



Government
Office for Science

 Foresight

What are the supply (workforce) and demand (product) implications of an ageing society?

Future of Manufacturing Project: Evidence Paper 22

Foresight, Government Office for Science

What are the supply (workforce) and demand (product) implications of an ageing society?

By

Professor Stephen McNair and Dr. Matt Flynn;
Centre for research into the older workforce, Middlesex University.

Jeremy Myerson, Rama Gheerawo and Gail Ramster
Helen Hamlyn Centre for Design, Royal College of Art.

October, 2012

This review has been commissioned as part of the UK Government's Foresight Future of Manufacturing Project. The views expressed do not represent policy of any government or organisation.

Contents

1. Executive summary	5
2. Introduction	6
3. The changing nature of “ageing”	7
3.1 Demographic change	8
3.2 Ageing, health and disability	8
3.3 The rise of the “third” age	9
3.4 Ageing is not a uniform process	9
4. Labour supply: manufacturing with an ageing workforce	10
4.1 Age and shape of the UK workforce; the workforce in ten years time	10
4.2 The UK’s position	10
4.3 Labour shortages	10
4.4 Making better use of older workers	11
4.5 Changing retirement patterns	12
4.6 Age discrimination	13
4.7 Qualifications	13
4.8 Training	14
5. The changing profile of manufacturing	15
5.1 The diversity of manufacturing	15
5.2 Older workers’ views on work	16
5.3 Employers’ attitudes and policies	19
6. Age and the manufacturing workforce	24
6.1 Firm size	25
6.2 Age and occupation	26
6.3 Age and sub-sectors	27
6.4 Other demographic issues	29
6.5 Labour market challenges for manufacturing	30
7. The demand side: responding to ageing markets	32
7.1 Older consumer assumptions	32
7.2 Age-neutral and age-specific products	34
8. Future buying habits	36
8.1 The digital divide	36
8.2 A failing market	37
9. Demand implications for manufacturing and its sub-sectors	38
9.1 The global ageing market	38
9.2 The value chain	38
9.3 Mass customisation and mass collaboration	38
9.4 Life sciences	39
9.5 Food and drink	40
9.6 Electronics	41
9.7 Automotive and personal transport	41

10. Marketing and attitudes.....	44
10.1 Current situation.....	44
10.2 Biological ageing and social ageing.....	44
10.3 Inclusive marketing	45
10.4 Inclusive design	45
10.5 Ability friendly design	46
10.6 Design for specific conditions – physical, sensory and cognitive.....	46
10.7 Likely new products and services	47
10.8 Design of homes to accommodate homeworking	49
10.9 Use of ICTs – barriers, bridges and opportunities – remote healthcare.....	49
11. Conclusions: the opportunities and challenges of an ageing society.....	51
11.1 A likely future	51
11.2 The importance of an inclusive response	52
11.3 Ageing and employment	53
11.4 Ageing and product demand.....	54
11.5 Manufacturing in an ageing world: the UK’s strengths and opportunities.....	55
11.6 Manufacturing in an ageing world: challenges for the UK.....	55
References	57

I. Executive summary

An ageing population presents significant challenges and opportunities to UK manufacturers. If manufacturing employers do not change their HRM practices, they will face steadily growing skills and labour shortages over the next twenty years. If they do not develop more inclusive approaches to product design they will lose the most rapidly growing market; the active healthy retired. Employers in manufacturing are behind their equivalents in other sectors in managing ageing workforces; and still tend to gear consumer product design and marketing toward shrinking younger markets. However, there are also great opportunities to tap into older labour pools and markets, and UK manufacturing has considerable strengths in sub-sectors where demand is likely to grow as a result of an ageing population. Future generations of older people will be healthier and wealthier than previous ones with more time for work and more money to spend.

This paper discusses the manufacturing sector's preparedness for changing age demographics. Over the next forty years, the number of people over traditional retirement age will grow rapidly, while those of traditional working age will shrink. For most people, extended lifespan will not mean extended "old age", but rather more time spent in good health, and greater disposable time and income than they had earlier in life. While longer lives are a cause to celebrate, they also create a range of economic, cultural and political challenges, especially the need to improve the economic "dependency ratio", by extending working life for many, or all, people.

For the manufacturing sector, there are two major challenges. If it fails to develop more effective strategies for using older workers, it will find itself faced with increasingly severe labour shortages. If it fails to understand the needs and aspirations of a growing older population it will lose an increasing proportion of its markets to competitors. Both are avoidable, and the UK has some distinctive strengths in this emerging world. There are also some signs that manufacturers are responding, but probably not yet with sufficient priority or urgency.

2. Introduction

Over the next forty years the population of the UK will age significantly, as life expectancy rises and birth rates remain relatively low. This presents major policy challenges, as the large age cohort born after the Second World War are replaced by a much smaller group born in the 1990s, and the challenge will grow well beyond 2020.

This paper is concerned with what these changes might mean for both the manufacturing workforce, and the demand for products and services in the UK, in the next ten and forty years. On one hand, as the population of traditional "working age" shrinks, manufacturers will need to find ways to make better use of older employees, and to retain them in work longer. On the other hand, as the size of the older population, both active and dependent, rises. Manufacturers will need to consider what kinds of products and services older people will want and need, to enjoy extended active retirement, and to manage declining capabilities as they age.

Two factors determine the economic and social impact of extending lifespan. The first is whether, and how fast, real retirement ages continue to rise, which will determine the economic impact of ageing, and the size of the potential workforce. The second is how far improvements in health will keep pace with extending lifespan, which will determine the relative size of the markets: for products aimed at the active retired; and for specialised services and products to help the very old to manage declining health and capability.

The ageing of society will have an impact on everyone. A society which has been dominated for decades by the interests and expectations of the young is increasingly prioritising the old, and debates about intergenerational equity have become more common, especially around employment opportunities.

In considering the likely impact of ageing on the economy it is important to note that the evidence is often relatively thin. Researchers and policymakers have only recently begun to take an active interest in these issues in any numbers, and the very rapid changes in the age profile of the workforce and population in recent years mean that research findings from ten years ago can be an unreliable guide to current attitudes and behaviour.

3. The changing nature of “ageing”

Just as many of the prominent features of today's British economy were unimagined in 1972, so we have seen a transformation in the nature of old age, and the shape of the population. Current life expectancy levels were not imagined forty years ago, but improvements in health have driven average life expectancy upwards in all developed countries¹, and the proportion of the UK population over 65, which rose from 15% in 1985 to 17% in 2010, is projected to rise to 23% by 2035 (ONS 2012a). Since 1972, average life expectancy at birth has risen by 9 years for men and seven years for women, while healthy life expectancy² has risen by 2 years in the five years since 2008 alone³. (ONS 2012b).

Similarly, in 1972, a decline in average fertility rates was seen as temporary, but they have since remained permanently below replacement level. The size of the overall workforce has been sustained only by the rise in women's employment, and more recently by immigration and rising real retirement ages (ONS 2012d)⁴. Although there has been some modest rise in birth rates recently, this may not be sustained, and can only begin to impact on the workforce after 2030.

In the 1970s, retirement was generally seen as a positive benefit, and most people retired at or above the State Pension Age (SPA) despite the fact that, for most, "retirement" was closely linked to ill-health, disability and poverty. In the following 25 years, real retirement ages fell significantly, but they began to rise again at the end of the 20th century, reaching almost 1970s levels today (ONS 2012d).

The income and wealth of the average retired person has also risen, and older people are now no more likely live in poverty than the general population. Furthermore, many older people want to work longer (McNair et al. 2004), although some stay purely because of financial need (Cory 2012).

Despite these changes, age stereotypes, both at work and in society generally are powerful, and change much more slowly than the reality they (partly) reflect. Many popular concerns about ageing populations reflect a mistaken assumption that the experience of a 65 year old today is like that of a 65 year old forty years ago. In reality, improvements in health mean that the onset of "oldness" is taking place, for most people, later in life. Of the 18-20 years more life which the average 65 year old can now expect, nearly 60% is likely to be spent free from limiting illness or disability, although this is less true for those who have worked in physically demanding and low skilled occupations.

¹ For over a century, every official prediction of average life expectancy has proved an underestimate, and there is no sign that this process is slowing.

² The period spent free of limiting disability or health conditions.

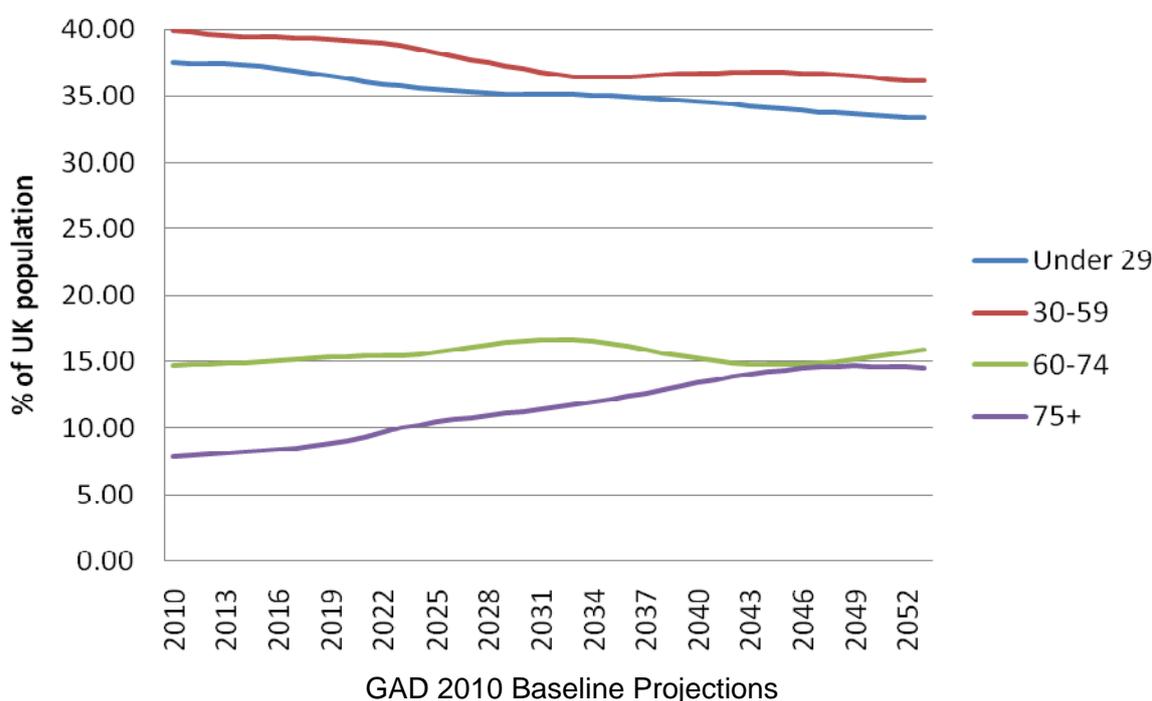
³ Largely as a result of improvements in the health of the retired population.

⁴ The age at which people actually retire is only loosely linked to SPA, which many people think of as "retirement age".

3.1 Demographic change

As Figure 1 shows, the proportion of people aged 60-74 in the UK is expected to rise slowly over the next 20 years, peaking at about 17% of the population around 2030. However, the proportion aged over 75 will rise more rapidly, overtaking the younger group in size around 2050. Furthermore, there will be a rapid rise in the numbers of the very old. Over the last century the number of people over 90 has risen from 13,000 to 430,000. The number of centenarians has risen fivefold since 1980 (from 2,500 to 12,640), and they are expected to reach more than a quarter of a million within forty years.

Figure 1: Changing UK age profile



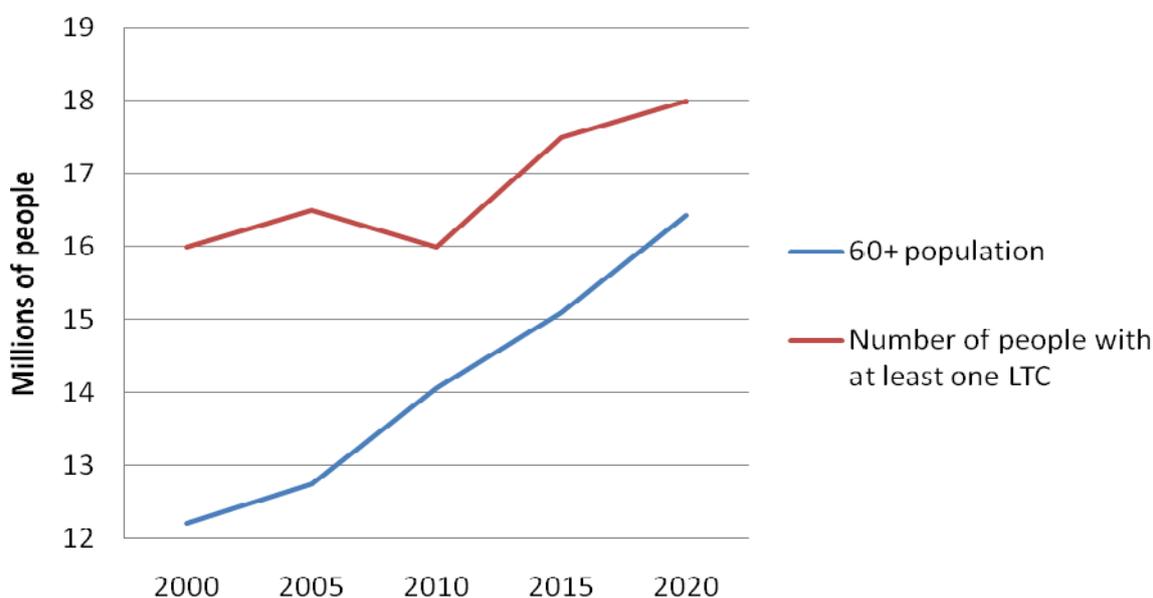
3.2 Ageing, health and disability

What this means in terms of the size of the workforce and consumer demand depends on a number of factors. A key one is the health of the older population. As the population ages, so too does the proportion of people with long-term health conditions (LTCs). Currently, 17% of the UK workforce has at least one LTC which restricts the kind or amount of work they can do, a figure which rises to one in three workers over 50. However, the impact of LTCs is unpredictable, and some individuals continue to live active lives, sometimes in paid employment, despite health conditions which seriously limit others. Furthermore, medical advances are reducing the prevalence and impact of LTCs, as are changes in workplace technology, and it has recently been established that, contrary to popular belief, work is, in general, good for people's health (Black 2008), although this is not true of all kinds of work.

