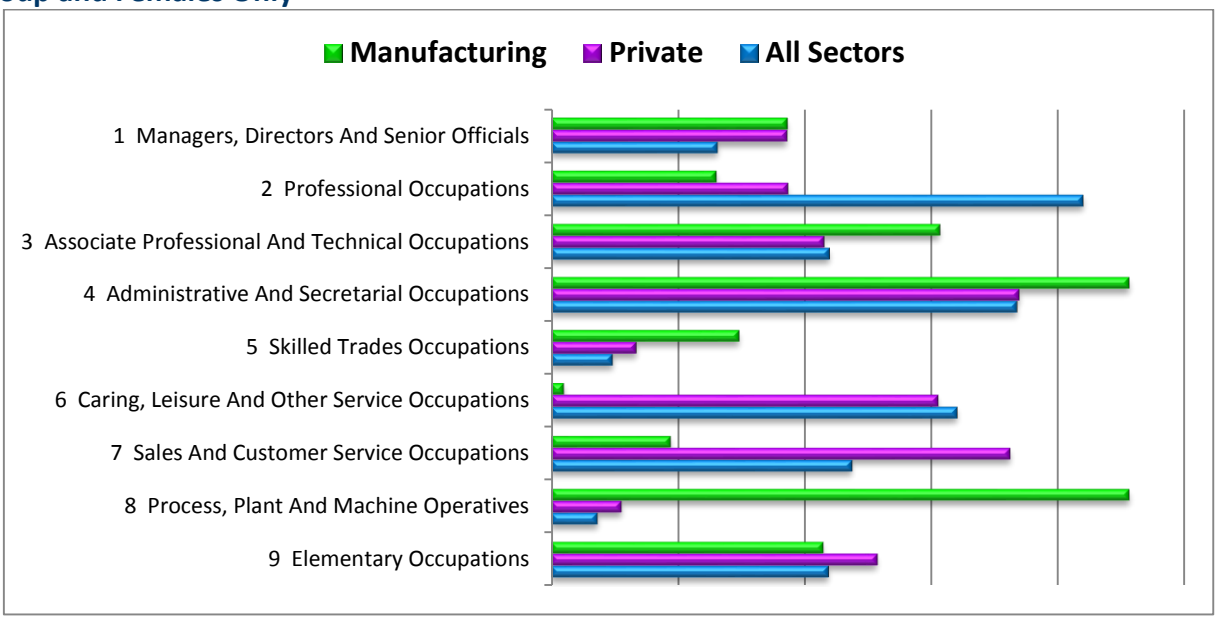
Having considered gender and occupational distribution within manufacturing, it is important to assess how far patterns of occupational segregation reflect patterns in the wider economy. Table 4.3 shows the occupational distribution of women and men in Scottish employment in all sectors, the private sector and the manufacturing sector. Figure 4.2 helps support this comparison by showing the proportionate occupational distribution of women only in all sectors, the private sector and the manufacturing sector. Including the private sector as a comparator is important given the potential influence of the higher participation and higher occupational attainment of women in the public sector on all sector only comparisons.

It is clear that the gender balance at manager/director level in manufacturing is the same as in the private sector - both higher than for the Scottish economy as a whole - and the gap between men and women in these roles is smaller in manufacturing. Certainly, manufacturing employment is more similar to other private sector employment than to all employment in Scotland in some important respects.

Table 4.3: Scotland only All Sectors/Private Sector/Manufacturing Sector by SOC2010 Major Group and Gender

SOC2010 Major Group	All Sectors		Private Sector		Manufacturing	
	Male	Female	Male	Female	Male	Female
1 Managers, Directors And Senior Officials	11.7%	**6.6%**	13.1%	**9.3%**	10.8%	**9.3%**
2 Professional Occupations	17.6%	**21.0%**	14.4%	**9.3%**	13.1%	**6.5%**
3 Associate Professional And Technical Occupations	14.6%	**11.0%**	12.4%	**10.7%**	12.0%	**15.3%**
4 Administrative And Secretarial Occupations	4.2%	**18.4%**	3.4%	**18.4%**	2.5%	**22.8%**
5 Skilled Trades Occupations	20.2%	**2.4%**	23.2%	**3.3%**	30.4%	**7.4%**
6 Caring, Leisure And Other Service Occupations	3.6%	**16.0%**	2.7%	**15.2%**	0.2%	**0.5%**
7 Sales And Customer Service Occupations	5.2%	**11.9%**	6.1%	**18.1%**	1.4%	**4.7%**
8 Process, Plant And Machine Operatives	11.5%	**1.8%**	12.9%	**2.8%**	20.7%	**22.8%**
9 Elementary Occupations	11.5%	**10.9%**	11.7%	**12.8%**	9.0%	**10.7%**
Total	100%	**100%**	100%	**100%**	100%	**100%**

Figure 4.2: Scotland only All Sectors/Private Sector/Manufacturing Sector by SOC2010 Major Group and Females Only



However, the proportion of women professionals is much lower in manufacturing (6.5%) than in all sectors (21%), and lower than in the private sector (9.3%). There is a higher proportion of women working in associate professional jobs in manufacturing (15.3%) than in all sectors (11%) and the private sector (10.7%). Interestingly, however, women do somewhat better in terms of employment in skilled trades in manufacturing than in the rest of the private sector: whilst men are four times as likely to occupy skilled trades positions in manufacturing, men in the wider private sector are seven times as likely to be in skilled trades positions. As might be expected, the proportion of men and women in caring, leisure and other service occupations is much lower in the manufacturing sector. As might be expected too, the proportion of men and women working in process, plan and machine operatives occupations is much higher in the manufacturing sector. However, a higher proportion

of women than men work in process, plan and machine operatives occupations in manufacturing - a finding that is not mirrored in the private sector (12.9% male and 2.9% female) and wider economy (11.5% male and 1.8% female) where men are significantly more likely than women to work in these jobs. Moreover, women employed in manufacturing across the occupational spectrum are more likely to be in jobs involving non-industry specific skills, such as non-technical professional and association professional skills (e.g. finance, HR, marketing and sales) and administration and clerical skills.

The research examined part-time and overtime working as well as flexible working practices. Looking firstly at part-time working, Table 4.4 indicates that women are much more likely to work part-time hours than men in all sectors, including manufacturing. However, women are only half as likely to work part-time in manufacturing than in the private sector and all sectors in Scotland (as Figures 4.3 - 4.5 help illustrate).

Table 4.4: Scotland only All Sectors/Private Sector/Manufacturing Sector Full-Time and Part-Time by Gender

	All Sectors		Private Sector		Manufacturing	
	Male	Female	Male	Female	Male	Female
Full-time	86.2%	**55.6%**	85.4%	**52.9%**	96.5%	**77.0%**
Part-time	13.7%	**44.4%**	14.5%	**47.1%**	3.5%	**23.0%**

Source: The Annual Population Survey, July 2012 to June 2013 (Special Access)

Figure 4.3 Females (PT/FT Split) All Sectors

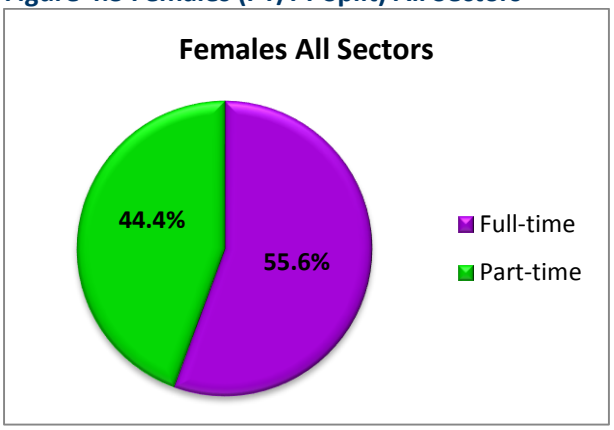


Figure 4.4: Females (PT/FT Split) Private Sector

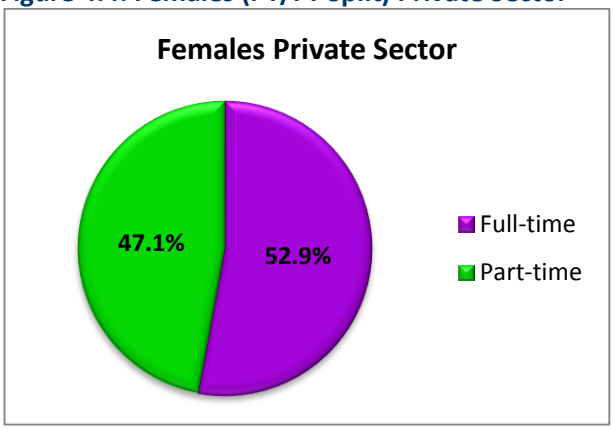
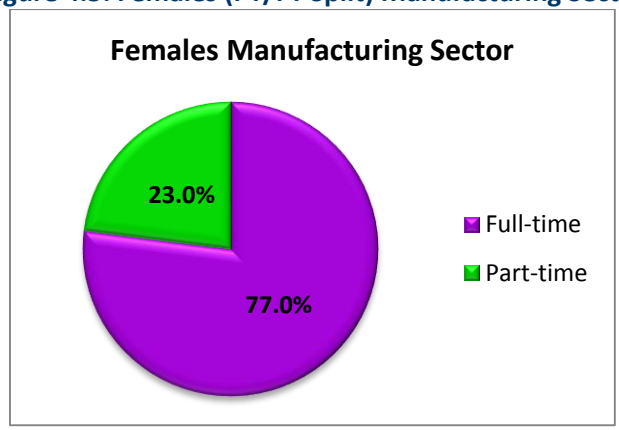


Figure 4.5: Females (PT/FT Split) Manufacturing Sector



Female part-time working within the manufacturing cluster, moreover, varies across major occupational group. Table 4.6 shows a breakdown of full-time/part-time working for females by

SOC2010 major group. Part-time working is relatively low in professional occupations (4.8%), managers, directors and senior officials occupations (13.1%) and associate professional and technical occupations (16.9%). Part-time working is relatively high in sales and customer service occupations (50%) and administrative and secretarial occupations (32.2%). Table 4.5 suggests that part-time working tends to be higher in non-manufacturing specific occupations, although part-time working in skilled trades occupations is slightly higher (25%) than the cluster average (23%).

Table 4.5: Female Part-Time/Full-time in Scottish Manufacturing by SOC2010 Major Group

SOC2010 Major Group	Full-time	Part-time
1 Managers, Directors And Senior Officials	86.9%	**13.1%**
2 Professional Occupations	95.2%	**4.8%**
3 Associate Professional And Technical Occupations	83.1%	**16.9%**
4 Administrative And Secretarial Occupations	67.8%	**32.2%**
5 Skilled Trades Occupations	75.0%	**25.0%**
6 Caring, Leisure And Other Service Occupations	..	**..**
7 Sales And Customer Service Occupations	50.0%	**50.0%**
8 Process, Plant And Machine Operatives	77.9%	**22.1%**
9 Elementary Occupations	74.0%	**26.0%**
Total	77.0%	**23.0%**

Source: The Annual Population Survey, July 2012 to June 2013 (Special Access)

4.1 Sub-Cluster Variation

Using national datasets to analyse detailed sub-cluster variation within the manufacturing labour force is limited by the small number of respondents within each sub-cluster. Women are employed across the manufacturing sub-clusters but their density is highest in four sub-clusters which together account for 55.1% of all female manufacturing employment. These are food and beverage manufacture (female density = 28.4%; male density = 17.3%), textile manufacture (female density = 9.1%; male density = 2.8%), machine and equipment manufacture (female density = 9.5%; male density = 17.8%) and chemicals and chemical products manufacture (female density = 8.1%; male density = 5.4%).

Drilling down from these sub-clusters reduces respondent numbers dramatically, but for illustration, women are most concentrated in the following areas:

- Processing fish, crustaceans and molluscs (female density 5.8%; male density 1.9%)
- Manufacture of rusk, biscuits, pastry and cake (female density 5.1%; male density 1.5%)
- Manufacture of medical & dental instruments and supply (female density 4.4%; male density 1.4%)
- Distilling, rectifying & blending spirit (female density 4.1%; male density 4.9%)
- Manufacture of pharmaceutical preparations (female density 3.7%; male density 1.9%)

Women, it was suggested, are better represented in the food and drink sub-sector, most notably in the manufacture of food because it is perceived as a ‘clean’ sub-sector. Men, on the other hand, tend to dominate the manufacturing of drinks, with women working in stereotypical female customer service-type roles.

It is impossible to disaggregate occupational data reliably at sub-cluster level given the relatively small Scottish sample size in national datasets. However, Scottish sector profiles from the respective manufacturing cluster skills councils are particularly helpful in disentangling sub-sector variations. Food and drink manufacturing in Scotland, for instance, has approximately 44,000 employees and a much higher proportion of female workers than in Scottish manufacturing as a whole (Improve Ltd 2011: 4). The majority of workers in this sub-cluster (60%) are employed in either elementary occupations (23%) or process, plant and machines operative occupations (37%) - with just 1% of the workforce in professional occupations (ibid: 5). In some contrast, the science, engineering and manufacturing technologies sub-cluster has a much greater share of manufacturing jobs (100,500), is by far the largest of all the sub-clusters and there is a lower proportion of women than in Scottish manufacturing as a whole (SEMTA 2011: 3). The majority of workers in this sub-cluster (60%) work in either skilled trades occupations (26%), professional occupations (17%) or managerial/director occupations (17%) (ibid: 4). The contrasting figures from these two sub-clusters serve to highlight the heterogeneous nature of the sector and point to patterns of gender segregation by sub-sector and level and type of occupation.

Within the manufacturing cluster there are three other sub-clusters, each with their distinct gender and occupational profile (cf Cogent 2011; Proskills 2011; Skillset 2011). A review of the skills profiles for all five sub-clusters, however, reveals that the proportion of employers with explicit equality & diversity policies is lowest in the science, engineering and manufacturing sub-cluster (SEMTA 2011: 6). There is also variation in part-time working across the manufacturing sub-clusters. ASSCS Scottish sector skills profiles reveal that although a higher proportion of females work part-time across all sub-clusters, proportions vary from sub-cluster to sub-cluster. Table 4.6 details the percentages of males and females working part-time by the five manufacturing sector skills clusters. A note of caution, however, is that the Scottish average part-time working percentage figure is reported as 20% in all ASSCS sector profiles, which is much lower than APS data suggests (i.e. 44.4%, see Table 4.4). Such conflicting figures render meaningful gender analysis of employment and skill problematic. Nevertheless, it can be reasonably assumed that ASSCS applied the same methodology to calculate part-time working in each sector profile. SEMTA has the lowest proportion of females working part-time (4%) and Skillset the highest (14%).

Table 4.6: Part-Time Working in Scottish Manufacturing by Gender and Skills Councils

Scottish Manufacturing Cluster Sector Skill Profiles (2011)	**Part-Time Working**	
	Male	**Female**
Science, engineering and manufacturing technologies (SEMTA 2011: 2)	2%	**4%**
Food and drink manufacturing and associated supply chains (IMPROVE 2011a: 4)	3%	**7%**
Chemicals, pharmaceuticals, nuclear, oil and gas, petroleum and polymer industries (COGENT 2011: 3)	1%	**6%**
Printing, mineral extraction and processing, health and safety and process and manufacturing of furniture, glass, ceramics, coatings and paper (PROSKILLS 2011: 2)	3%	**8%**
TV, film, radio, interactive media, animation, computer games, facilities, photo imaging, publishing, advertising and fashion and textiles (SKILLSET 2011: 3)	7%	**14%**

5 Gender and Pay

Table 5.1 shows the median and mean gender pay gap in manufacturing for the UK and Scotland. Although women are slightly better represented in Scottish manufacturing than in the other 'home nations' (see UKCES 2012: 64), median and mean gender pay gaps are considerably higher in Scotland (26.5% and 28.9% respectively) than in the UK as a whole (20.8% and 19.0%).[2] Mean and median pay gaps in Scottish manufacturing are also much higher than for Scotland as a whole (see Table 1.1 i.e. 7.6% and 13.3%). Gender pay inequality is, therefore, a significant issue in manufacturing employment in Scotland.

Table 5.1: Male and Female Full-Time Hourly Pay (excluding overtime) in Manufacturing Sector (UK and Scotland)

	Median Hourly Pay (Exclud. Overtime)			Mean Hourly Pay (Exclud. Overtime)		
	Men (FT)	**Women (FT)**	**Pay Gap**	**Men (FT)**	**Women (FT)**	**Pay Gap**
UK	£13.18	£10.44	**20.8%**	£15.47	£12.53	**19.0%**
Scotland	£13.95	£10.26	**26.5%**	£16.06	£11.42	**28.9%**

Source: Annual Survey of Hours and Earnings (2013) - Work Region Industry SIC2007 (PROV) Table 5.6a

Drawing on ASHE data at the level of SIC 2007 Divisions and regions supported a more detailed analysis of Scottish manufacturing gender pay gaps across the sub-clusters. As Table 5.2 highlights, men's median and mean pay is higher than women's pay in all of the 24 Divisions except for 'other manufacturing', where there is a mean pay gap of -11.5% (i.e. women earn more). Pay gaps across the sub-clusters vary but mean gaps are particularly high in the following sub-clusters: manufacture of textiles (43.8%); printing and production of recorded media (42%); and manufacture of computer, electronic and optical products (39.1%).