The pattern of LTCs is also changing: while the number of smokers is expected to reduce over time, obesity will increase, with the NHS estimating that 30% of the UK population

may be obese by 2030 (DH 2007). Figure 2 shows Department of Health (DH) estimates of the population (young and old) with at least one LTC over the next decade.

Figure 2: Number of people with at least one Long-term Condition



DH (2007, p13) (projected from 2007) and GAD (2010) (projected from 2010)

3.3 The rise of the “third” age

One of the most striking social changes of the last quarter century has been the emergence of the "third age" as a new phase of active retirement. This is without precedent in human history. Until the mid 20th century most people moved from working life directly to dependent old age, with, at best, a few years of rest between. Now, for most people, the active third age lasts for a decade, and for many it will be much longer. This affects both their consumption patterns, and their attitudes to work. For many, work, paid or voluntary, is an option, not a necessity, and improvements in health and technology mean that there are now few jobs which cannot be done by the average 70 year old. Nevertheless, for some, poor health, disability, poverty and caring responsibilities make the third age short, or even non-existent.

3.4 Ageing is not a uniform process

As they age, most people experience some decline in the seven broad "capabilities" - vision, hearing, thinking, communication, locomotion, reach and stretch, and dexterity. However, individuals do so at very different rates. Declining vision begins for many people in adolescence, while for others it remains good into their 90s; some people are capable of running a marathon well beyond 80, while others struggle with stairs at 60. This makes it important to respond to ageing inclusively, not by designing products, services or working practices exclusively for "older people" but by seeking strategies to minimise barriers for people with limited capabilities, whatever their age. Thus, a well-lit workplace is good for everyone, including those with limited eyesight, while a wheelchair ramp not only helps people in wheelchairs, but also those with problems with stairs, with pushchairs or deliveries. Furthermore, declining physical capacity and health disproportionately affect those in manual occupations.

4. Labour supply: manufacturing with an ageing workforce

4.1 Age and shape of the UK workforce; the workforce in ten years time

Predicting the future 40 years is extremely difficult. However, the shape of the workforce in the early 2020s is much easier. The size and qualifications of the potential labour pool is known: effectively determined by the numbers already in the workforce. Most of those who will enter the workforce in this period are already in formal education, and their subject and career choices and qualifications are unlikely to vary greatly from current patterns. Furthermore, they will constitute only some 15% of the 2020 workforce. The skills of the existing workforce will change as a retiring generation with relatively low qualifications (but with considerable skills acquired through apprenticeship and experience) are replaced by a generation with higher formal and academic qualifications⁵. However, any significant upgrading of the skills of the workforce of 2020 will depend on training people already in the workforce (including older workers).

4.2 The UK's position

By comparison with many of its economic competitors, the UK is already making quite effective use of its older population. As the OECD (2003) commented in its review of age and employment policies, the UK removed most of the previous incentives to early retirement in the early 2000s. Since then, it has introduced new incentives for staying longer, like financial rewards for deferring pensions; and outlawed compulsory retirement ages, and age discrimination in work.

The UK's employment rate for people aged 55-64 is 57.1%. It has been rising steadily since 2000, when it was 50.7%, and the European Commission expects the UK rate to approach 70% by 2060 (Eurostat 2012). The current UK figure is more than ten points higher than the EU average of 46.3%, exceeded only by Germany, Sweden and Denmark in the EU, although well behind Iceland, Norway, Switzerland and Japan, all with rates above 65%, and the USA (60.3%).

The rise in employment among all people over 65 has been even more remarkable. In the second quarter of 2012 it reached 6.7%, having risen by 18% in the previous year (ONS 2012c).

4.3 Labour shortages

The population, and workforce, demographic profile means that, without dramatic change in retirement patterns, there will be significant labour shortages in the economy as a whole by 2020. This will be particularly severe in some sub-sectors of manufacturing, notably nuclear engineering, textiles, metalworking, and transport equipment. Although

⁵<http://skillsreport.cogent-ssc.com/skillsfactory.htm>

the workforce size in these sub-sectors is predicted to fall, substantial numbers will be needed to replace the large cohorts of people now in their 50s and 60s as they retire. Although there will be a temporary respite in other sub-sectors, these too will experience problems beyond 2020. The UK Commission on Employment and Skills (UKCES), which produces the most comprehensive national workforce projections, factoring in predictions about changes in efficiency resulting from automation, new technologies and capital investment at sub-sector level, suggest that all will be short of labour, as particularly large age groups enter retirement UKCES (2011a).

4.4 Making better use of older workers

A continuation of current behaviour will therefore see manufacturing facing increasing competition for labour and skills from other sectors, especially for the critical, and rapidly growing, numbers of high skilled jobs, and particularly for science and technological skills. Retaining a viable workforce will require strategies to increase the size of the pool: by making better use of older people, women and disabled people, all of whom are underrepresented in manufacturing as a whole; or by immigration, although political pressures make it unlikely that this will make a major impact. Employers can also make better use of younger and middle aged workers who have been displaced for reasons of redundancy and restructuring. However, of all these groups, the largest potential source of additional labour is older people, especially in those sub-sectors where there are large numbers of people in their 50s and 60s now.

There are three broad ways to increase and improve the use of older workers: retention, redeployment and recruitment. Much of the increase in older peoples' labour market participation in the last decade is the result of the first of these. Many UK employers, including some in manufacturing, have chosen to retain experienced and trusted employees. However, manufacturing lags behind other sectors in offering flexible working, which is one of the principal ways of making work more attractive to older people (McNair and Flynn 2006).

Servitising- Using older workers' skills along the value chain

One way in which employers could use their older workers' skills in new ways is through the expansion of manufacturing firms into service provision, known as servitising. Here the shape of the value chain is redesigned, with the manufacture of the product itself more closely linked to other elements of the value chain, as well as greater coordination between manufacturers and their service providing subsidiaries. (Johnson, Mena 2008) This could present opportunities for older people to move from production to other roles: in after sales support, quality assurance or sales, which may be less physically demanding, but make effective use of experience and knowledge acquired in the manufacturing processes. However, such an expansion of work opportunities is predicated on older worker mobility (e.g. being able to move from the assembly line to the service sector), and older workers, particularly those without qualifications, face barriers to mobility and being able to demonstrate the utility of their skills in different ways.

The second option, redeployment of existing workers, is less widely used in the UK generally. The proportion of employees who say their skills are underused in their work doubles between 50 and 70 (McNair 2010), although some employers have sought to develop new roles for older employees which build on their experience, while making space for career development by younger colleagues.

The third option, recruiting older people from other sectors or from the unemployed, is even less common, and one major weakness of the current market is the reluctance of employers to recruit older people. This appears surprising, given that employers often claim to recognise and value what older people can offer, in life and work experience, acquired knowledge, and work ethic (McNair, Flynn and Dutton 2007). Many employers suggest that older workers are particularly strong in the "soft skills" which are widely seen as a weakness of the current manufacturing workforce, as a growing proportion of workers are engaging directly with customers. However, these are often seen as a weakness of older workers in manufacturing, many of whom who have traditionally had little contact with customers.

It seems likely that the reluctance of manufacturing employers to recruit older people reflects a fear of recruiting, and then being unable to get rid of, people who are poorly motivated or otherwise unproductive. It has also been suggested that employers are concerned with the costs of retraining with a relatively short payback period, although in practice employers in general are more, rather than less, likely to invest in training for workers in their 50s (McNair 2012), and, because older workers are less mobile, a well-managed recruit of 55 may well give 15 years of service, while a trained new graduate may well leave after four or five.

Reluctance to recruit older workers can be dysfunctional, both for individual employers and for employers in general (as well as for individual older people). Firstly, it reduces labour mobility, as older people in work become reluctant to seek job change or promotion, for fear of provoking discrimination or redundancy by attracting attention to their age. (McNair et al 2004). Secondly, older people made redundant are likely to spend much longer unemployed than their younger peers, losing skill and motivation as they do so, and thus eroding the skills pool available, at a time when specialist skills and experience are in growing demand (Riach & Loretto 2011). The net effect is an inefficient use of skills.

4.5 Changing retirement patterns

The timing and nature of retirement has a critical effect on the shape of the workforce, and patterns of "retirement" have been changing. Growing numbers are deferring retirement, and many people are retiring flexibly, or through transitional or "bridging" jobs and voluntary work, while others leave but subsequently return. The reasons for these changes are complex, but, contrary to popular belief, money appears not to be the principal motivator for most of those who wish to stay longer. Surveys repeatedly show that the commonest reasons for staying are the inherent interest of the work, the sense of purpose and social status associated with work; the social engagement with workmates, clients and customers (McNair et al 2004; Harper 2007).

4.6 Age discrimination

Age discrimination is outlawed by the Single Equality Act (2010). The changing of the law on retirement was staged, with a Default Retirement Age of 65 (DRA) introduced as an interim measure in 2006. However, the DRA was removed in 2012, and it is now unlawful to require anyone to leave work solely on grounds of age⁶.

Under the DRA, a statutory right of appeal against a decision to retire was introduced. It is very significant that, although the appeal was only to the employer who had made the original decision, the large majority of appeals were granted (Metcalf & Meadows 2007). This is very important for HR practice, since it suggests that compulsory retirement is an unnecessary tool. Many will choose to retire voluntarily at approximately traditional retirement age, and that when an individual does wish to stay longer, a formal conversation between employer and employee usually results in agreement about an on-going productive role.

Although age discrimination may be difficult to demonstrate, especially in recruitment, the cost of age discrimination claims to employers have been rising rapidly, and discrimination remains a factor affecting the employment of older people (ACAS 2011). The impact of legislation, including the abolition of the DRA, seems to have been positive for those in employment in secure jobs, whose chances of being retained by their employer have improved, but it has made little difference to date in the position of older unemployed people, who are much more likely to become long term unemployed than younger people with comparable qualifications and experience.

A further concern expressed by some employers and policymakers is that retaining older workers can reduce opportunities for younger workers, and especially for the young unemployed. The economic evidence does not support this: in those industries and areas where employment of older people is high, so is employment of younger people (Walker 2005), which suggests that, in general, retaining older people, with skills and experience, is a stimulus to economic growth rather than the reverse, although there may be exception in particular firms or localities.

4.7 Qualifications

Lack of appropriate qualifications is often cited as a reason why older people have difficulty finding work. In general, employers use qualifications as a tool for sifting applications, and since qualifications have changed over time, this may have the effect of excluding people with older qualifications, even though they may have been keeping their skills and knowledge up to date through learning on the job. The older workers most at risk of long term unemployment are those who have worked, often very productively, for a long time for the same employer, who understands their contribution. However, when they become redundant, their lack of current qualifications is a severe handicap, regardless of level of experience. This is particularly the case as employers increasingly use online recruitment processes which filter applications on the basis of qualifications and keywords. An experienced technician with apprenticeship qualifications from the 1970s, thirty five years' experience in the trade and highly motivated to work, may thus

⁶ There is a provision for exceptional circumstances, but these are extremely rare.

easily find him or herself rejected without his application ever being seen by a human, in favour of a younger applicant with much less experience and motivation.

4.8 Training

In a sector where technical knowledge changes rapidly, continuous training is clearly a priority. This probably affects much manufacturing work, but is a much larger and more severe problem in some sub-sectors. Levels of training are generally higher in large organisations, but older workers are disproportionately found in SMEs, where training levels are notably lower. Much of this training is informal and on the job, and not always recognised as "learning", and it often does not lead to formal qualifications.

Historically, training levels have fallen with age, and employers have been less willing to invest in training employees as they aged. There is now evidence that this pattern is changing. The most recent surveys show higher levels of training than in the past among older people, and that employers are actually likely to spend more on training for workers over 50 than for those in their 40s (McNair 2012, NALS 2012). However, training is not evenly distributed across the workforce. Levels are higher in the public sector and in large organisations, and the National Employer Skills Survey shows that overall training levels are lower in manufacturing than most other sectors, with only about 60% of firms providing training for some workers in the last year (UKCES 2012)⁷.

Training is often seen as a means of enabling older unemployed people to return to work, but here the evidence is mixed. The most positive evidence on training for unemployed older people, suggests that training can be effective if it is closely focused on a particular job in a particular company, and linked to work experience, to enable employee and employer to get to know each other (Wilson 2010). Otherwise, however, training, with or without formal qualification, appears to have minimal effect on employment, except in those fields where specific qualifications provide a licence to practice. The largest study done on Further Education courses designed for the unemployed⁸ (Foster and Casebourne 2011) showed a very positive effect on self-confidence, and enthusiasm for work, but only a marginal improvement in employment prospects, especially if the individual was older, with any kind of health problem or disability, or from a minority ethnic group.

⁷ The level is comparable with retail and wholesale, hotels and restaurants, an business services, and well below health, education and public services, where levels are over 80%.

⁸ A very large survey based on administrative data on all adults on FE courses designed for the unemployed.

5. The changing profile of manufacturing

Despite recent changes to the value of the pound and productivity improvements which have helped the sector's global competitiveness, the manufacturing workforce as a whole is declining, with thirteen of the twenty fastest shrinking occupations in this sector (UKCES 2011a).

However, although current forecasts predict that the size of the manufacturing workforce will continue to shrink over the next decade, recruitment overall will remain a priority because of the demand to replace people retiring. *Working Futures* (UKCES 2011a) anticipates an overall decline of 170,000 manufacturing jobs over the next decade, but a net replacement demand overall of one third of the 2007 workforce in the same period, due to age and market change. The manufacturing SSCs calculate a net requirement for some 380,000 people over a five year period, divided fairly evenly between them⁹.

5.1 The diversity of manufacturing

Manufacturing is not a homogenous entity, and within the broad sector, patterns of age and labour market demand vary greatly by sub-sector. Unfortunately, the picture is confused by the lack of consistent definitions of sub-sectors: the Sector Skills Councils do not match the Standard Industrial Classification codes; and some of the key growth areas are hidden, because they form part of a larger more conventional sub-sector, bridge between sub-sectors, or extend beyond conventional "manufacturing" into servicing and customer support. Current classification systems are especially problematic when considering future patterns, since the sub-sectors which transcend current classifications (overlapping manufacturing, business services and retail) account for over 2.2 million UK jobs and £220 billion GVA (BIS 2010a).