However, the relatively small number of women working in the sector in particular means that there is key missing data for some Divisions. An x is marked in Table 5.2 to indicate insufficient male and/or female data to present reliable pay information. There are only eight of the 24 Divisions where all female and male mean and median pay data is available, and therefore pay gap data in the other Divisions should be treated with caution. High pay gaps in Divisions with relatively low numbers of men and/or women may well be the product of a very small number of, for instance, high earning men or women. Focusing on these eight Divisions only, pay gaps are highest in the following sub-clusters: manufacture of computer, electronic and optical products (39.1%); manufacture of fabricated metal products, except machinery and equipment (32.5%); and manufacture of food products (29.2%).

[2] It should be borne in mind, however, that the full-time gender pay gap is higher in the private sector than in the public sector (EHRC 2009: 12), and that manufacturing is largely a private sector endeavour. Furthermore, the Public Sector Equality Duty (PSED) does not extend to most private sector enterprises (see, for example, EHRC 2012).

Table 5.2: Male and Female Full-Time Hourly Pay (excluding overtime) in Scottish Manufacturing Sector by SIC2007 Divisions

	Median		Pay Gap	Mean		Pay Gap
	Men (FT)	Women (FT)		Men (FT)	Women (FT)	
10 Manufacture of food products	£9.40	£7.25	**22.9%**	£11.66	£8.26	**29.2%**
11 Manufacture of beverages	£16.30	£13.72	**15.8%**	£18.55	£15.37	**17.1%**
12 Manufacture of tobacco products						
13 Manufacture of textiles	x	£8.99		£15.79	£8.87	**43.8%**
14 Manufacture of wearing apparel	x	£8.68		x	£9.29	
15 Manufacture of leather and related products		x			£9.71	
16 Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	£11.22			£14.29		
17 Manufacture of paper and paper products	£12.23	£10.61	**13.2%**	£13.93	£11.23	**19.4%**
18 Printing and reproduction of recorded media	x	£9.24		£16.99	£9.85	**42.0%**
19 Manufacture of coke and refined petroleum products						
20 Manufacture of chemicals and chemical products	£12.81	£11.04	**13.8%**	£14.39	£11.78	**18.1%**
21 Manufacture of basic pharmaceutical products and pharmaceutical preparations	£18.22	x		£19.98	£14.92	**25.3%**
22 Manufacture of rubber and plastic products	£12.22	£10.32	**15.5%**	£13.72	£11.77	**14.2%**
23 Manufacture of other non-metallic mineral products	£13.56			£14.17		
24 Manufacture of basic metals	£20.62			£21.53		
25 Manufacture of fabricated metal products, except machinery and equipment	£12.43	£9.39	**24.5%**	£14.27	£9.63	**32.5%**
26 Manufacture of computer, electronic and optical products	£16.74	£10.66	**36.3%**	£19.27	£11.74	**39.1%**
27 Manufacture of electrical equipment	£13.72	x		£14.50	£10.32	**28.9%**
28 Manufacture of machinery and equipment n.e.c.	£14.54	x		£15.96	£15.39	**3.6%**
29 Manufacture of motor vehicles, trailers and semi-trailers	£12.50			£11.58		
30 Manufacture of other transport equipment	£16.08	£13.77	**14.4%**	£18.53	£14.64	**21.0%**
31 Manufacture of furniture	x			£10.53		
32 Other manufacturing	£9.32	x		£9.92	£11.06	**-11.5%**
33 Repair and installation of machinery and equipment	£19.75	x		£22.01	£15.36	**30.2%**

Source: Annual Survey of Hours and Earnings (2013) - Work Region Industry SIC2007 (PROV) Table 5.6a

A key issue relating to gender pay inequalities is the composition of pay in terms of earnings premia, allowances and bonuses to which men and women may have differential access. Looking at the composition of earnings within the manufacturing cluster, APS data generated small category sizes, limiting their reliability. In the relevant pay period, however, of those who reported bonus pay in their last pay, 18% were women and 92% were men i.e. men are significantly more likely to receive bonus pay. Again, although the overall numbers were small, a higher proportion of women received shift allowances, bonuses and other additions to pay whilst a higher proportion of men received overtime payments, payment for working unsociable hours, stand-by or on call allowances and profit related pay. Moreover, a higher proportion of men (79.7%) than women (72.7%) are paid overtime above the normal basic rate for the job. ASHE data is not available by sector and occupational classification. Having identified the top female and male occupations in the Scottish manufacturing sector at 4-digit SOC level, however, it is possible to examine ASHE regional pay data for these occupations (see Tables 5.3 and 5.4). An important note of caution is that these occupational groups span all sectors, albeit some are primarily located within manufacturing.

Table 5.3: Top Female Scottish Manufacturing Occupations - Mean and Median Full-Time Hourly Pay (excluding overtime) for Females by 4-Digit SOC Code

SOC2010 Code	Top Female Occupations (SOC2000)	Median	Mean
4159	General office assistants or clerks	£9.44	£10.25
9134	Packers, bottlers, canners, fillers	£7.06	£8.41
8111	Food, drink & tobacco process operators	£7.11	£7.80
8137	Sewing machinists	£6.62	£7.23
4122	Account wages clerk, bookkeeper	£11.29	£12.16
3542	Sales representatives	x	£14.19
1121	Production works & maintenance managers	£16.97	£19.48
8131	Assemblers (electrical products)		
1132	Marketing and sales managers	x	£36.92

Source: Annual Survey of Hours and Earnings (2013) - Work Region Occupation SOC2010 4-Digit (PROV) Table 15.6a

Table 5.4: Top Male Scottish Manufacturing Occupations - Mean and Median Full-Time Hourly Pay (excluding overtime) for Males by 4-Digit SOC Code

SOC2010 Code	Top Male Occupations (SOC2000)	Median	Mean
5223	Metal working production & maintenance fitter	£13.70	£14.62
1121	Production works & maintenance managers	£23.91	£27.31
8111	Food, drink & tobacco process operators	£8.25	£9.92
5241	Electricians, electrical fitters	£13.34	£13.80
9260	Other good handing & storage occupations n.e.c.	£8.79	£9.36
1132	Marketing and sales managers	x	£36.76
5215	Welding trades	£12.44	£13.02
5221	Metal machine setter & setter-operator	x	£12.75
3113	Engineering technicians	£15.61	£17.25

Source: Annual Survey of Hours and Earnings (2013) - Work Region Occupation SOC2010 4-Digit (PROV) Table 15.6a

These tables highlight that women tend to be located in occupations that are lower paid. The top four female occupations, for example, all have median earnings of less than £10 per hour as opposed to only one of the top four male occupations. It is interesting that three of these top female and male occupations are the same but median and mean full-time pay in two of these occupations are lower for women - with the exception of marketing and sales managers, where mean pay is slightly higher for women.

APS data underlines the tendency for women to be located in lower-paid occupations. Table 5.5 lists those occupations by 4-digit SOC code with gross monthly earnings of £2500 and over in the Scottish manufacturing cluster, indicating where the relative proportion of women or men in these occupations is higher.

Table 5.5: Occupations with Gross Monthly earnings of £2500 and over

SOC2010 Code	Occupation	Relative Proportion Higher (Gender)
8139	'Assemblers and routine operatives n.e.c.'	Male
2129	'Engineering professionals n.e.c.'	Male
5249	'Electrical and electronic trades n.e.c.'	Male
2126	'Design and development engineers'	Male
8133	'Routine inspectors and testers'	Male
1121	'Production managers and directors in manufacturing'	Female
3567	'Health and safety officers'	Male
8141	'Scaffolders, stagers and riggers'	Male

Source: The Annual Population Survey, July 2012 to June 2013 (Special Access)

Turning to actual hours of work, the vast majority of men (80.8%) and women (78.6%) employed in manufacturing work between 31 and 40 hours per week. Women are more likely (as highlighted in the previous section) to work less than full-time hours: for 25.8% of women, basic usual hours are 30 hours or less per week compared to 5.3% of men. Conversely, men are more likely to work longer hours than women, with 16.7% of men reporting basic usual hours are more than 40 hours per week (some reporting very long hours) compared to 6.1% of women. More men than women report that weekly hours tend to vary (39.6% of men cf 28.7% of women).

Looking beyond normal working hours, the majority of men and women did not undertake any hours of paid overtime (60.4% and 65.9% respectively). However, 25.3% of men undertook six or more hours of paid overtime compared with 14% of women - a findings consistent with ASHE data which reveals that mean weekly paid overtime hours for full-time workers in Scottish manufacturing is 0.8 hours for women compared with 2.4 hours for men (see ASHE 2013: Table 15.11a). ASHE data also highlights that the mean weekly overtime pay for women working full-time is much lower than for men (£9.50 and £41.70 respectively, see ASHE 2013: Table 5.4a). Notably, 38% of women reported working unpaid overtime hours compared with 32.2% of men.

6 Qualifications, Skills and Training

In order to understand fully the relationship between occupation and reward, it is important to take into account human capital factors such as qualifications and skills as well as access to training and development opportunities. In considering how the level and nature of qualifications of women and men compare in manufacturing, APS data reveals that 74.6% of women have three or more Highers compared with 70.4% of men, whilst 25.4% of men have fewer than three Highers, as do 24.6% of women. Men are more likely to report having one or more Advanced Highers (87.5% versus 12.5%) although the number of respondents is too low here to be reliable. Looking at higher qualifications, more women (17.5%) than men (16%) reported holding a degree-level qualification (including foundation degrees, graduate membership of professional institute, PGCE, or higher). Men were, however, more likely than women to focus on single subject undergraduate degree (88% cf 79%). More men than women employed in manufacturing held a doctorate as their highest qualification (17.8% cf 10%). A greater proportion of women, however, held a Masters degree (65% cf 62.2%) or other postgraduate qualification (25% cf 17.8%).

Table 6.1 identifies the highest qualifications held by employees in manufacturing by gender.

Table 6.1: Level of Highest Qualification Held by Gender in Scotland only Manufacturing

Qualification Level		Male	Female	Total
NQF Level 4 and above	% within Level of highest qualification held	72.1%	27.9%	100.0%
	% within Sex of respondent	**31.8%**	**33.9%**	32.4%
NQF Level 3	% within Level of highest qualification held	78.9%	21.1%	100.0%
	% within Sex of respondent	**16.2%**	**11.9%**	15.1%
Trade Apprenticeships	% within Level of highest qualification held	94.6%	5.4%	100.0%
	% within Sex of respondent	**16.4%**	**2.6%**	12.7%
NQF Level 2	% within Level of highest qualification held	67.2%	32.8%	100.0%
	% within Sex of respondent	**11.5%**	**15.4%**	12.5%
Below NQF Level 2	% within Level of highest qualification held	68.9%	31.1%	100.0%
	% within Sex of respondent	**9.6%**	**11.9%**	10.2%
Other Qualifications	% within Level of highest qualification held	66.9%	33.1%	100.0%
	% within Sex of respondent	**7.7%**	**10.5%**	8.5%
No Qualifications	% within Level of highest qualification held	57.9%	42.1%	100.0%
	% within Sex of respondent	**6.9%**	**13.8%**	8.7%

Source: The Annual Population Survey, July 2012 to June 2013 (Special Access)

A slightly higher proportion of women (33.9%) than men (31.8%) hold higher-level qualifications i.e. at NQF Level 4 and above. Women do less well at middle-level qualification level i.e. trade apprenticeships and NQF Level 3 (possibly related to fact that many of these middle-level qualifications are associated with trade/technical-level apprenticeships). More than half of women

(51.6%) compared to just over one-third of men (35.7%) hold lower-level qualifications (i.e. NQF Level 2 and below). Moreover, twice as many women (13.8%) than men (6.9%) in the Scottish manufacturing cluster hold no qualifications. However, it is difficult to assess gender patterns in problems such as over-qualification and skills underutilisation in manufacturing from extant data sources (e.g. APS, ASSCS, UKCES). It would be helpful, for instance, to examine the level and type of qualifications women hold and the level and type of qualifications required to get the job. Indeed, stakeholder interviews revealed that some highly skilled female engineers opt for lower-level, lower paid jobs that offer more flexible working arrangements such as part-time work.

Previous research by ASSCS (2011) suggests that the Scottish manufacturing employers were less likely to have a staff training plan than firms in all Scottish industries, and the UK Commission's Employer Skills Survey (UKCES 2014: 68) report a significant reduction in the number of training and development days across UK manufacturing. APS data reveals that a higher proportion of men than women received job-related training or education in last three months (23.1% of men, 16.1% of women), although slightly more women received job-related education and training in the last four weeks (45.6% compared with 41.9%).

6.1 Modern Apprenticeships

All modern apprentices in Scotland have employee status and therefore Modern Apprenticeship statistics reflect the demand-driven nature of the system. The 2012 Modern Apprenticeship Employer Survey highlights that 25% of employers in the manufacturing cluster in Scotland offer an apprenticeship - second only to construction employers (SDS 2013: 32). Analysis of APS data reveals that of those Scottish manufacturing workers who had completed an apprenticeship, 96% were men and 4% were women.

SDS Modern Apprenticeship statistics are publicly available on its website, as are a number of related reports/statistics. The analysis presented here is based on publicly available data from SDS for all 2012/13 new starts, using ASSCS definition of the manufacturing 'cluster' to identify manufacturing Modern Apprenticeships. Full year 2013/2014 figures will not be available until after the project end date.

Table 6.1 shows that the overall gender split in manufacturing Modern Apprenticeships in 2012/2013 was 20% female and 80% male. It is therefore apparent that, as one of the main skill pipelines into the cluster, this route is inherently gendered. Moreover, the vast majority of these women (77%) started a Modern Apprenticeship in Food and Drink Operations, which is one of the lower-paid sub-sectors. As Improve (the SSC for food and drink manufacturing and associated supply chains) state in their introduction to their Modern Apprenticeship framework, 'relative to the Scottish economy as a whole, employment is concentrated in comparatively lower skilled occupations. About half of the workforce is employed in processing, plant/machine and operative roles' (Improve 2014: 4).

The gender imbalance is even more pronounced for 16-19 year old new starts, where the split is 7% female and 93% male (see Table 6.2). This may not be occurring solely within manufacturing. In Scotland, mirroring developments in England, young people are losing out with the expansion of adult apprentices. In 2008/2009, 74% of all new start Modern Apprentices in Scotland were aged 16-19 years and 2012/13 data reveals that this figure dropped to 44%. The latest quarterly figures released by SDS, moreover, show that just 33% of new start apprentices were aged 16-19 years. It

is perhaps for this reason that the interim report of the Wood Commission (Scottish Government 2013b) has now called for key stakeholders to work together to consider innovative ways in which apprenticeships, particularly higher-level apprenticeships (above Level 3) in key growth sectors, for young people can be developed and expanded.

However, for most women undertaking Modern Apprenticeships, these remain firmly below Level 3. Tables 6.3 and 6.4 provide a breakdown of Modern Apprenticeships in the manufacturing cluster by SVQ Level 2 and Level 3. There were no Level 4 and above starts in 2012/2013. Of particular note is that 79% of all new female starts were undertaking a Level 2 qualification compared to 35% of all males.

Table 6.1: Modern Apprenticeship Frameworks in the Scottish Manufacturing Sector 2012/2013 - All Ages by Gender

ALL AGES MANUFACTURING CLUSTER			
	Female	**Male**	**Total**
SVQ Level 3 in Oil and Gas Extraction	**9**	124	133
SVQ Level 3 in Process Manufacturing	**4**	33	37
SVQ Level 3 in Signmaking	**1**	6	7
Water Treatment Management at Level 2 /3	**2**	32	34
Food and Drink Operations at Level 2/3	**531**	681	1212
Extractive and Mineral Processing at SVQ Level 2-5	**3**	175	178
Furniture, Furnishings and Interiors at Level 2/3	**0**	0	0
SVQ Level 2/3 in Glass Industry Occupations	**2**	133	135
SVQ Level 3/4 in Occupational Health and Safety Practice	**9**	16	25
SVQ Level 2/3 in Printing Industry Occupations	**1**	8	9
SVQ Level 2 in Wood and Timber	**0**	4	4
Level 3 in Engineering/Technical Apprenticeship in Engineering SCQF 8/9	**47**	1382	1429
SVQ Level 2/3 in Life Sciences	**12**	9	21
SVQ Level 3 in Creative and Digital Media	**6**	10	16
SVQ Level 2/3 in Fashion and Textiles Heritage	**61**	126	187
TOTAL	**688**	2739	3427
GENDER SPLIT	**20%**	**80%**	**100%**

Table 6.2: Modern Apprenticeship Frameworks in the Scottish Manufacturing Sector 2012/2013 - 16-19 year-olds by Gender

16-19 YEAR OLDS MANUFACTURING CLUSTER			
	Female	**Male**	**Total**
SVQ Level 3 in Oil and Gas Extraction	**8**	81	89
SVQ Level 3 in Process Manufacturing	**4**	32	36
SVQ Level 3 in Signmaking	**1**	5	6
Water Treatment Management at Level 2 /3	**1**	7	8
Food and Drink Operations at Level 2/3	**41**	117	158
Extractive and Mineral Processing at SVQ Level 2-5	**2**	4	6
Furniture, Furnishings and Interiors at Level 2/3	**0**	0	0