However, some important distinctions can be noted:

- Five sub-sectors account for 54% of manufacturing GVA and 52% of manufacturing jobs.
- Only two of these (food, beverages and tobacco; and chemicals) have seen a growth in GVA from 2007-2010.¹⁰
- The workforce of the Chemicals sub-sector is particularly critical because a large proportion of its production goes to other sub-sectors of manufacturing.
- Advanced materials is recognised in its own right by Government, both as one of eight key growth sectors, and because of the part it plays in the success of the other seven, directly and indirectly through technology diffusion.
- The sub-sectors showing the most dramatic decline in GVA are all relatively small – clothing, textiles, basic metals, and electrical machinery.
- BIS has identified five sub-sectors as growth areas for manufacturing: low carbon and environmental technology; advanced materials; nano-materials and technology; medical biotechnology; and digital technology.

⁹ENEI and Capita (2011)

¹⁰ The remaining three are Fabricated Metal; Printing and Publishing; and Machinery and Equipment

- However, a number of other factors affect the likely future of individual sectors. One is the "natural" age profile of the sub-sector. In those with a high proportion of highly qualified people, like pharmaceuticals and medical and precision instruments, labour market entry is typically later, skewing the profile upwards. In declining sectors, like clothing and textiles, one might expect to see declining recruitment, leading to an ageing "residual" workforce, but potential severe shortages at some future date. In occupations like repair and installation of machinery, or with a high regulatory requirements (health and safety and inspection) one might expect a higher proportion of experienced workers, and hence an older workforce. These differences are significant but difficult to quantify. Although it might be expected that in sectors and occupations involving heavy manual work, people are more likely to retire early on health grounds, developments in technology and health and safety are progressively reducing the number of such jobs.

5.2 Older workers' views on work

Since around 2000 there has been a significant change in attitudes and behaviour in relation to retirement, with real retirement ages rising, after several decades when they fell steadily. This appears to reflect aspirations to work longer, and employer needs, at least as much as financial or government pressures.

The last quarter of the twentieth century saw what has been termed a "collusion towards early retirement" (Ebbinghaus 2001) whereby employers, older workers and their union representatives and line managers all (tacitly or explicitly) supported youth-centric approaches to human resource management (HRM), especially through voluntary early retirement schemes. This was true across the whole economy, but particularly in those industries experiencing closure or radical restructuring. Since 2000, this pattern has changed, and employers have been increasingly seeking to encourage valued older workers to stay longer, while older workers have been increasingly willing to do so.

This has been particularly true in sectors which have introduced measures to facilitate extended working lives, such as flexible working hours and lifelong learning, as employers seek to retain and recruit workers by making work more attractive or convenient, and especially where such practices apply to all employees (McNair and Flynn 2005). For example, large retailers, many of whom were identified by Government as "Age Positive" employers, operate on a 24/7 basis, with relatively flexible and interchangeable roles, which enable them to offer all employees relatively flexible conditions. Others have retained employees by increasing employee engagement, notably in the health and social care sector, where regulation and cultural expectations lead to training continuing throughout working life (UKCES 2011a).

While long-term drivers are pressing for better age management policies in manufacturing, short-term ones are mixed. While manufacturing employers generally agree that ageing workforces will affect the industry as a whole, there has also been strong resistance to public policy measures such as abolition of the DRA (EEF 2008). The long term decline of employment in some sub sectors has also embedded an early retirement culture where workers expect to retire early.

Two surveys provide a useful snapshot of the views of workers in manufacturing. The European Working Conditions Survey (EWCS)¹¹ shows that workers over 50 generally had a more positive view of their jobs than their younger colleagues, and were overall more likely to feel satisfied with work well done. They are, however, also less likely than younger workers to feel supported by their colleagues and employers when faced with a problem at work, and less likely to see their jobs as providing an opportunity to grow. Older workers were also more likely to consider their work emotionally demanding compared with younger colleagues.

Although workers aged over 50 are rather more likely to report working in their own time to meet work demands (35.6% compared to EU average of 32.5%), older workers in the UK are generally more satisfied with their working conditions than their peers in many competitor countries. Only in Denmark and the Netherlands is dissatisfaction with working conditions lower among workers over 50 (6.5% compared to an EU average of 15.7%) (EUROSTAT 2012).

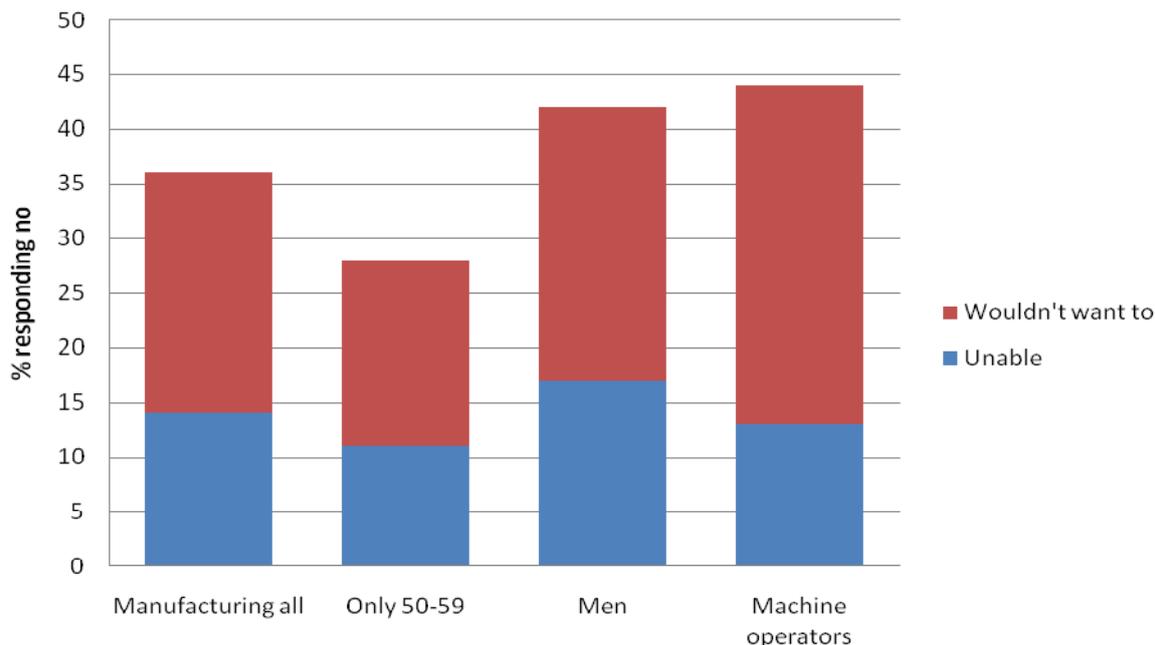
Real retirement ages in the UK are the sixth highest in the EU, and intended retirement ages are also high. Half of those employed between 50 and 69 say they want to retire at or after 65, compared with the EU average of 40%. Reasons for retirement are much more likely to be health or care related (UK 34%/EU 22%), or reflect job problems or redundancy (UK 27%/EU 16%) than in the EU generally, where "reached retirement age" or "preferred to stop working" are much more common (UK 39%/EU 61%). Curiously, older people in the UK are much more positive about the future of pensions than the EU average, despite the fact that the aggregate income replacement ratio after retirement is, at 0.44, one of the lowest in the EU (EU average 0.51).

Phasing retirement is one way in which extending working life can be made more attractive. A quarter of employees in their 50s in the UK say they have either reduced working hours in preparation for retirement, or plan to do so within five years, and this rises to half of those aged 60-69. Only three EU countries have higher proportions doing this.

Although only a third of workers say that they are resistant in principle to the idea of working longer, there is some evidence that working longer is more problematic in manufacturing than in other sectors. EWCS asks respondents whether they would be able to do their current jobs when they reach the age of 60. 22% of manufacturing workers said they would not want to be working in their current jobs at 60 and a further 13% said they could not (34% total). This figure is higher than that for transport (27%); business services (31%) and public administration (25%). Even amongst manufacturing workers in their fifties, over a quarter could not see themselves continuing to 60 in their present occupations. However, it should be noted that as the reality approaches, attitudes appear to change: Figure 3 also shows that the proportion not wanting to work beyond 60 falls with age.

¹¹ We are using EWCS 2010, UK only dataset

Figure 3: Would you be able to do your current job when you turn 60



EWCS 2010 UK only dataset

A second survey, Employee Outlook, conducted by YouGov¹² on behalf of the CIPD in summer 2011, surveyed the general public on how the current economic climate had affected their work and well-being. Workers over 50 across all sectors were more likely to report good work-life balance than their younger peers. Table 1 shows the responses of older workers in manufacturing and in the overall workforce, compared to younger ones (i.e. older workers in manufacturing were more likely to report excessive workload than younger workers in manufacturing, while the reverse is true of workers in general):

Table 1: Older workers' views on work – by comparison with younger workers

Older workers in all sectors	Older workers in Manufacturing
Less frequent excessive workload	More frequent excessive workload (25% every day)
	Too much workload (48%)
More difficulty in finding a new job if necessary	More difficulty in finding a new job if necessary
Better work-life balance	Worse work-life balance
Greater job satisfaction	
Less frequent work appraisals (25% of respondents reporting "never")	Less frequent appraisals (47% reporting never)

¹² A UK panel survey of 2068 individuals

Better mental health	
Slightly worse physical health	Equally good physical health and neither more nor less likely to be in physically demanding work.
More likely to be in a job which requires a high level of physical ability	

CIPD Employee Outlook 2012

The table highlights some of the challenges facing manufacturers in retaining older workers, especially in the face of competition from other sectors. Older workers in manufacturing are more stressed at work and have worse work-life balance than those in other sectors. However, contrary to conventional wisdom, they are less likely, in general, to be in physically demanding jobs, or jobs which have a negative impact on physical health. It is also not necessarily the case that older manufacturing workers are more likely to suffer health problems. LFS data confirms that older workers in manufacturing are less likely than those in the general population to have health problems which limit work activities (38% to 43%). Unsurprisingly, they are mostly concentrated in semi-routine and lower supervisory occupations. One possible explanation of these low numbers is that manufacturing workers in physically demanding work exit through early retirement.

5.3 Employers' attitudes and policies

Governments, in the UK and across the EU, have recommended that employers adopt "age friendly" HRM practices such as flexible working, lifelong learning and phased retirement, to encourage older workers to delay retirement. (Naegel and Walker 2006) Awareness of age demographics as an HR issue is lower in manufacturing than across the economy as a whole, and is particularly low amongst small firms. (ENEI and Capita 2011). There is some evidence that manufacturing employers have also been more reluctant than those in other sectors to adopt practices to facilitate longer working lives (McNair, Flynn 2006). Compared with employers in general, manufacturers are:

- More likely to have age restrictions for certain types of job, and consider some work too physically demanding for older workers
- Less likely to apply formal systems of appraisals, performance management and career development for older workers
- Less likely to provide flexible working arrangements for people who are approaching retirement and/or have eldercare responsibilities.

However, EEF reports that employers' views on employing older workers have been changing as skills shortages have increased competition for skilled labour. Furthermore, globalisation of supply chains is forcing more flexible approaches to working hours for some managers, design and engineering staff. According to EEF, around a third of manufacturing firms now offer flexitime, part-time hours and unpaid leave. However, flexible work arrangements are much more likely to be accessible to non-production staff than production staff. (EEF 2011a)

The EEF informant also noted that much of the loss of older workers in the manufacturing sector was as a result of macro-economic structural changes which employers at the time dealt with through early retirement incentives. Employers are now looking to recruit

displaced manufacturing workers through job placement and training programmes. However, he noted that manufacturing employers are now competing with businesses from other sectors. It was also reported that the demand for older workers is primarily focused on those with engineering and science skills, while the reduction in high pay/low skill blue collar jobs is continuing to drive an early retirement culture in production work. Although EEF members are concerned about skills shortages generally, they also opposed abolition of the DRA. Opposition was greatest among employers which had large older workforces. (EEF 2008) According to EEF, manufacturers are not strongly concerned about their older workers' physical abilities to carry out work.

In a survey conducted by the science and engineering qualifications agency, EAL, 48% of senior managers of manufacturing firms say that they would prefer to recruit older unemployed workers, rather than young school leavers.¹³ A manufacturing report by the Employers Network on Equality and Inclusion (ENEI) and Capita (2011), based on workshops organised by the relevant sector skills councils lists the following strengths of older workers, which account for this (reported) preference:

- Lower levels of turnover:
- Skills, experience and abilities to mentor new recruits
- Lower levels of short-term illness and fewer accidents
- Life experience
- Ability to manage stress

In research for the DWP's Age Positive campaign (DWP 2001), employers also considered older workers to be more reliable and conscientious than their younger peers. However, they also considered older workers to be less adaptable, more likely to be long-term ill, and to be slower learners. Such age perceptions are not always grounded in hard evidence, and can mask underlying causes of differences. For example, while older workers are less likely to train than younger people, this is not necessarily a refusal to train: they are also less likely to be offered training by their employers. Further, the evidence on stress management is somewhat mixed. The frequency of people reporting workplace stress is inversely U-shaped, peaking for workers in their late thirties and forties, but then declining afterwards (HSE, 2007.) Of course, one of the reasons why levels of stress reporting declines is because older workers who are chronically stressed at work change jobs, or leave the labour market completely, but the pattern is replicated in wider research into wellbeing in the general population.

¹³<http://www.telegraph.co.uk/finance/jobs/9194528/Manufacturers-reject-school-leavers-in-favour-of-older-workers.html>

Managing age in BMW

One of the better known case studies of innovative age management practices is that of BMW which in 2007 recognised that its workforce average age would rise from 39 to 47 in a decade. A study was then carried out to identify production line innovations to facilitate longer working lives. A “pilot production line” in Germany was staffed according to the age profile which was expected in the firm by 2017: 20% over 50 and a further 25% 40-50. The study identified both modest and comprehensive changes to the assembly line to improve health and safety. According to a Harvard Business evaluation, younger workers originally resisted working on the line, referring to it as the “pensioners line”. However, the innovations which were aimed at improving older employees’ working conditions were also found to be beneficial to staff of all ages (Loch et al. 2010).