SVQ Level 2/3 in Glass Industry Occupations	0	23	23
SVQ Level 3/4 in Occupational Health and Safety Practice	1	1	2
SVQ Level 2/3 in Printing Industry Occupations	1	6	7
SVQ Level 2 in Wood and Timber	0	3	3
Level 3 in Engineering/Technical Apprenticeship in Engineering SCQF 8/9	36	1076	1112
SVQ Level 2/3 in Life Sciences	10	7	17
SVQ Level 3 in Creative and Digital Media	4	7	11
SVQ Level 2/3 in Fashion and Textiles Heritage	3	27	30
TOTAL	112	1396	1508
GENDER SPLIT	7%	93%	100%

Table 6.3: All Level 2 Modern Apprenticeship Frameworks in the Scottish Manufacturing Sector 2012/2013 by Gender

BREAKDOWN LEVEL 2			
	Female	Male	Total
Water Treatment Management at Level 2	0	2	2
Food and Drink Operations at Level 2	477	600	1077
Extractive and Mineral Processing at SVQ Level 2	0	120	120
Furniture, Furnishings and Interiors at Level 2	0	0	0
SVQ Level 2 in Glass Industry Occupations	2	93	95
SVQ Level 2 in Printing Industry Occupations	1	7	8
SVQ Level 2 in Wood and Timber	0	4	4
SVQ Level 2 in Life Sciences	2	2	4
SVQ Level 2 in Fashion and Textiles Heritage	61	126	187
TOTAL	543	954	1497
GENDER SPLIT	36%	64%	100%

Table 6.4: Level 3 Modern Apprenticeship Frameworks in the Scottish Manufacturing Sector 2012/2013 All Ages by Gender

BREAKDOWN LEVEL 3			
	Female	Male	Total
SVQ Level 3 in Oil and Gas Extraction	9	124	133
SVQ Level 3 in Process Manufacturing	4	33	37
SVQ Level 3 in Signmaking	1	5	6
Water Treatment Management at Level 3	2	30	32
Food and Drink Operations at Level 3	54	81	135
Extractive and Mineral Processing at SVQ Level 3	3	55	58
Furniture, Furnishings and Interiors at Level 3	0	0	0
SVQ Level 3 in Glass Industry Occupations	0	40	40
SVQ Level 3 in Occupational Health and Safety Practice	9	16	25
SVQ Level 3 in Printing Industry Occupations	0	1	1
Level 3 in Engineering	47	1382	1429
SVQ Level 3 in Life Sciences	10	7	17
SVQ Level 3 in Creative and Digital Media	6	10	16

SVQ Level 3 in Fashion and Textiles Heritage	**0**	0	0
TOTAL	**145**	1784	1929
GENDER SPLIT	**8%**	**92%**	**100%**

Women undertaking Modern Apprenticeships are significantly under-represented at Level 3 (see Table 6.4) where 8% of apprentices are women and 92% were men. This finding requires further investigation, particularly given the Scottish Government's commitment to tackling occupational segregation in Modern Apprenticeship provision. The majority of women, moreover, are not only undertaking a lower-level qualification - and, with it, undergoing a typically shorter period of training - but in a vocational stream that leads to relatively low paid work (i.e. food & drink operations). The majority of men, in contrast, are undertaking a higher-level qualification with a typically longer period of training in a vocation stream that is relatively high paid (e.g. engineering).

These gendered patterns in Modern Apprenticeships were acknowledged by stakeholders in the sector:

> This is very typical now that girls now across all MAs predominate at level 2, males across all sectors predominate at level 3 and of course there's less spend per head and they're less technical. (Stakeholder)

It must be borne in mind that Modern Apprenticeships are just one route into manufacturing. There may well be other Modern Apprenticeship routes into manufacturing in more generic areas such as administration and finance. What the Modern Apprenticeship tables highlight, however, is gendered patterns in manufacturing specific Modern Apprenticeships in Scotland: women are under-represented in Modern Apprenticeships overall in the year analysed, particularly under-represented in 16-19 year old apprenticeships and are further under-represented in Level 3 apprenticeships.

6.2 Skills and Skill Pipelines

Modern Apprenticeships are just one key skill pipeline into manufacturing specific jobs. STEM-related graduate pathways represent another key skill pipeline into jobs at professional level. As section 4 highlighted, however, women are proportionately under-represented in professional occupations within the cluster (6.5% of all females in professional occupations compared with 13.1% of all males). What is more, it is important to bear in mind that these are proportionate figures and that women represent just one quarter of the total manufacturing workforce.

Not only are women under-represented proportionately and numerically in professional occupations but analysis of APS data at 4-digit SOC level reveals clear patterns of occupational segregation within the professional category. Men tend to be clustered in manufacturing specific engineering professional occupations (e.g. mechanical engineers, civil engineers, electrical engineers, electronics engineers, production and process engineers, engineers n.e.c). Women tend to be clustered in non-manufacturing specific occupations (e.g. chartered and certified accountants, management consultants and business analysts, business and financial project management professionals). The proportionate gender balance is more even in IT-related professional occupations (e.g. IT project and programme managers, IT business analysts, architects and system designers, programme and software development professionals) and in some non-engineering scientific occupations (chemical scientists, physical scientists, natural and social scientists n.e.c).

These patterns of occupational segregation at professional level suggest there are a range of skill pipelines into professional occupations within the cluster and that many women are entering through non-manufacturing specific graduate pathways (e.g. business-related, IT-related and non-engineering routes). One explanation of why women are better represented in manufacturing specific non-engineering roles than engineering roles relates to gendered STEM subject choices at school. Indeed, the professional pipeline into the industry is influenced by the type of STEM subjects studied at school. As one stakeholder commented:

> If you want a job in engineering, you do maths and a science subject … the companies say 'I don't want someone with maths and biology or maths and chemistry … it's maths and physics we need'. [But] girls choose biology generally and boys choose physics generally.

However, over one-third of all women in the manufacturing cluster in Scotland work in process, plan and machine operative occupations or elementary occupations and the skill pipelines into these roles are not always clearly mapped - but are certainly at a lower level. For many of these occupations, the skill pipelines require on-the-job training only. Improve (2011b: 7 and 17), for instance, note that the formal entry qualifications for elementary occupations tend to be either no qualifications or Level 1 qualifications (equivalent to GSCE standard grades D-G). Similarly, the pre-requisite for entry into many process, plan and machine operative occupations is a Level 2 qualification (equivalent to GSCE standard grades A-C) or a related Level 2 Modern Apprenticeship. Certainly, stakeholders indicated that the industry sub-clusters exhibited different skills profiles. Food and drink, for example, is perceived as relatively low-skilled sub-sector. At the same time, it was suggested that just because a large proportion of jobs in the food and drink sub-cluster are relatively low skilled, there is still a requirement for some highly skilled jobs.

7 Discussion and Conclusion

7.1 Occupational Segregation

The manufacturing cluster shows significant patterns of horizontal and vertical segregation. Key stakeholders were unsurprised by these patterns. Identifying from national datasets the top nine male and female occupations in the industry highlights the dissimilarity in the jobs that men and women do, with only three overlapping categories, two of which are managerial occupations.

Managerial-level work:
Interestingly women in manufacturing appear to do reasonably well in obtaining managerial, director and senior official jobs relative to their overall representation in the cluster, comprising 24% of this occupational category and 26% of employment across manufacturing. Indeed, women are present at the highest levels of manufacturing companies in greater proportions than in the Scottish economy as a whole. However, while small sample sizes restrict the usefulness of national data in delineating the precise managerial occupations of women in the industry, when we look at jobs that women do at managerial/director level, the gender balance is more even in the more generic business-related occupational areas (e.g. financial managers and directors, marketing and sales directors, purchasing managers and directors) than in more industry specific technical roles. Many stakeholders suggested that women tended to achieve more in non-industry specific roles such as HR and finance, and many of these roles deliver comparable earnings to industry specific roles. Talking specifically about the food and drink sector, one stakeholder commented:

> There's a lot of women in HR, I can name a lot of women who are managing in HR. There's actually a good number at operation level, Ops Managers etc. and a lot of them seem to come from the meat side of things. I think they are coming from farming so they might not be taking over the home farm because there's a big brother or something like that but they obviously know a lot about it. This is just my personal experience from the women I know in the industry. I think if you were to break it down there would be a lot in HR, Ops management and marketing as well.

Firm size may also have a bearing on the roles women occupy. One stakeholder suggested that in family firms managerial succession within the family might lead to more women in managerial roles.

Professional, associate professional and technical work:
Women are significantly under-represented relative to men in professional work. As discussed in the previous skill pipeline section, women are more likely to be working in non-manufacturing specific professional occupations such as accounting, finance and IT. Men are more likely to be working in manufacturing specific engineering professional occupations such as mechanical engineering, electrical engineering and production/process engineering.

Whilst women are slightly better represented in associate professional and technical work, APS data reveal similar patterns of occupational segregation to those evident within professional occupations. Women tend to be working in non-manufacturing specific associate professional and technical occupations (e.g. finance and accounting technicians, buyer and procurement officers, marketing associate professionals). Men tend to be working in manufacturing specific associate professional and technical occupations (e.g. electrical and electronic technicians, quality assurance technicians, planning, process and production technicians). Women are significantly better

represented in some manufacturing specific non-engineering work such as laboratory technician work.

Skilled trades-level and administrative/clerical work:
Modern Apprenticeships are a key pipeline into manufacturing specific jobs within the cluster. As highlighted in the section on Modern Apprenticeships, women are significantly under-represented in general and significantly more likely to undertake a Modern Apprenticeships at a lower level than their male counterparts. Given these findings, it is not surprising that within the cluster women are under-represented in the skilled trades occupations.

However, as noted also in the earlier section on Modern Apprenticeships, there are potentially other Modern Apprenticeship framework routes into manufacturing in more generic areas such as administration and finance. Indeed, the top female occupation in the cluster is general office assistants/clerks - and it may well be the case that one of the routes into these occupations is through Modern Apprenticeships.

Routine-level work:
Women are over-represented in routine-level work, with over one-third (33.5%) of all women in the manufacturing cluster in Scotland working in process, plan and machine operative occupations or elementary occupations. This over-representation is not surprising given that the second and third top female jobs in the cluster are packers, bottlers, canners, fillers and food, drink & tobacco operators.

Patterns of occupational segregation and pay:
Patterns of horizontal and vertical segregation evident in the manufacturing cluster in Scotland go some way to explain gender pay gaps. There is a large gender pay gap in relation to mean hourly pay of 28.9%, significantly higher than in the rest of the UK (19%). In 23 of the 24 sub-cluster Divisions, the gender pay gap favours men. Women are over-represented in lower-level jobs and in lower-skilled sub-clusters and under-represented in professional roles. Women are under-represented in the highest earning occupations.

However, where the data supports comparison of men and women's earnings at an occupational level, we see that while the mean earnings of marketing and sales managers are comparable, male production works and maintenance managers earn on average £27.31 per hour whilst their female counterparts earn £19.48 per hour. Male food, drink and tobacco process operators earn £9.92 per hour, compared with £7.80 for women in the same occupation.

7.2 Workplace Culture

A number of employers, particularly larger employers, are reportedly working hard to attract more women into the sector. Even with the resources and clear efforts by some employers and stakeholders, stakeholders noted that manufacturing was not always the easiest working environment for women:

> It's okay to have £2m campaign advising folk to work and women can go there but as soon as the women goes into the wee place across the road and hears the language and the culture it puts them off … a report two days indicating that, it still is as bad as that. (Stakeholder)

> You also need to do the other end at the same time because if you stimulate you know people to come forward and then they get into a workplace culture which is hostile and doesn't have the terms and conditions that support them … it's that very difficult thing with having to do it all all the time. (Stakeholder)

This sometimes difficult environment can extend to, for instance, training arrangements:

> I was in a major engineering company and they opened a new training department … I said to them does it have women's toilets, of course, does it have disabled toilets, we don't know, is it on any bus routes, don't know, when is the training going to take place. And this happens a lot in engineering, they'll put on additional training either first thing in the morning pre-work, you're giving an hour of your working and they're giving an hour so it's pre-work or post-work but it's linking in so it's extending [into] those areas [where] people with domestic responsibilities have duties. (Stakeholder)

Support networks, moreover, are reportedly often male-orientated and, as a result, women may not always return after maternity leave:

> Especially in the larger companies, there's a large support mechanism in there but it tends to be male-dominated. So there's golfing outings, there's football outings. So even if you're off sick long-term, or to a certain extent if you were to be on paternity leave, you would still be involved in that network to the same extent. That social network isn't there for females. So when you are out you're socially isolated … that employment network disappears. (Stakeholder)

The under-representation of women in skill pipelines and in the sector generally serve, it was argued, to reinforce under-representation generally:

> If [women] are less likely to be on [the pipeline] in the first place, they are less likely to be promoted, they are less likely to stay in. If they leave they are less likely to return, so that leaky pipeline is far worse for women than it is for men. (Stakeholder)

7.3 Employment Practice

For some stakeholders, the scarcity of women in the industry reflects a lack of flexible working opportunities. Opportunities for part-time working in the industry are relatively limited. Work is predominantly full-time and it was reported that there is often little consideration given, for instance, to possible positive action measures:

> Historically it was guys went out and worked and did engineering roles and you were the breadwinner and so, all of this history of stereotyping so people would say 'yep it's a full-time role'. Whereas if you were to say now in our company 'right we've got an engineering role here for a mechanical engineer' it would be interesting to see if we would consider job share. (Stakeholder)

The existence of a formal policy on flexible working was not indicative, according to some stakeholders, of the actual availability of flexible working. Notwithstanding this, a number of stakeholders were convinced of the merits of more flexible working to increase women's participation in the industry:

> You don't have part-time opportunities for women, you've part-time opportunities for everybody and if you have, not just policies but the culture of part-time working and flexible working, then you're more

likely not only to recruit people from a diverse background including those with domestic responsibilities but you're probably more likely to retain them. (Stakeholder)

I think we just need to be more creative about finding solutions to that, there are always solutions and we just need to find them and not just 'I tried that one and won't try again. (Stakeholder)

However, some stakeholders talked of how the industry struggled to support flexible working due to just-in-time production demands and service cultures that required round the clock response - suggesting that there are structural barriers to increasing women's participation within manufacturing. Furthermore, it was also proposed that women may not be the automatic first choice of recruiters, or are not even applying to the industry. As one stakeholder reflected:

I just think that sometimes you recruit in your own image, if you know what I mean? And so, if we've got this predominantly white male population within engineering, the default position is for people to recruit in their own image. I'm sure there are female graduates in engineering who are keen to obviously join companies such as ourselves but are they even getting in front of a recruitment panel and even bothering to send CVs in? I mean hopefully they are but I'm sure some are dissuaded by that.

It was suggested that many managers have worked their way up through the ranks, often starting as apprentices, and therefore female representation at managerial level is likely to be gendered. Recruiting managers from the external labour market, on the other hand, can serve to redress this imbalance:

If you think that the managers of today are the apprentices of yesterday … gender segregation 20 years ago wasn't any better than what it is now. It's only if you bring people in from outside then it's more likely to be women. (Stakeholder)

7.4 Pipelines

Stakeholders put forward a variety of reasons as to why the manufacturing cluster struggles to attract and appoint women. A number of stakeholders argued that a focus on graduate engineers misses the point. Rather, very early influences on children influenced the likelihood of young people entering the industry. One stakeholder suggested that parents and teachers - key influences on children - were often ill-informed about the sector. A number of stakeholders, moreover, spoke about the perceptions of engineering as a dirty job. As one commented:

Perceptions of engineering past, present and future is of 'dirty engineering', but things have moved on. That message needs to be heard by children, teachers, and parents to enable the positive messages to get through.

Some stakeholders thought that teachers and college/university lecturers should undertake work experience to help them understand the sector and the range of jobs within in it. Intervention, many stakeholders suggested, should start at primary school. However, some of the challenges in attracting more females were outlined:

You know when companies engage with kids at school or college … and it's a partnership between education, schools, parents and companies … more often than not - he's really experienced in the company and the guy that will pitch up at the school will be a 40 year old, you know, white male that will talk engineering. And all the girls will go 'that's fine if you're a guy'. (Stakeholder)

Gendered STEM subject choices at school (females more likely to study biology/chemistry and males more likely to study physics) go some way to explain why women are slightly better represented in manufacturing specific non-engineering roles.

> A lot of the higher paid positions would be on the science side of it, I mean you've got quality managers, environmental managers. I mean if you come away from the production line you've got nutritionists, I know a number of women who have gone down that line, that would take you into new product development and as I say environmental and quality you've also got the engineering side of it. More women I think are looking at the engineering side of it, not necessarily in food and drink manufacture, the whole business development and sales side, the marketing, the finance. (Stakeholder)

The under-representation of women at technical level in particular may reflect the gendered pipelines into these roles. Women are under-represented in Modern Apprenticeships in science, engineering and manufacturing technologies. In fact, the majority of all women (69.3%) who started a Modern Apprenticeship in the Scottish manufacturing cluster in 2012/2013 started a Level 2 Modern Apprenticeship in Food & Drink Operations. As one stakeholder stated, this framework is for 'the type of people that are looking for those production line and operative roles … [where] there's more Level 2 jobs than there are Level 3'. There are relatively fewer numbers undertaking a Level 3 Modern Apprenticeships in Food & Drink Operations, it was suggested, because this framework level is targeted at individuals looking to move in to a team leader-type role.