Managing retirement in British Telecom

British Telecom (BT) has a large number of employees with long service with the company. In order to better plan for changes in its workforce profile, it introduced a flexible working scheme designed to retain its older workers. As an alternative to full retirement, employees are given the opportunity to “wind down” (reduce working hours); “ease down” (reduce work responsibilities); become “helping hands” (take time for volunteer work); or “step down” (take on a job with less responsibility). The policy enables older workers to not only reduce their working hours, but also to change their job content in order to reduce stress as they transition to retirement (Parry 2008).

Managing age in Germany through social partnership

Some of the more innovative approaches to age management are occurring in Germany. In two industrial sectors which overlap manufacturing: chemical and steel, collective agreements have been reached between trade unions and employer federations to manage age. In both sectors, the agreements focus on the life course, foresee compulsory organisational age structure and qualification analysis, the establishment of a "demography fund", and outlines possible age management strategies (Frerichs, Sporket 2007). The drivers for the agreement were, on the one hand, ageing workforces in both sectors resulting from recruitment freezes and legacy workforces; and on the other changes to State welfare and pension systems (including an end to the Altersteilzeitgesetz (ATZ) (Part-time employment prior to retirement law) scheme. (Muller-Camen et al. 2011) The demography fund diverted funds which would have been used to fund ATZ for ergonomic work stations, life-long learning, and health and safety measures to enable older workers to delay retirement. The fund is jointly managed by the unions and employers.

In the UK, such partnerships are less common, in part because union density, while higher than that of the service sector is still low at 18.7%, and falling. UK employers also have greater scope to hire and fire, relative to their German counterparts, and therefore maintain an up or out organisational culture. Unions, on the other hand, are under pressure to protect pension rights and therefore in a defensive position on age diversity issues. The TUC informant noted that, although age diversity is a priority for the union movement, there is also pressure on unions to protect pension rights and resist measures to increase occupational and state pension ages. That said, there are a few large UK manufacturers which are developing new approaches to managing age. One example is a collective agreement between BAE systems and the trade union Prospect. The agreement focuses on the period leading up to retirement, offering employees the chance to reduce working time for the half-year leading up to retirement. Further, although the UK lacks the institutional structure for social partnership, in recent years there have been limited examples of labour-management coordination to tackle sector wide workforce issues. For example, the Union Learning Fund makes use of workplace level trade union presence to facilitate employers in identifying workforce training needs.

The EEF reports that only 27% of its members are concerned that changing age demographics may mean that fewer workers will be physically capable of carrying out work tasks. In view of this, it is not surprising that only 28% of manufacturers are considering redesigning jobs, and only 23% are anticipating redesigning workplaces.

One widely admired model for managing health and capability is the "Workability" model developed by the Finnish Institute of Occupational Health (Ilmarinen 2007). Their "Workability Index" assesses the relationship between an individual worker's capacity and the work (s)he does. Here, capacity is defined not only in terms of physical capacity, but also mental capacity (e.g. ability to deal with stress at work); skills sets; work-life

balance; tacit knowledge and ability; and relationships in the workplace. It is claimed that the assessment tool is able to accurately predict likely problems for the individual in the workplace and role, and help identify remedial measures. As a result, in Finland, and in some other countries, modest interventions have been introduced which build on the individual's abilities, and which have a positive effect in extending productive working life. However, although WAI has a strong empirical basis, there has been little interest in adopting it in the UK, in part because capability assessment has negative connotations with workers and trades unions (who fear it can be used as a tool for selecting people for redundancy) and requires some initial investment by the employer in training assessors. The UK also lacks the independent national occupational health services which make the Finnish model workable.

In the UK the report produced for Government by Dame Carol Black (2008) examined the relationship between work and health, and found clear evidence that, in general, work is good for individual health, especially if working practices are well designed. However, several informants noted that managing the health of older workers is a particular challenge for SMEs, which usually lack access to occupational health specialists who can help managers to manage workforce health issues. The IOM informant commented that general practitioners are increasingly being relied upon to assess workers' employability and are not in a position to promote healthy working environments in the way that occupational health advisors in large corporations can.

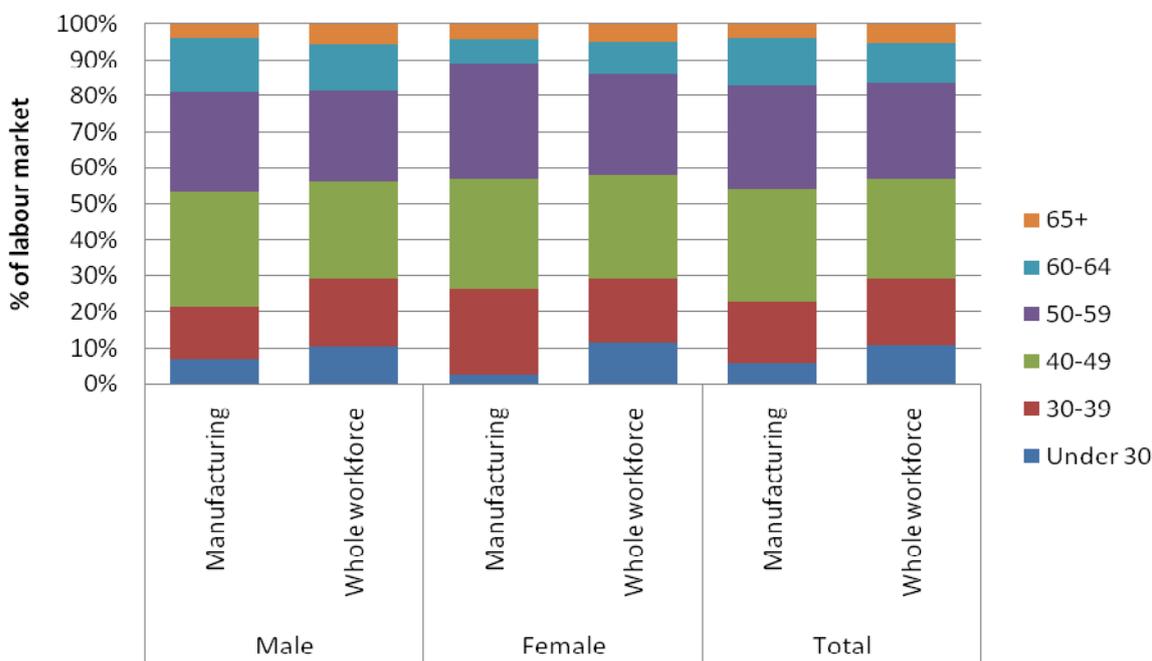
While there have been high profile initiatives to manage health and well-being in large manufacturers like BMW and BAE, SMEs lack the resources and workforce scale to implement major health initiatives. Healthy Working Lives, an agency of the Scottish National Health Service, has developed a pilot to provide consultancy to SMEs in managing the health and well-being of their workforces.¹⁴ The programme operates as a partnership between the agency and SMEs, with the latter having to share some of the costs after initial consultations. However, the programme is a pilot, and equivalent systems have not been introduced in other parts of the UK.

¹⁴<http://www.healthyworkinglives.com/award/index.aspx>

6. Age and the manufacturing workforce

Of the sixteen sectors of the UK economy, manufacturing has the fourth oldest workforce¹⁵, with a third of all workers aged over 50. The proportion of older men is particularly high. Figure 4 shows that the proportion of people likely to retire in the next 5 years is higher in manufacturing than in the economy as a whole, and the larger bulge in the age profile in the 40-49 year old group indicates that the problem will become increasingly severe over the next 20 years. Furthermore, these overall figures mask significant variation between sub-sectors and firms with some SMEs already facing shortages. Nevertheless, age is amongst a range of factors (including gender, migration, and qualifications) which employers are concerned about in relation to skills and labour shortages. Although a majority of EEF members cite the loss of specialist skills through retirement as amongst their greatest concerns, only 5% are very worried about the broader issue of losing significant proportions of retiring workforces (EEF 2008). Several informants noted that manufacturers are aware of the issue of ageing workforces, but nevertheless tend to favour younger workers in recruitment and selection.

Figure 4: Age profile of manufacturing sector



LFS Data Manufacturing Only January to March 2012

One of the main reasons for the bulge in 40-59 age-group in manufacturing is the loss of high paid semi-skilled and manual jobs during restructuring of the 1980's. Older workers were actively encouraged to leave work early, and recruitment freezes meant that few younger workers were replacing them (Phillipson 1998). By 2000, 40% of retired men reported retiring earlier than they had expected (Cabinet Office 2000). The result was a narrow and ageing workforce profile whose legacy is seen today. Although older worker employment bottomed out in the 1990's (Hirsch 1998), this was as a result of an increase in work in female dominated sectors. During the current recession, 706,300 jobs were lost (GMB 2012), with between a quarter and a third of manufacturers reporting the use

¹⁵ After agriculture, real estate, transport and education.

of redundancies to shed labour (CIPD 2012). However, more employers were using part-time working as a strategy to retain scarce skills and experience, against the possibility of economic recovery, and this has benefited those older workers who wanted to move to part-time work in the run up to retirement. Nevertheless, while early retirement is less often explicitly used than in the 1980's, manufacturing employers were still (up to 2006)¹⁶ more likely than those in other sectors to relate redundancy offers directly or indirectly on age. (McNair and Flynn 2006)

6.1 Firm size

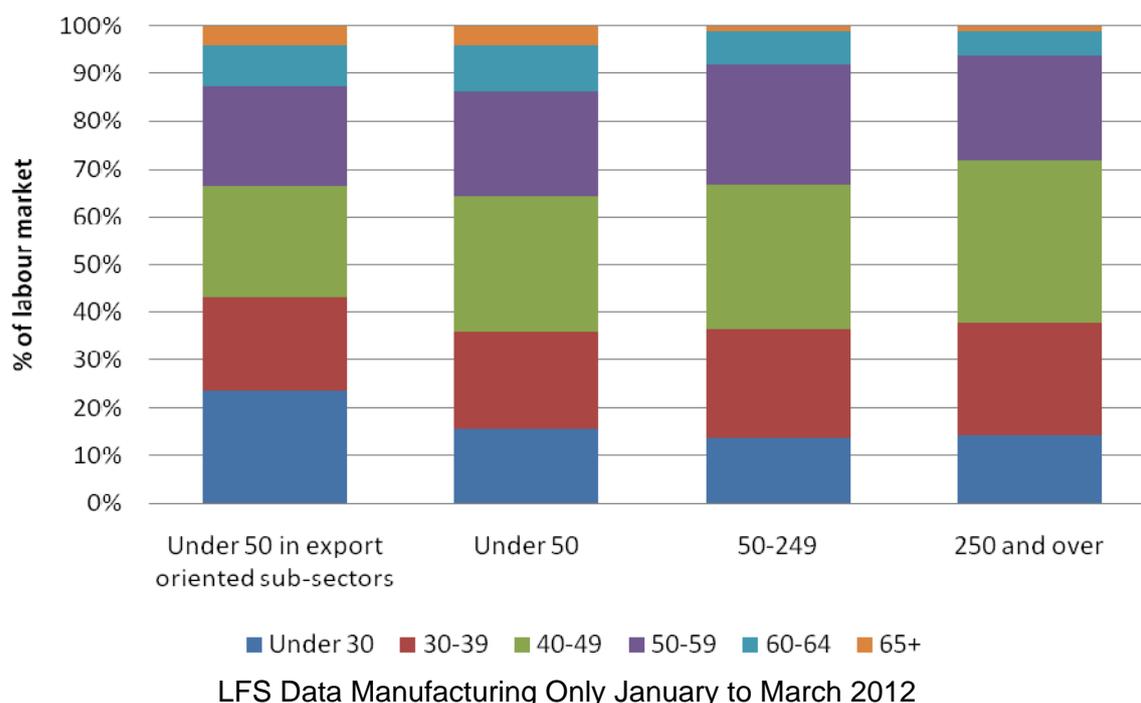
In the UK, small manufacturers (SMEs), those with fewer than 250 employees, account for €183M of annual turnover, approximately 36% of all manufacturing output, while they account for 57.5% of the manufacturing workforce (1.48 million FTE). Labour productivity for SMEs is lower than large manufacturers (50.2% value added per employee in firms 50-250 against 73.5% value added for firms 250+)¹⁷. Labour productivity in SMEs tends to be lower than in larger enterprises because they are more labour intensive and do not benefit from economies of scale. (BIS 2010b) However, it has been noted that productivity in some SMEs have outpaced that of large manufacturers, especially in export oriented start-ups (which a BIS (2010b) report labelled 'Born Global' firms) which benefit particularly from innovation. The eight sub-sectors with the highest proportion of export oriented start-ups (coke/chemicals; motor vehicles/parts; rubber/plastics; machinery/equipment; medical/precision; other transport; electrical machinery; office equipment/radio) are in the manufacturing sector. Such SMEs benefit from globalisation in terms of productivity for three reasons: "churn" (with less productive firms going out of business); large firms outsourcing to them; and innovation and knowledge sharing.

Overall older workers are heavily concentrated in SMEs. Although a third of firms have never employed anyone over 50, because of the natural life cycle of small firms, a third of the workforce in SMEs is over 50, and 15% is over 60. There appears to be two drivers for this: that employees tend to leave large corporations before the end their working lives, moving by choice or necessity into smaller firms, and that small firms have difficulty in competing with larger ones for prime age employees in pay and terms and conditions of employment. This can be seen in the eight aforementioned sub-sectors with the highest proportion of "Born Global" firms. Figure 5 shows how much more dependent such firms are on those under 30 and over 50 than the large firms. SMEs in these sub-sectors have a large proportion of younger workers and only slightly smaller proportion of over 50's relative to all manufacturing SMEs.

¹⁶ The introduction of the Employment Equality (Age) Regulations (2006) made such bias unlawful, although it may well persist in practice.

¹⁷ EUROSTAT data

Figure 5: Age profile by firm size



6.2 Age and occupation

The UK labour market as a whole has experienced a hollowing out of mid-level occupations (especially skilled trades-people) over the last twenty years (Sissons 2011) with the growth of high skilled professional occupations and of elementary occupations concentrated in the service sector. In manufacturing, the largest replacement demand to 2020 will be for senior managers and professionals (UKCES 2011a, p73). The UK Commission for Employment and Skills projects the following net changes over a decade:

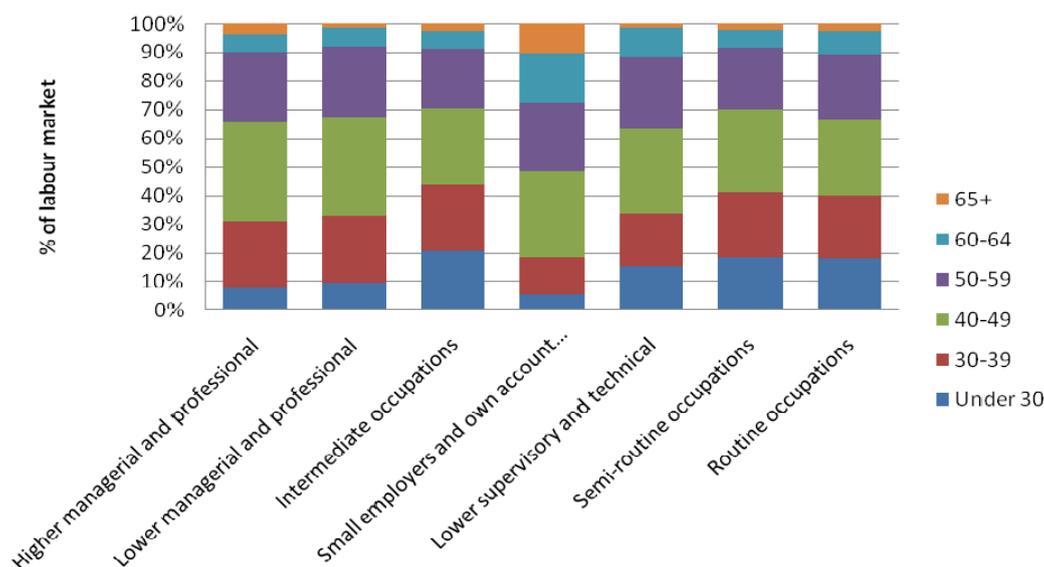
- a 12.4% increase in demand for managers, directors and senior officers;
- a 13.5% increase in professionals and associate and technical jobs;
- a 14.6% loss in skilled trade occupations; and
- a 23% loss of process and machine jobs.

However, these net figures mask different replacement needs as large groups of older people retire.

Excluding the self-employed (82% of whom are own employees without staff), the occupational group with the largest proportion of older workers is lower supervisory and technical staff. This is followed by higher managerial staff and routine occupations. While major manufacturing employers are focusing their recruitment on graduates, particularly those with science and engineering skills, short-term shortages in trade skills are now driving manufacturers to expand their apprenticeship programmes (EEF 2011b). In addition to recruiting under-25's, manufacturers are also beginning to recruit older apprentices, including those who had been displaced through previous rounds of job attrition (EEF 2008). It should also be noted that a high proportion of manufacturing workers over 50 have level 3 or lower qualifications, and the fastest shrinking occupational groups are those requiring this level of education. Nevertheless, although

qualification levels in general are lower for older workers than younger, manufacturing also has a high proportion of older workers with STEM skills, which are in high demand, and replacing these skills has been identified a significant challenge for the sector (Wilson, 2009).

Figure 6: Age profile by occupational groups



LFS Data Manufacturing Only January to March 2012

6.3 Age and sub-sectors

The age profile of each sub sector reflects a variety of factors. Some (like textiles) are old because they are perceived to be in decline and are not recruiting, some (like nuclear) because of policy uncertainty. Others are older because of long lead times to qualify and acquire experience. Some are young because they are new industries, founded by young people who have not yet aged.

How far the age profile of a sub sector is an issue depends not only on the total labour demand, but also on replacement demand. Where there is a high proportion of people over 50, retirement will create a need for recruitment, even if overall labour demand is falling. Strategies to retain, and retrain, older workers longer can delay the problem, and may well be valuable, both in terms of sheer numbers, and of accumulated experience and knowledge, but they will need to be linked to recruitment to secure long term replenishment.

Tables 2 and 3 show the age profiles of manufacturing sub sectors and relates that to change in GVA over 15 years. Critically, they show what will happen to the size of the workforce if those currently in the sector and are over 50 are replaced by those already in the sector aged under 30. Table 2 shows the seven sub sectors where the shrinkage in numbers is greatest. Together they account for over a third of the current manufacturing workforce, and all have been shrinking in terms of GVA for some years. However, it is likely that all will continue to exist, and will reach, at some point, a floor level. This is particularly important where the sub sector is a supplier to other growth sectors.

Table 2: Most age vulnerable sub-sectors

	<30	50+	Current share of manufacturing jobs	Likely change in workforce size 2012-2027	Change in GVA 1994-09
	%	%	%	%	%
Textiles	12.5	47.1	2	-30	-50
Coke, petrol, nuclear	8.5	38.3	2	-28	-15
Other transport	12.6	36.9	6	-23	?
Electrical equipment	14.8	38	4	-23	-35
Basic metals	12.6	39.7	2	-22	-38
Machinery n.e.c.	12.9	38.5	10	-21	?
Fabricated metal products	14.5	36.5	10	-20	-10

UKCES 2011a and BIS 2010

Nuclear related manufacturing is an extreme case (partly concealed by its bracketing with other energy related manufacturing). It faces a particular age demographic problem because of long running policy uncertainties, which have discouraged recruitment over a long period, linked to very long lead times to develop appropriate skills. The predicted retirement of 5% of the nuclear workforce every year from 2015 will require 40% recruitment over a decade, to maintain stability. By contrast, the sectors least likely to experience declining numbers, accounting for a little over a quarter of manufacturing jobs in 2012, are:

Table 2: Least age vulnerable sectors

	<30	50+	Current share of manufacturing jobs	Likely change in workforce size 2012-2027	Change in GVA 1994-09
	%	%	%	%	%
Food, beverages & tobacco	18	22	16	-4	10
Wood and wood products	19	33	2	-10	-30
Pulp & paper products	20	29	2	-10	-15
Pharmaceuticals	15	27	6	-10	33
Wearing apparel	10	27	1	-12	-55
Computer, electronic & optical	13	29	?	-14	?

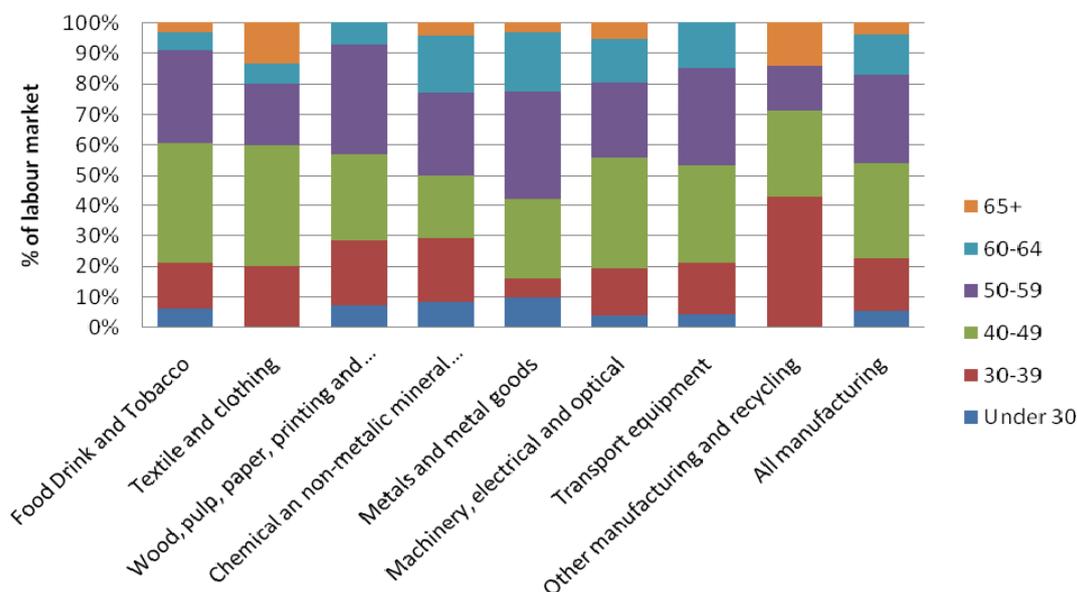
UKCES 2011a and BIS 2010

The proportion of workers across manufacturing who stay in work beyond 65 is small (by comparison for example with retail), although some sub-sectors appear to find it easier to offer roles which appeal to older worker: part-time, flexible working, self-employment, mentoring or consultancy. Sectors with more than 3% of the workforce over 65 are clothing, basic metals, non-metallic minerals, furniture, wood products and machinery, all of which are expected to decline over the next fifteen years. However, in some of these (like Furniture) there are likely to remain niche markets for products which depend on the high craft skills and experience which older workers bring.

6.4 Other demographic issues

Finally, demographic factors need to be seen in the context of other economic and demographic changes, including job churn, ethnicity and gender. First, economic restructuring through the present and previous recessions, and internal reorganisations has resulted in a large number of displaced workers of all ages. In all sub-sectors apart from nuclear, more people leave through redundancy than through retirement. The Labour Force Survey shows that, of those manufacturing workers of all ages currently out of work (both unemployed and inactive), a third are seeking or wanting to get back into work, and as labour supply tightens, other employers will recruit from this pool if manufacturers do not. This is not counting the number of displaced manufacturing workers who find new employment in other sectors. An ESF funded pilot project in the South East proved successful at retraining unemployed male manufacturing workers to work in the (rapidly growing) care sector (Wilson 2010), and our DWP informant noted that a similar pattern can now be seen in the South West.

Figure 7: Age profile of sub-sectors



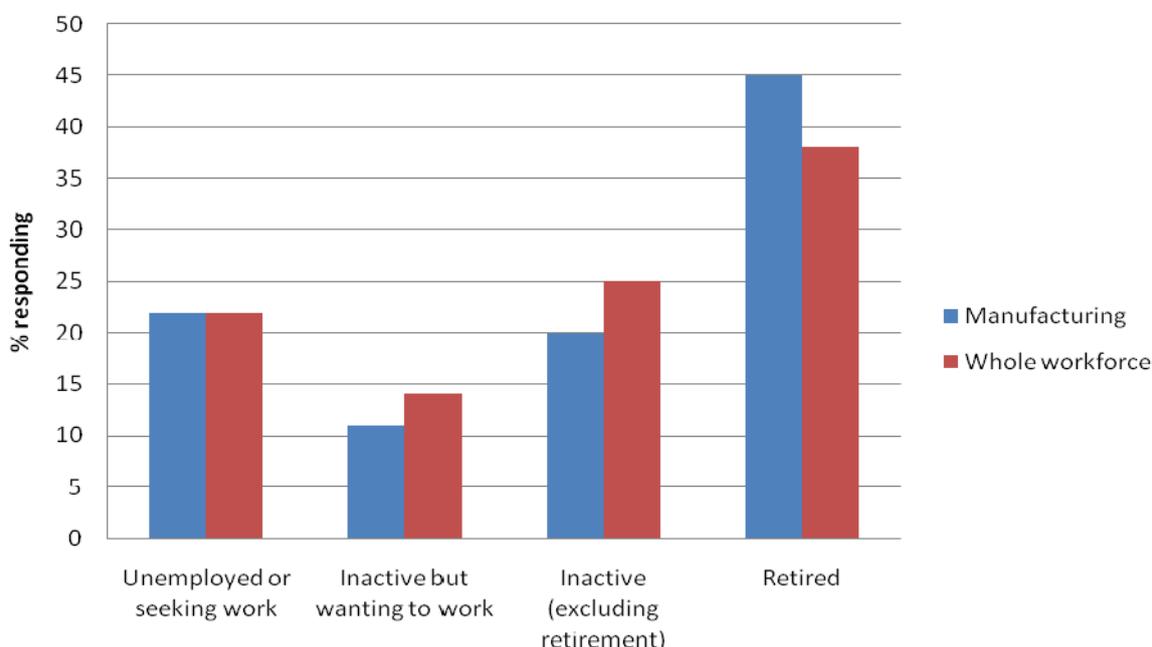
LFS Data Manufacturing Only January to March 2012

The changing gender profile of employment is also significant. Women's participation in the workforce has increased steadily in recent decades, but they remain significantly underrepresented in most parts of manufacturing, and they typically experience a substantial drop in earnings, and a shift into lower status, often part-time, work after childbearing (Owen-Hussey et al, 2006). In the context of growing labour demand and a

shrinking population of "working age", it seems likely that employers will need to increase the numbers of women in work, and seek ways of making better use of their talents.

Finally, migration has been a major factor in changing the shape of the labour market in the last decade, with a historically unprecedented influx of relatively well qualified, and motivated, migrants from the expanding EU. This is the principal reason why the overall workforce has not yet shrunk significantly, and why the UK population is expected to continue to rise, unlike many of our competitors¹⁸. However, it is politically and socially inconceivable that this experience will be repeated, and there are concerns in some quarters, including EEF, that Government attempts to restrict immigration will be a constraint on economic growth, with particular concerns about restrictions on Post-Study Work visas which manufacturers may limit the supply of skilled workers, particularly those with science and engineering degrees (O'Keefe 2012).

Figure 8: Reasons for being out of work



LFS January to March 2012, using only respondents of all ages who cited their last jobs

6.5 Labour market challenges for manufacturing

UK manufacturing as a whole is less well placed to respond to the challenges of an ageing workforce than other sectors. In general it has less flexible working practices, and a stronger tradition of full time work and rigid retirement ages. It also suffers, at least as much as other sectors, from under-qualified leadership and management, which makes creative management of performance more challenging. While many older people, and perhaps especially those in higher skilled jobs, are open to staying longer in work, they will only do so if work is made sufficiently attractive: providing interest, purpose and social engagement, and encouraging continuing training and career development (upwards and downwards according to individual preferences and capabilities). If manufacturers respond as positively as some other sectors have done in recent years

¹⁸ First generation immigrants typically have higher fertility rates than the host population.

there would appear to be no reason why longer working lives should not become a reality.