Some stakeholders argued that for workers in routine occupations in the manufacturing sector, there are limited career progression prospects:

> There isn't really [any career opportunity] to be honest if production line is where your skills are. You might get to team leader, you might get to shift supervisor … but it tends to be dead men's shoes, there is limited space for those. (Stakeholder)

The limited progression pathways from routine-level work differentially impacts on women's prospects given that women in the manufacturing cluster in Scotland are proportionately over-represented in elementary occupations and process, plant and machine operatives occupations.

7.5 Concluding Comments

Women are significantly under-represented in manufacturing cluster employment in Scotland. This under-representation is a concern for a variety of reasons: parts of the manufacturing cluster are growing employment; there are world leading manufacturing companies in Scotland that provide high quality employment; there are skills gaps and shortages that need to be filled and the age profile of the industry will provide replacement job opportunities and will require companies to grow their own skills; and there is scope for high earnings within many sub-sectors.

Future representation of women within the manufacturing cluster labour market in Scotland is, to some extent, dependent on more equal representation coming through the skill pipelines. This more equal representation could help to close the Scottish manufacturing gender pay gap. However, this research has raised significant concerns over the gendered nature of these skills pipelines. In addition, more than one-third of women currently working in the sector are located at occupational levels most at risk of skill-biased technological change.

One stakeholder suggested that one potential approach to increasing female participation in the sector might be in new and emerging areas of manufacturing. For example, developments in robotics could be a possible 'hook' to get more women into the sector:

> A lot of girls are interested in robotics and I wonder if what you need is to get women in to areas that have not yet definitely been grabbed by men first so they've got like an equal chance to shape the way forward … if you're only recruiting one or two women you're never going to get a critical mass in any factory to change anything but if you could maybe push these new exciting areas like robotics which build on mathematics you might … get things that appeal more to girls.

8 References

ASSCS (Alliance of Sector Skills Councils, Scotland) (2011) *Manufacturing Cluster Report: Scottish sector Profile 2011*. Edinburgh: ASSCS.

BIS (Department for Business Innovation & Skills) (2010) *Manufacturing in the UK: An economic analysis of the sector*. BIS Economics Paper No.10. London: Department for Business Innovation & Skills.

Close the Gap (2013a) *Gender Pay Gap Statistics*. Close the Gap Working Paper 9. Glasgow: Close the Gap.

Close the Gap (2013b) *Shifting the Balance? Exploring the trade union responses to tackling gendered occupational segregation*. Close the Gap Working Paper 8. Glasgow: Close the Gap.

COGENT (2011) *Chemicals, Pharmaceuticals, Nuclear, Oil and Gas, Petroleum and Polymer Industries: Scottish Sector Profile 2011*. Edinburgh: ASSCS.

EEF (Engineering Employers' Federation) (2010) *The Shape of British Industry: Growing from Strong Foundations*. London: EEF.

EEF (Engineering Employers' Federation) (2013) *FSTE 100 - Women in Manufacturing*. London: EEF.

EEF (Engineering Employers' Federation) (2014) *Manufacturing Outlook: March 2014. EEF's snapshot survey of business conditions in engineering and manufacturing companies*. London: EEF.

EHRC (Equality and Human Rights Commission) (2009) *Proposals for promoting greater transparency in the private sector: A consultation on improving gender equality in the workplace*. London: EHRC.

EHRC (Equality and Human Rights Commission) (2012) *Essential guide to the public sector equality duty: A guide for public authorities (Scotland)*. Glasgow: EHRC.

Financial Crisis Inquiry Commission (FCIC) (2011) *The financial crisis inquiry report: Final report of the national commission on the causes of the financial and economic crisis in the United States*. Washington, DC: US GPO.

FSBS (Federation of Small Businesses Scotland) (2012) *Small Businesses in Manufacturing*. Edinburgh: Federation of Small Businesses Scotland.

Giffi C and McNelly J (2013) *Untapped resource: How manufacturers can attract, retain and advance talented women*. New York: Deloitte LLP.

IMPROVE (2011a) *Food and Drink Manufacturing: Scottish Sector Profile 2011*. Edinburgh: ASSCS.

IMPROVE (2011b) *Analysis of the ECVET situation and its implementation in the food sector WP.2 UK Report*. York: Improve Ltd.

IMPROVE (2014) *A Modern Apprenticeship in Food and Drink Operations Level 2. Framework Document for Scotland*. York: Improve Ltd.

Mumford K and Smith P (2007) 'The Gender Earnings Gap in Britain: including the Workplace', *The Manchester School*, 75(6): 653-672.

National Women's Law Centre (2013) *Still No Recovery for Women in the Manufacturing Sector: Manufacturing Employment Trends for Women and Men, 2008-2013*. Manufacturing Fact Sheet. Washington, DC: National Women's Law Centre.

Olsen W Gash V Vandecasteele L Walthery P and Heuvelam H (2010) *The Gender Pay Gap in the UK 1995–2007: Part 1 Research Report*. London: Government Equalities Office.

ONS (Office for National Statistics) (2009) *UK Standard Industrial Classification of Economic Activities 2007 (SIC 2007)*. London: The Stationary Office.

ONS (Office for National Statistics) (2013) *Information Paper: Quality and Methodology Information (Workforce Jobs)*. London: The Stationary Office.

Perfect D (2011) *Gender Pay Gaps*. Equality and Human Rights Commission Briefing Paper 2. London: Equality and Human Rights Commission.

Proskills (2011) *Building Products and Refractories, Coatings, Ceramics, Extractive and Mineral Processing, Furniture, Furnishings and Interiors, Glass and Related Industries, Paper, Printing and Wood: Scottish Sector Profile 2011*. Edinburgh: ASSCS.

PWC (PriceWaterhouseCoopers) (2009) *The Future of UK Manufacturing: Reports of its death are greatly exaggerated. Observations, analysis and recommendations - April 2009*. London: PriceWaterhouseCoopers.

The Royal Society of Edinburgh (2012) *Tapping our Talents. Women in science, technology, engineering and mathematics: a strategy for Scotland*. Edinburgh: The Royal Society of Edinburgh.

SCER and SKOPE (Scottish Centre for Employment Research and centre on Skills, Knowledge and Economic Performance) (2014) *Work, Employment, Skills and Training: Where Next for Scotland?.* Available at: http://www.skope.ox.ac.uk/sites/default/files/west%20report%20FINAL%20v7.pdf.

Shanmugalingam S Puttick R and Westlake S (2010) *Rebalancing Act.* London: NESTA.

SEMTA (2011) *Science, Engineering and Manufacturing Technologies: Scottish Sector Profile 2011*. Edinburgh: ASSCS.

SDS (Skills Development Scotland) (2013) *Modern Apprenticeship Employer Survey - 2012*. Glasgow: Skills Development Scotland.

SkillSet (2011) *TV, Film, Radio, Interactive Media, Animation, Computer Games, Facilities, Photo Imaging, Publishing, Advertising and Other Content Creation: Scottish Sector Profile 2011*. Edinburgh: ASSCS.

STUC (Scottish Trades Union Congress) (2011) *The Future of Manufacturing in Scotland*. Glasgow: STUC.

The Scottish Government (2011) *The Government Economic Strategy.* Edinburgh: The Scottish Government.

The Scottish Government (2013a) *Scottish Annual Business Statistics*. Edinburgh: The Scottish Government.

The Scottish Government (2013b) *Commission for Developing Scotland's Young Workforce. Interim Report* Edinburgh: The Scottish Government.

UKCES (UK Commission for Employment and Skills) (2012) *Manufacturing: Sector Skills Assessment 2012.* Evidence Report 76, November 2012. Wath-upon-Dearne: UKCES.

UKCES (UK Commission for Employment and Skills) (2014a) *Working Futures 2012-2022.* Evidence Report 83*,* March 2014. Wath-upon-Dearne: UKCES.

UKCES (UK Commission for Employment and Skills) (2014b) *UK Commission's Employer Skills Survey.* Evidence Report 81*,* January 2014. Wath-upon-Dearne: UKCES.

US Congress Joint Economic Committee (2013) *Manufacturing Jobs for the Future*. Washington, DC: US GPO.