One major uncertainty raised by informants to this study was the extent to which the age issue is an employer level problem (requiring employer level solutions) or an issue which requires a co-ordinated approach at the national or sectoral level. In European countries with a stronger tradition of sectoral cooperation between employers, and with stronger models of social partnership, there is evidence of sectoral and national initiatives. Such models have limited applicability in the UK. Here there are examples of large manufacturers which have moved forward on an individual basis, though much more rapidly in sectors like retail, than in manufacturing. There appears to still be resistance to a shift away from youth-centred management amongst employers, unions and older workers themselves, exacerbated at present by concerns about youth unemployment. There is also uncertainty over how SMEs can manage changing age demographics, bearing in mind that the complexity of the patterns. Although older workers form a larger proportion of employees in SMEs overall, the majority of small firms employ no older workers. The Scottish Healthy Working Lives programme is small but innovative example of a government agency intervening where it has identified a gap in SME capacity.

7. The demand side: responding to ageing markets

An ageing society not only brings labour market challenges and opportunities, it also creates new and expanding markets for manufactured goods and services. Having now reviewed the effect of ageing demographics on manufacturing workplaces, we turn our attention to the potential markets for manufactured goods.

Not only will the size of the older consumer market increase, but so too will their disposable income. On average, net financial wealth (excluding housing and pension wealth) increases with age to reach a peak at around 70 before declining (ILC, 2007). The total net financial wealth of people aged 50 and over is of the order of £560 billion. This probably amounts to 85% of all such wealth (Metz and Underwood, 2005), although not all older people are wealthy, with 18% of single pensioners and 15% of pensioner couples living in low income households (The Poverty Site, 2012). In 2008, Age UK estimates that £97 billion was spent by people over 65, and this is now predicted to have reached over £100 billion. To understand the effects of an ageing consumer base in the future, we need to look at how the current demands of older consumers are different from other age groups; and whether these are a reflection of our time, or characteristics that will still be true for future generations.

7.1 Older consumer assumptions

Inevitably for a group so large, the definition of older people is far too broad. We frequently see statistics that group everyone over retirement age into the same box. The Ofcom Communications Market Report, cited in this document, makes numerous comparisons between 16-24 year olds (an age group of just 8 years) with those 65+ (Ofcom, 2012). However, it is unwise to assume that the behaviours and patterns of consumption within this older age group, which spans several decades, is homogeneous. The average 60 year old typically has different levels of physical, mental and sensory ability from the average 80 year old, yet some people can stay healthy with strong physical and mental abilities into their nineties, whilst others experience the onset of debilitating health conditions at a much younger age. Whilst both life expectancy and healthy life expectancy are rising, there are significant regional and socio-economic differences. For example, the proportion of life spent in good health is rising in England and Wales, but falling in Scotland and Northern Ireland (ONS, 2012b).

The wide age bracket attributed to 'the older consumer', which, in 2012, includes people of different cultures, religions, economic background, occupations, lifestyles and at least two generations, actually makes this group more heterogeneous than most.

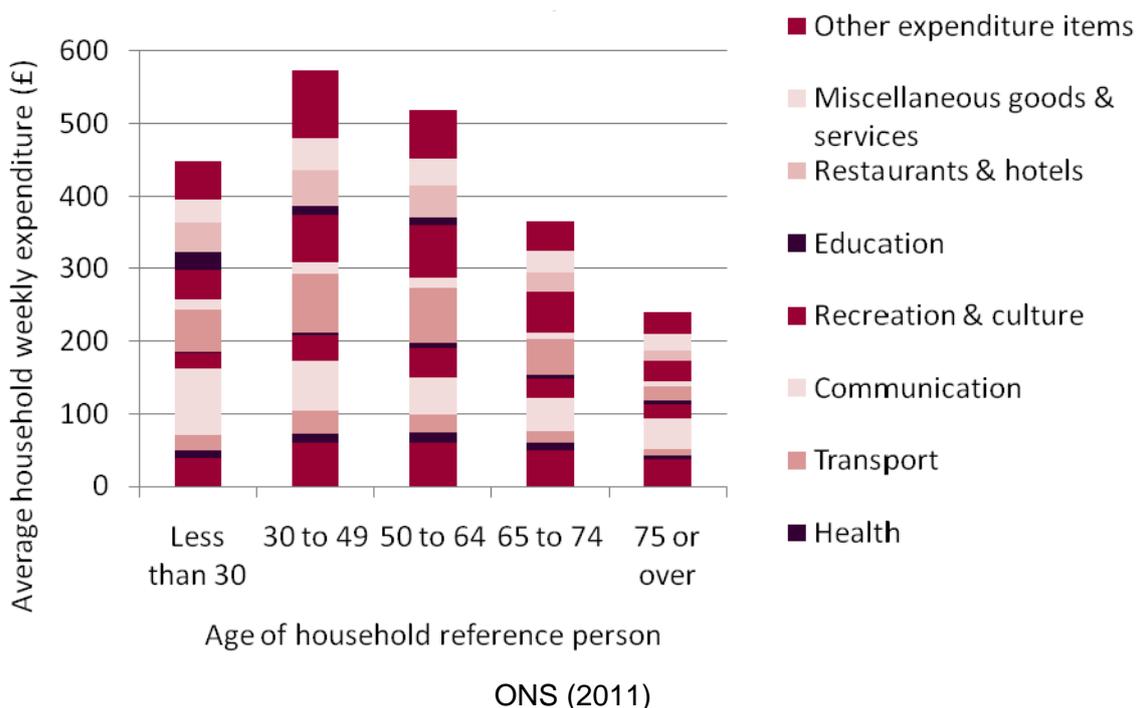
This diversity within the older population means that any patterns of consumption attributed to "the older consumer", (other than in sheer market size,) are weak, and consumer patterns cannot easily be separated by age (ILC-UK, 2010). To generalise at all about the older consumer, alternative divisions rather than age could be explored, such as life stage, generation, cognitive age, or by ability.

When looking at existing assumptions about the older consumer, some have been identified as out-of-date, such as older consumers being brand-loyal. Whilst ILC-UK

found that older people were less likely to shop around because they did not see the benefit of doing so (ILC-UK, 2010), they could also be seen as a more discerning group. If you could demonstrate to them that a brand or product would work for them, and work better, then they would respond to that (Gettinby, 2012).

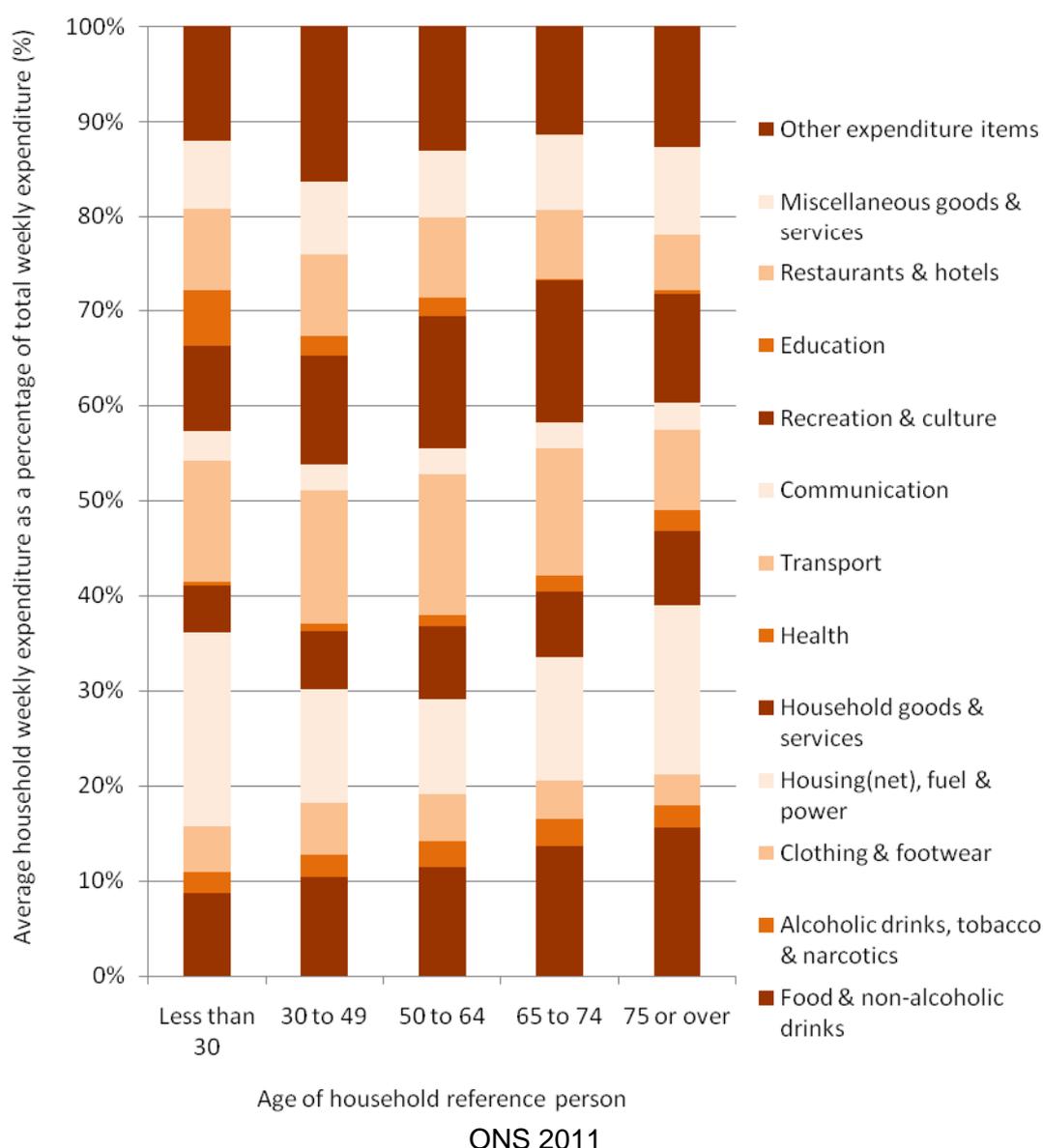
Many older people will display multiple minor impairments, especially as they age. Although extra years will continue to be active ones, significant illness and disability will continue to be concentrated in the last five years of life with major costs coming in the final 6 months (Coleman, 2003)¹⁹. There exist some opportunities in health and social care for the very old, whose needs will be more specific due to increased impairment and ill health than an age-neutral group.

Figure 9: Household expenditure by age of household reference person, 2010



¹⁹ It is, of course, impossible to predict at what age this will affect any given individual.

Figure 10: Household expenditure on main items as a percentage of total expenditure by age of household reference person, 2010



7.2 Age-neutral and age-specific products

When looking at the consumer market in relation to age, products can be divided into age-neutral (i.e. those designed for people of all ages) and age-specific (i.e. those designed to meet the changing abilities associated with the effects of ageing) products. The vast majority of products are age-neutral, including most food and drink, clothing, household goods, white goods, mainstream technology.

The real impact of an ageing population will not be in the purchase of 'old' products but rather it is the larger age-neutral market that is set to benefit more from their spending power (BIS, 2010a). Figure 10 shows the sectors where household spending increases as a proportion of total expenditure with age:

- food and non-alcoholic drink;
- fuel and power;

- household goods and services;
- health;

While less is spent on transport. However other categories were quite stable, making it difficult to identify any habits particular to older people. Due to demographic change alone, all sectors were projected to grow by 10-25% between 2008-2033, with most increase in Health, Food/Drink and Fuel/Power (BIS 2009). The absolute and relative increase in the older consumer market will be the primary driver of the consumer market for the next decade (Stroud, 2012).

8. Future buying habits

The ILC-UK report two alternative views of how future spending habits may change due to an ageing population. One view, widespread amongst marketing professionals, is that simply projecting current expenditure forward for demographic growth is inadequate, as the spending habits of the "boomer" generation will be different from the current older population. (ILC-UK 2010). The argument is that the "baby-boomers" have grown up with mass consumption and are familiar with information technology. Between 2011 and 2012 home internet access among 65-74 year olds increased from 54% to 64%, the largest rise of any age group (Ofcom 2012).

However, the notion that the baby-boomers are a distinct group in terms of cultural expectations and behaviour is contentious. It emerged in the USA in the marketing world, and has historically been used differently in the USA from the UK (where it is normally taken to refer to births between 1946 and the mid-50s). The ESRC/AHRC Cultures of Consumption programme, has found little evidence to support the notion that they are distinctive, or that the baby-boomers were redefining retirement in terms of consumption. Even within the next generation of older people, the idea of a group with a shared cultural identity is misleading, with those born into post-war austerity having different values to those born into the later boom of the 1960s. What has emerged is that people have modest aspirations for later life to maintain their current lifestyle (ILC-UK 2010), and their consumption habits were only changing because of physiological and social implications of ageing, not cultural or generational factors. This could lead to an increase in the purchase of age-specific products in order to prolong independence and mitigate the effects of ageing, or rejecting one age-neutral product for another because they were not compatible with diminished abilities.

8.1 The digital divide

Computers only became widespread in the workplace and the home around 2000. As a result, those now in their 50s and 60s have had much better access to the technology, and to learning to use it, than their predecessors. In 2012, 55-64 year olds were as likely as 45-54 year olds to express negative views of new communication methods (26% and 22% respectively said they had not made their lives easier), but twice as many of those over 65 responded this way (50%) (Ofcom, 2012.) This digital divide will close, as future older people will continue to embrace new technology. However, 70% of those aged 70+ feel that getting to grips with technology becomes more difficult with age (Age Concern 2008).

Furthermore, people's inclination to learn new technologies naturally diminishes as they get older. Whilst smartphone ownership is similarly widespread among 35-54 and 55-64 age groups (97% and 91%), it is much lower (68%) for the 65+ group. However, not all communication technologies are following the same pattern. Tablet ownership was slightly higher in the 45-54 age bracket than any other, and e-readers use was higher in those 35-64 than those under 35 (Ofcom 2012.) While some young people buy technology to make lifestyle statements, older people are more likely to buy new technology for what it does, not for what it is. An interesting indicator of the changing use of online technologies among older people is the fact that the proportion of people over 50 using the internet for learning rose between 2005 and 2012 from zero to 12% of all learners, and was especially high among people over 75 (McNair 2012).

8.2 A failing market

Any differences in the spending habits of older people are more related to what the market provides than what the consumer wants (ILC-UK 2010). Even though the potential market for 'age-neutral' products is growing, due to population ageing, it is so far failing to capitalise on (and in some cases excluding) the older consumer. "The need for these products may be age-neutral, but their design and marketing is for a young body and a young mind" (Stroud 2012). Businesses that tailor their service to appeal equally to older people as they do to other age groups will benefit most.

There are further opportunities for manufacturers to design age-specific products for an ageing population. By definition these products are designed to mitigate the effects of losing one-or more age-related abilities, and marketed at the older consumer, which itself can have negative connotations, with some people reluctant to buy products that they associate with frailty or a loss of ability. There is often a lack of design quality, where style has been sacrificed for usability. Whilst staying independent is extremely important, people do not want to be forced to buy products they would otherwise reject. "There are few good-looking products, environments and services to help make [older people's] lives easier, more colourful and more joyful" (Wolff 2012).

There is widespread disregard and at worst, market failure to provide age-neutral products for older consumers. It is the market's failure to include older people, that is holding back growth (ILC-UK 2010).

9. Demand implications for manufacturing and its sub-sectors

Population ageing has two major implications for UK manufacturing. Worldwide, manufacturers need to recognise the 'megatrend' that is global population ageing, and the opportunities that lie in the export market. In the UK, they must cease to exclude the older consumer from the market, by designing inclusively at all stages of the value chain.

9.1 The global ageing market

According to the United Nations, "Population ageing is unprecedented, a process without parallel in the history of humanity". In 2009, the UK population was ranked 17th in percentage of population aged over 60, whilst the Asia-Pacific region had the oldest (Japan), largest (China) and many of the fastest growing (China, Korea, Singapore) ageing populations (UN 2009).

By 2050, the population of people aged over 60 in China is estimated to be 440 million (UN, 2009), equal to the entire 2050 population of the United States (US Census Bureau 2008). The advantage for UK manufacturing will come if it can move towards providing for this trend, acquiring IP and expertise in the field, and can make its stamp early, on a global scale (Gettinby 2012).

A current concern is that UK manufacturing will not respond, but consider the ageing population effects as "something in their top 5, that never makes it to number 1. It needs to be in the top 3, and kept there, as a focal point' (Gettinby 2012).

9.2 The value chain

In considering the effects of population ageing on manufacturing industry, it is not enough to isolate the product design and development stage; it must take a whole system view. The opportunities for age-friendly design within the system can be identified by looking at it from the consumer perspective, covering marketing and communication; product design; retail experience; payment methods; delivery' packaging and instructions' and after-sale support. (ILC-UK 2010). All of these touch-points must be age-friendly for a product to succeed in the older market.

9.3 Mass customisation and mass collaboration

'The Third Industrial Revolution', the digitisation of manufacturing, is described as the convergence of several remarkable technologies: "clever software, novel materials, more dexterous robots, new processes (notably 3D printing) and a whole range of web-based services" (Economist 2012a).

Future manufacturing will be able to produce consumer products that are personalised and customised to each customer's taste and needs, leading to an era of mass customisation. The ability to customise products is well suited to the needs of people of different abilities, including older people.

UK manufacturing has responded to the global expansion of manufacturing by outsourcing the lower value stages of the value chain, such as production (BIS, 2010a). The global network that exists as part of the third industrial revolution signifies future, more complex, ways in which different stages could operate and interact. Component details could be held in the cloud and downloaded for print, three-dimensionally, in local 'factories' around the world, or in the home, rather than distributed from a central supplier, reducing transport and energy costs. Customers could print objects themselves, and share designs through the commons. We are entering an era of mass customisation but also of mass collaboration.

The growth in 3D manufacturing could revolutionise the supply and demand side of manufacturing, opening new opportunities for 'in situ' making, and potentially giving older people more of a voice in the process. A report (Sissons et al 2012) completed in October 2012 by the Big Innovation Centre (an initiative of the Work Foundation and Lancaster University) highlights the need to put a policy and framework in place in the UK for developing 3D printing technology. The report outlines the following areas for immediate consideration: Intellectual Property, Regulation, Legal Responsibility, Standards, New Material, and both Digital and Physical Infrastructure. University and Science minister David Willets announced that a £7m tranche of funding will be available through the Technology Strategy Board for businesses to research and develop 3D manufacturing ideas (v3.co.uk 2012).

The growth of mass collaboration projects by networks of strangers on a global scale could have a big impact on manufacturing. One production model, 'commons-based peer production' refers to large numbers of people collaborate on projects that combine their collective skills to create a product shared among the network (Moilanen 2012).

Combining mass collaboration with rapid manufacturing through 3D printing, termed 'social manufacturing' (Economist 2012b), could be socio-economically and technologically disruptive for the manufacturing industry. The benefits for the older consumer lie in having an active role in the production process, either lightly, by submitting customisation requests that meet their needs, by using their own skills to contribute to the industry, or by printing new products straight into their own home (Economist, 2012b). This may become more likely as the population of highly skilled retired people with time available grows.

9.4 Life sciences

The UK'S rapidly growing biomedical industry is well positioned to grow strongly in response to population ageing. However, other countries will wake up to this opportunity and the UK cannot afford to be complacent. Whilst other countries have invested heavily, the UK biomedical research budgets have only been maintained in real terms (Nesta 2011), and a proportion of this investment is in minor modifications to existing products designed to maintain intellectual property rights, rather than to innovate. This highlights the importance of fundamental research and the building of knowledge transfer relationships between academic institutions and business.

There are opportunities in pharmaceuticals, medical technology and medical biotechnology. Pharmaceuticals have dominated healthcare and there needs to be continuing drug development to combat, counteract or delay the effects of ageing. However, preventative healthcare, reducing or eliminating the onset of illnesses and

disease, could both ease the burden on hospitals and address some of the growing problems such as obesity. Over a third of those age 65-74, and nearly half of those over 75, have a long-standing illness or disability that limits activities (Young Foundation 2012). There will be a growing consumer healthcare market for remote diagnosis, for self-testing and home-monitoring of the kind that already facilitates the management of heart conditions or diabetes by monitoring blood pressure, cholesterol, and blood glucose. They also have potential to address issues of patient compliance and persistence with a course of treatment.

There are disruptive biotechnologies emerging through hormone and gene therapy or regenerative medicine. The Technology Strategy Board identifies 'regenerative medicine' as the next major source of innovation. Regenerative medicine involves the repair and replacement of damaged cells and tissue. This could offer cures to dementia, heart failure, diabetes, blindness and the deterioration of joints (TSB 2012). This is hugely significant. Cases of osteoarthritis alone have been predicted to double to over 17 million by 2030, by a leading expert (Arthritis Care, 2012), due to dramatic increases in the number of people with the two biggest factors, being over 50 and overweight, with Arthritis Care citing an increase in obesity from 16 million to 27 million in the UK by 2030.

Some of the benefits of nanotechnology will emerge in the near future, through improvements in 'diagnostic devices, imaging agents and techniques and implants' (Moore, 2010). Early diagnosis of disease is beneficial all-round due to a better prognosis for the patient and reduced costs to the health service.

In the longer term, whilst research in regenerative medicine is thriving, problems summarised by Moore include a lack of suitable capital, regulation hurdles, a lack of clinical evidence on cost-effectiveness, and reluctance in Europe to adopt innovative products, making an off-putting environment for commercialisation of regenerative medicine (Moore, 2010).

9.5 Food and drink

The Institute of Manufacturing states that "the UK has become a leading source of new foods with health propositions, demonstrated by the fact that in 2007, 36% of new health product launches in the European Union originated in the UK" (Institute of Manufacturing 2010).

The market for health foods is set to stay strong, due to both an ageing population and the obesity epidemic. Products designed for low-salt, low-cholesterol diets have been around for decades. New wellness and care products will emerge, for example food-additive products, in order to differentiate from competitors and combat age-related or health-related problems. The next generation of older people will still have the money in retirement for this market to benefit, and a sub-group of older people will be conscious of issues around wellness (Stroud 2012).

A significant issue in food and drink consumption for an ageing population is inaccessible packaging and poor labelling. The packaging manufacturing industry (glass, metal, plastics) needs to pay attention to this (Packaging News 2011). More 'frustration-free' packaging needs to be developed for older people as 48% struggle to take lids and caps off bottles and 54% report that text is too small to read. These can translate into important safety issues as physical, sensory and cognitive ability can decrease with age.

Widowhood is a particular issue for older people in relation to food and drink. The rise of single person households, and of people with limited cooking experience or cognitive issues all suggest more attention to portion size, product life and simplicity of cooking.

9.6 Electronics

“The digital technologies have got potential, but there’s very little where we have the ability as a country to deliver the solution ourselves” (Gettinby 2012). Digital technologies can have an impact with an ageing market in three ways - by addressing social isolation through communication technologies, through the development of intuitive interfaces that are inclusive of all abilities, and as a way to support health or security in old age, through tele-care, tele-health and smart homes. Smart homes are automated residences wired up with technology to support easier living.

New technologies are already emerging that change the way that we interact with computers. Microsoft Kinect’s motion sensors allow interactions with computer games without a controller. This paves the way for other interfaces to emerge controlled by hand-gestures or other movements of the body, in three-dimensions. Interfaces that allow a switch between or a combination of touch, movement and voice control would help people to engage with digital technologies regardless of any temporary or permanent physical disability.

9.7 Automotive and personal transport

In 2005 a study by HWB predicted that, by 2010, over 50% of new cars would be bought by people over 55 (HWB International 2005). The report goes on to cite significant numbers of people reporting arthritis, and identifies dashboard design, access, seat level and position, font size, lighting, as well as the design of dealerships. A car better designed to be accessible by people of different abilities will simplify the challenge of driving (BIS 2010a). An example of such inclusive design is the Ford Focus. In designing the original car, Ford deliberately considered the needs of an ageing market of drivers who are less flexible, through modifications, for example, to door width and seat height. More recently they have developed driver assistance packages which use CCTV to aid parking for those with limited mobility, and alert drivers to crossing white lines. The result is a car better designed for an older market, but it is not marketed as an "old person's" car (which would deter not only young drivers but many older ones too).

Designing for declining cognitive abilities is another challenge. In terms of the wider transport network, public transport may be more physically inclusive through wheelchair access and seats for older people but busy transport networks need to be intuitive, from the ticketing and signage to the logic of the layout and stages of the process (Gettinby 2012). Some research suggests significant links between quality of life, car ownership and access to public transport (Gilhooly et al 2003). Loss of licence can be seen as a strong predictor of depressive symptoms in older people as the ability to drive and operate a vehicle is seen as a mark of independence. An examination of what a private car offers can show some key determinants of a good mobility framework including a door-to-door service, availability not linked to time of day or weather, convenience and most importantly, independence (Kunur et al 2007). There is a manufacturing opportunity for more inclusive, easy-to-drive vehicles for the increasing number of older drivers and for new automated transport systems that combine arterial routes with short local journeys, bringing the positive qualities of private transport to public systems.

Ageing decreases mobility, physically and socially. People lose contact, comfort and convenience. The economy suffers as people's spend diminishes and their needs increase. The RAC Foundation's report 'Maintaining Safe Mobility for the Ageing Population' (Box et al, 2010) shows the need for ageing mobility, the relative safety record of older drivers, but their reducing journeys as they age. It highlights their desire to travel whilst recognising the physical, visual and cognitive impairments that occur with age. It also highlights the need for a design approach to counter all of these. It demonstrates the need for vehicles and vehicle technologies that are inclusive and sympathetic to older peoples' needs and calls for alternative typologies that go beyond the car.

The current mobility scooter currently tries to fill this gap, but there are many issues around it which can be solved by the design and manufacturing. University College of the Fraser Valley's 2008 research paper 'Mobility Scooter Research' (Steyn et al, 2008) demonstrates the importance of the scooter in maintaining and enhancing quality of life, but also raises issues of regulation, registration and education. The House of Commons Transport Committee considered mobility scooter safety in 2010 and recommended Government review of their use and safety stating that "Currently there is a boom in sales of such vehicles and a thriving market for second-hand mobility equipment which is not regulated and there is no requirement for training, registration or insurance/road worthy testing."

The Department for Transport says there are more than 300,000 mobility-scooter users in the UK, and sales are booming, the market value has reached £500million. The cost of these vehicles ranges from around £350 to £7000 in the UK market. Transport and Travel Research (TTR) have stated that the number of powered wheelchairs and mobility scooters in use in the UK is expected to increase even further in the near future as a result of the ageing population and the growing number of large shopping malls with accessibility (Barham et al, 2006). Until recently, the retailers involved in mobility equipment consisted mainly of specialist shops. However, some generalist retailers are now stocking these products. For instance, Halfords has teamed up with Sunrise Medical, selling three or four types of scooters. Argos and Asda are also moving into retailing mobility equipment to a limited degree, and the Southern Co-operative offers a few simple wheelchair products (currently using the products supplied by Mangar). Some Aldi stores reportedly stock a small range of simpler wheelchairs (George and Linda Lennard Associates, 2010).

Many of the current vehicles available are designed using 'off the shelf' components and are produced using low volume or batch production such as GRP laminate for bodywork and metal fabrication for chassis leading to service and reliability problems such as poor resistance to damage and unreliable electronics. Lead acid batteries are often used to reduce cost giving increased weight, and their limited range can present a safety hazard, as well as inconvenience. Manufacture in the Far East can lead to poor spare parts availability and service issues.

There has been a growth of personal transport vehicles that have relevance to the mobility scooter market. Major car companies are looking to gain a share of the personal transport market. General Motors recently unveiled a new personal urban mobility concept PUMA in collaboration with Segway. The original Segway Human Transporter (HT), a self-balancing scooter, is powered by electricity and can transport a passenger at speeds up to 12 mph. The PUMA can carry two people with a top speed of 35 mph.

Whilst these vehicles have mass market appeal, they have do not directly meet the needs of older people. The Segway requires the user to stand and the PUMA is costly.

10. Marketing and attitudes

10.1 Current situation

The exclusion of the older consumer from the market is partly due to a failure to design for changing abilities, but also due to a reluctance to market to older people due to negative stereotypes of ageing, among young and old.