9 Appendices:

Appendix A - Defining Manufacturing

Manufacturing Sector - UK Standard Industrial Classification of Economic Activities 2007 (ONS 2009: 29-37)

SECTION C	**MANUFACTURING**
Divisions	**10-33**
	10 Manufacture of food products
	11 Manufacture of beverages
	12 Manufacture of tobacco products
	13 Manufacture of textiles
	14 Manufacture of wearing apparel
	15 Manufacture of leather and related products
	16 Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials
	17 Manufacture of paper and paper products
	18 Printing and reproduction of recorded media
	19 Manufacture of coke and refined petroleum products
	20 Manufacture of chemicals and chemical products
	21 Manufacture of basic pharmaceutical products and pharmaceutical preparations
	22 Manufacture of rubber and plastic products
	23 Manufacture of other non-metallic mineral products
	24 Manufacture of basic metals
	25 Manufacture of fabricated metal products, except machinery and equipment
	26 Manufacture of computer, electronic and optical products
	27 Manufacture of electrical equipment
	28 Manufacture of machinery and equipment n.e.c.
	29 Manufacture of motor vehicles, trailers and semi-trailers
	30 Manufacture of other transport equipment
	31 Manufacture of furniture
	32 Other manufacturing
	33 Repair and installation of machinery and equipment

Appendix B: SDS Broad Industry Classification of Modern Apprenticeship Frameworks

Two umbrella sectors	Broad framework group	SDS occupational grouping	Framework	
1-Construction, Engineering and Manufacturing	2-Construction and related industries	5-Construction & Related	18	Construction
			19	Construction (Civil Engineering & Specialist Sector)
			20	Construction (Technical Operations)
			28	Electrotechnical Services
			33	Extractive and Mineral Processing
			42	Glass Industry Operations
			46	Heating, Ventilation, Air Conditioning and Refrigeration
			64	Plumbing
	3-Primary industry, Engineering, Manufacturing and Automotive	2-Animal Care, Land and Water based	6	Agricultural and Commercial Horticulture
			7	Agricultural Crops and Livestock
			8	Agriculture
			9	Amenity Horticulture
			10	Animal Care
			11	Aquaculture
			32	Equine
			40	Game & Wildlife Management
			47	Horticulture
			83	Veterinary Nursing
		3-Automotive	12	Automotive
			29	Engineering
			42	Glass Industry Operations
			75	Supervisors in Vehicle Fitting Operations
			78	Vehicle Body and Paint Operations
			79	Vehicle Fitting
			80	Vehicle Maintenance and Repair
			81	Vehicle Parts Operations

			82	Vehicle Sales
		4-Chemicals and Biotechnology related	15	Biotechnology
			17	Chemicals Manufacturing and Petroleum Industries
			33	Extractive and Mineral Processing
			52	Laboratory Technicians in Education
			56	Life Sciences
			65	Polymer Processing
		7-Energy	27	Electricity Industry
			41	Gas Industry
			84	Water Industry
			85	Wind Turbine
		8-Engineering	28	Electrotechnical Services
			29	Engineering
			30	Engineering (OPITO)
			31	Engineering Construction
			46	Heating, Ventilation, Air Conditioning and Refrigeration
			53	Land Based Service Engineering
			54	Land-based Engineering
			61	Oil and Gas Extraction
			68	Rail Transport Engineering
			70	Security
			71	Security Systems
		14-Other Manufacture	35	Fashion & Textile Heritage
			39	Furniture Manufacture
			42	Glass Industry Operations
			72	Signmaking
2-Service Industries	1-Management, Administration and Financial services	1-Administration and Related	16	Business & Administration
			50	IT Users
		9-Financial Services	67	Providing Financial Services
		12-Management	45	Health and Social Care
			57	Management
			69	Retail
	4-Hospitality and Tourism	10-Food and Drink	13	Bakery
			37	Food Manufacture

			58	Meat and Poultry Processing
		11-Hospitality and Tourism	37	Food Manufacture
			48	Hospitality
			77	Travel Services
	5-Retail, Customer service and Personal services	16 - Personal Services	14	Beauty Therapy
			43	Hairdressing
			44	Hairdressing & Barbering
		17 - Retail and Customer Service	21	Contact Centres
			23	Customer Service
			36	Floristry
			48	Hospitality
			69	Retail
	6 - Sport, Health and Social Care	18 - Sport, Health and Social Care	2	Achieving Excellence in Sports Performance (Football)
			3	Active Leisure and Learning
			4	Active Leisure, Learning and Wellbeing
			5	Advice and Guidance
			24	Dental Nursing
			26	Early Years Care and Education
			45	Health and Social Care
			63	Pharmacy Technicians
			73	Sport, Recreation and Allied Occupations
			86	Youth Work
	7 -Transport, Communications and Other Services	6 - Creative and Cultural Skills	22	Creative
			51	Jewellery, Silversmithing and Allied Trades
			59	Museum, Gallery and Heritage
		13 - Media, Publications and Related	66	Printing
		15 - Other Services	1	Accounting
			34	Facilities Management
			35	Fashion & Textile Heritage
			49	Information & Communication Technologies Professio
			55	Learning & Development
			60	Occupational Health & Safety Practice

		19 - Transport and Logistics	25	Driving Goods Vehicles
			38	Freight Logistics
			62	PCV Driving (Bus and Coach)
			74	Storage and Warehousing
			76	Supply Chain Management

Appendix C: Modern Apprenticeship Frameworks in the Scottish Manufacturing Cluster

Cogent (MA frameworks):
SVQ Level 3 in Oil and Gas Extraction
SVQ Level 3 in Process Manufacturing
SVQ Level 3 in Signmaking
Water Treatment Management at Level 2
Water Treatment Management at Level 3
Improve Ltd (MA frameworks):
Food and Drink Operations at Level 2
Food and Drink Operations at Level 3
Proskills (MA Frameworks):
Extractive and Mineral Processing at SVQ Level 2
Extractive and Mineral Processing at SVQ Level 3
Extractive and Mineral Processing at SVQ Level 4
Extractive and Mineral Processing at SVQ Level 5
Furniture, Furnishings and Interiors at Level 2
Furniture, Furnishings and Interiors at Level 3
SVQ Level 2 in Glass Industry Occupations
SVQ Level 3 in Glass Industry Occupations
SVQ Level 3 in Occupational Health and Safety Practice
SVQ Level 4 in Occupational Health and Safety Practice
SVQ Level 2 in Printing Industry Occupations
SVQ Level 3 in Printing Industry Occupations
SVQ Level 2 in Wood and Timber
Semta:
Level 3 in Engineering
Technical Apprenticeship in Engineering (Business Improvement Techniques) - SCQF 8/9
SVQ Level 2 in Life Sciences
SVQ Level 3 in Life Sciences
Skillset (Creative Skillset):
SVQ Level 3 in Creative and Digital Media

SVQ Level 2 in Fashion and Textiles Heritage
SVQ Level 3 in Fashion and Textiles Heritage

Appendix D: Scottish Manufacturing Business Counts 2013 by SIC 2007 Division

SECTION C MANUFACTURING Divisions	Total	Micro (0 to 9)	Small (10 to 49)	Medium-sized (50 to 249)	Large (250+)
10 : Manufacture of food products	660	370	190	85	15
11 : Manufacture of beverages	120	80	20	10	10
12 : Manufacture of tobacco products	0	0	0	0	0
13 : Manufacture of textiles	275	215	45	15	0
14 : Manufacture of wearing apparel	190	145	35	10	0
15 : Manufacture of leather and related products	25	20	0	0	0
16 : Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	650	515	105	20	5
17 : Manufacture of paper and paper products	85	50	25	15	0
18 : Printing and reproduction of recorded media	585	485	90	15	0
19 : Manufacture of coke and refined petroleum products	10	5	0	0	0
20 : Manufacture of chemicals and chemical products	150	90	35	25	0
21 : Manufacture of basic pharmaceutical products and pharmaceutical preparations	20	10	0	0	0
22 : Manufacture of rubber and plastic products	220	125	65	25	0
23 : Manufacture of other non-metallic mineral products	245	180	55	10	0
24 : Manufacture of basic metals	75	45	15	10	0
25 : Manufacture of fabricated metal products, except machinery and equipment	1,605	1,215	305	80	10
26 : Manufacture of computer, electronic and optical products	320	225	55	35	5
27 : Manufacture of electrical equipment	150	90	45	15	0
28 : Manufacture of machinery and equipment n.e.c.	480	335	105	25	10
29 : Manufacture of motor vehicles, trailers and semi-trailers	90	65	15	10	0
30 : Manufacture of other transport equipment	110	95	10	5	0
31 : Manufacture of furniture	225	190	25	5	0
32 : Other manufacturing	565	490	55	15	0
33 : Repair and installation of machinery and equipment	965	835	90	25	10
Column Total	**7,825**	**5,865**	**1,395**	**465**	**100**

Source: UK Business Counts, Scotland 2013 - NOMIS 17 April 2014