The fashion industry is an interesting example of this. It is heavily geared towards younger consumers, with the majority of high street fashion and imagery aimed at teenagers and young women. Older consumers have largely been excluded from trends based on beliefs that they are not interested in fashion, and not a market worth investing in. Three reasons for Marks and Spencer to ignore older women given in Marketing Week were that younger women spent more on clothing, younger women had more 'lifetime value', and that thirty-year-old women would not wear the same as their sixty-year-old mothers therefore a business has to choose one or the other (Ritson 2011).

The very derogatory observation that younger women would not want to dress like a sixty-year-old illustrates the ageism in society. Whilst some women may choose to cover up more as they age, this does not equate with a loss of interest in looking stylish or fashionable. They have not had the choice, and been restricted (or restricted themselves) due to society's expectations. We have observed that the wish of each generation for their later life is to preserve their lifestyle. For those of M&S model Twiggy's age, this means having high street fashion available to them, a pattern that will continue in future generations.

Too much marketing persists in being youth-centric with agencies and consultancies typically valuing youth over experience. "Market analysis continues to slice and dice statistics for those under 24, but categorises everyone over 55 in one box" (Lavery 2012). Manufacturers need to make sure their agencies have relevant 'grey hair' experience in them to address this market. Campaigns need to be co-created with end user groups, not written by younger people for older people.

10.2 Biological ageing and social ageing

It is worth distinguishing between biological and social ageing. Biological ageing refers to a person's physical, sensory or mental abilities experienced through the effects of ageing. In the future, this deterioration in different abilities could be held off for longer however the significant numbers of people predicted to be in the upper age brackets will still mean see an increase in products and services that meet ageing-ability needs.

The future implications of social ageing are more difficult to predict. Social ageing refers to how society expects different ages to behave, which in turn restricts people's behaviour in order to conform. Their buying habits are affected, as 'people my age don't do that sort of thing' (ILC-UK 2010).

10.3 Inclusive marketing

The answer is not to market to the older social-age stereotype but to include older people as part of a larger age continuum. Brands as a whole do not want their products to be seen as 'for old people' for fear of losing other age groups, however they will also lose the older market. As Fiat said "A young man will never buy an old man's car and neither will an old man buy an old man's car" (Norwegian Design Council 2011). The best marketing campaigns are marketed at all ages. We need to dismiss age-related stereotyping and adopt an attitude of 'inclusive marketing' (Lavery 2012).

10.4 Inclusive design

Inclusive design has been recognised by the UK government as a potentially important driver of change; it is described as 'a process whereby designers ensure that their products and services address the needs of the widest possible audience' (DTI 2000).

Currently, people 60+ do not demand, or even expect, inclusive design. Generational and cultural reluctance to complain is also a factor (ILC-UK 2010). It is hoped that the next generation of older people will have higher standards for design, having had more experience of and therefore high expectations of an inclusive society. This potential impact on the design for manufactured goods and services that meet age-related abilities could be significant.

As more people live longer whilst managing ailments and health conditions, this could be enough to increase the market demand for manufactured goods and services that are designed inclusively of age and ability, therefore improving standards of design (Lavery 2012). A 2010 House of Commons briefing paper concluded that, in general, healthy life expectancy was not increasing as fast as life expectancy, increasing demands on the NHS (Cracknell 2010). A 2006 report from the Parliamentary Office of Science and Technology remarked that trends could be interpreted as reflecting an increase in years experiencing mild discomfort, but a decrease in severe disability (POST 2006). Whilst this is encouraging, increasing numbers of people living for longer whilst managing mild disability strengthens the case for more inclusive design.

It is up to consumers as well as manufacturers, the government and the third sector, to promote a more inclusive attitude. Michael Wolff, the UK government's inclusive design advisor, says that inclusive design produces more useful innovation and more successful product and service design". All design should be inclusive" (Wolff 2012).

Age-related deterioration of an ability is unpredictable: and may come at any age, suddenly, or gradually. For many, eyesight begins to deteriorate in childhood. A manufacturer or service provider that ignores these gradual deteriorations in ability is punishing their existing customers by not designing for their future selves. One example given was of a hotel refurbishment that reopened with atmospheric, low level lighting, making it difficult for existing customers with diminishing eyesight to see. Other losses in ability may be present from birth, the result of an accident or medical condition, or temporary, and sometimes voluntary, such as when people use headphones. Consequently, design should not just be 'for old people'. Future products should be ability-friendly, whatever the age.

10.5 Ability friendly design

A product that is designed inclusively, that can still be used by those of use with one or more limited abilities, can be used by the greatest number of people. In 2009 Age UK awarded its first age-friendly design accreditation, 'Age OK' to the Sky remote control, a device designed for those with poor eyesight and poor dexterity (Sky 2009). However, many people of all ages find it easier to use. Legislation to ensure level access to public buildings, intended for people who use wheelchairs, has had unintended benefits by improving access for people with pushchairs and those making deliveries (including grandparents and older delivery workers).

The next step is to make not just the product inclusive, but the whole experience. One expert suggested that the ability-friendly thinking that led to the Sky remote control exists in a silo within the company (Stroud 2012). Unless everything from marketing to after-sales support has the same approach, it will undermine the progress made in inclusive product design as the customer will still be excluded.

Age inclusivity: Apple

With a company like Apple, the ability-friendly attitude appears in more than just the product. The 'out of box' experience is celebrated, with its high quality packaging, ease of opening, and intuitiveness of the products from the first use. Apple has shown how an experience designed to be inclusive can also be stylish and desirable.

10.6 Design for specific conditions – physical, sensory and cognitive

Age-related changes in ability include the physical (reduced mobility, dexterity, flexibility, strength, ability to keep warm and retaining nutrients), sensory (loss of hearing, taste, eyesight) and cognitive (memory loss, and side effects of dementia). This reduction in ability can have an effect on the way people interact with the products, services and environments around them.

The Inclusive Design Toolkit

The Inclusive Design Toolkit by Cambridge University has detailed information on the effects of different conditions and how to design for them (<http://www.inclusivedesigntoolkit.com>)

It proposes a model of 'perceiving, thinking and acting' for how a person interacts with a product or service. Perceiving generally requires sensory skills, thinking requires cognitive skills, and acting requires motor skills. A fourth factor that can influence an interaction is the environment.

The toolkit proposes 7 capabilities: sensory (vision, hearing), cognitive (thinking, communication), and motor (locomotion, reach & stretch and dexterity). A product or service can be assessed by comparing the level of a user's capabilities against the capabilities needed to use the product or service. It advises that "successful application of the design guidance requires understanding the needs and characteristics of the target users, developed through a discovery phase at the start of the design process, [involving] consultation with experts in the relevant capabilities and with users who have capability losses."

These design considerations not only make a product accessible by a great number of people, it can also be life-saving. Kim Walker at a TEDx talk reported how 20 older people drowned in New York when a boat capsized because it had not been designed to consider the passengers' slower mobility and flexibility, and greater obesity (Walker 2012).

Design considerations for different abilities need to be applied not only to manufactured products, but throughout the consumer experience, for example, a retail environment needs to be accessible by public transport, involve short distances, provide toilet facilities and provide information face-to-face, by phone and internet. Manufacturers require practical input on individual capabilities in order to make informed decisions - the "Better Design Survey" data aimed to produce the most useful measurement for understanding capabilities across a range of products (Clarkson et al 2010).

10.7 Likely new products and services

New products and services that will emerge as a direct result of an ageing population would be those that respond to change in abilities associated with age and the lifestyle implications. Some of the implications of ageing are that older people may stop driving, rely more on public transport, depend more on friends, family and the health services, live alone, have less social contact, have more responsibilities in terms of their own health management, care for their partner, and have decreasing wealth.

New age-related products and services will delay, reduce or compensate for the change in an ability, or reduce, assist with or work-around an implication. There will be opportunities for expansion in health and care products. The next generation of older people will have more income to spend on health, wellness and care, whilst the state will be stretched. This is an opportunity to develop this market. The market for 'fashionable' mobility aids will increase. 'Flo' is an award-winning walking aid designed by Isla Parry.

It is made from composite material and its curved form means that it can be wrapped around the lower leg to hold it in place and act as a lever helping the user to stand up (Rethinkthings.co.uk n.d.).

The way in which people buy products will change. Food and nutrition is very important to maintaining a healthy lifestyle but traditional food shopping is not meeting all needs. One third of people 65+ live alone, yet it can be difficult to buy small quantities of fresh products without losing financially, especially with so many bulk-buying discounts (Age UK 2010). Forming purchasing co-ops for food or utilities could be one way that older people could meet their needs, particularly when less financially secure.

Many older people report difficulty food shopping (19% of those 80-84, 60% over 90) (Age UK, 2010). Supermarkets have been able to expand home deliveries due to the internet. This is because the time-consuming part of the process is selecting the shopping to begin with, which can be done by the customer though the web. For today's older people who are far less confident internet users, this is not a solution, but a phone-based service would be too expensive for the supermarket.

Wiltshire Farm Foods

One specialist service by Wiltshire Farm Foods home delivers frozen ready-meals. This offers more flexibility than meals-on-wheels due to the choice of meals and being able to stock-up on products, but is less personalised than supermarket deliveries. The delivery staff are CRB-checked, and the same driver will deliver day-after-day, who can also put the food in the freezer and keep an eye on anyone with particular nutritional needs, such as if they're recovering from a stay in hospital (<http://www.wiltshirefarmfoods.com/caring>).

These delivery men and women that provide the human link between online purchasing and our homes could be key members of the future community. Other local services will also develop in a networked world. The term 'collaborative consumption' refers to peer-to-peer exchanges, via sale, exchange or rent, of services, skills, space or objects. "Technology is reinventing old forms of trust" (Botsman, Rogers, 2010).

Collaborative consumption taking place at a local level uses the internet to reignite face-to-face contact. The fact that these interactions involve the physical exchange of stuff for mutual benefit removes the model from one of charity of volunteering, to one between equals. Examples such as Southwark Circle (<http://southwarkcircle.org.uk/>) and The Amazings (<http://sidekickventures.net/businesses/the-amazings>) show how older people can participate as the providers as well as recipients, by selling their time and skills, sharing their belongings or renting out their space.

10.8 Design of homes to accommodate homeworking

According to Age UK, one third of working adults aged 55+ use some flexible working, and as noted above, employers, including manufacturers, will need to make greater use of flexible working in order to meet future skills shortages. Older men in particular were using home working more than other types of flexible working (Age UK 2011).

One of the negative effects of homeworking is the social isolation of the individual from people outside of the home. Future homeworking could harness our networked world and help people to enjoy social connections, with their own colleagues or with other homeworkers online or locally. This need not be limited to roles that require internet use to fulfil a work task. However, this alone may not overcome isolation issues.

In terms of design, “equipment, tools, files and materials need to be accessible, visible and ordered, and furniture adaptable and comfortable”. Equipment and processes may need to be redesigned to be carried out autonomously and checked that they meet the safety and hygiene requirements to be carried out in a home environment where children and people from outside the company are also passing through. Recent advances in information technology, such as wireless networks and slimmer, flat-screen machines, make home working tidier, safer and less obtrusive. Work stations should adhere to ergonomic rules and equipment and designed to reflect the capabilities of the older worker (HHCD n.d.).

10.9 Use of ICTs – barriers, bridges and opportunities – remote healthcare

The UK has the highest take-up of tele-care in Europe, due to central government provision of assistive living devices. The personal alarm system is cheaper in the UK as the system is largely supported by families who are contacted when the alarm sounds rather than the more expensive option of a call centre (European Commission 2010). Whilst these channels from healthcare or social care provider to individual exist, the NHS is not quick to respond to new demands and technologies. In Europe more generally, nationalised healthcare makes tele-health difficult to propagate at present because of the lack of a strong business case. NHS Direct is one way in which the NHS reaches people in their own homes, and improvements in internet quality and mobile telecommunication technology mean that it will be more feasible to explore video consultation (European Commission 2010).

However, the tele-care and tele-health market is not, at least yet, driven by the consumer. These products are not aspirational. “People who have been independent suddenly depending on some kit - it only gets to that stage if they’re fearful for their safety or if their kids make them get it because they’re worried” (Gettinby 2012).

The Young Foundation reports significant barriers to tele-health for older people, including lack of internet access, low awareness of what technology can do, poor target marketing at the ‘frail elderly’ that older people do not identify with, cost, security, increased isolation. The positive conclusion however was that when tele-health technology worked, it could be transformative (Young Foundation 2012).

For tele-care, there is potential for new technology to appeal positively to consumers rather than be something that they are forced into. Products such as grab rails still look like something that belongs in at a hospital, not in a person's home. However the designer glasses market shows how an assistive product can become aspirational, to the extent that people own several pairs depending on their mood, change the frames regularly to match fashion, and in some instances, wear glasses with no prescription.

Assistive products and devices can keep us socially connected and help us to maintain our independence. The future for the industry lies less in assistive devices designed specifically for dependent older people, and more towards integration with current technology that is accessible to all. The Nintendo Wii is an example of a mainstream product that can monitor weight and fitness whilst providing both activity and online social interaction.

Some systems may fulfil tasks aimed at more vulnerable people, such as help remembering and administering medication, or detecting a fall and contacting a carer, whereas others, such as controlling utilities if the gas is left on or a tap overflows, would benefit everyone. Whether this develops in a controlled way through retrofitting homes to become 'smart houses', or organically, through the gradual networking of everyday objects into 'the internet of things' (Nesta 2012), "older people should be enabled to have a central role in the design, branding and marketing of technological advances that can impact positively on their lives" (Young Foundation 2012).

It has been reported there were nearly 150,000 new telecare users in England in 2006/7, and a further 161,000 in 2007/8. If all of these involved enhancements to the basic social alarms through addition of sensors and so on, then this would amount to about 3% of the population aged 65 years or older having 'telecare', representing a significant opportunity for manufacturers (European Commission 2010).

11. Conclusions: the opportunities and challenges of an ageing society

The global population is ageing rapidly: while average life expectancy is rising by one year every five years in the UK (and even faster globally), fertility rates have been below "replacement rate" since the 1960s. Over the next forty years the number of people over traditional retirement age will grow rapidly, while those of traditional working age will shrink.

Extended lifespan is not, for most people, a matter of an extended "old age" in the traditional sense. Much of this time will be spent in relatively good health and most "older people" will have similar expectations of life, work and opportunities to younger people. Many will have greater disposable time and money than earlier in life, and people seek to maintain independence and control over their lives, even in the final stages of life when the scope may be very constrained.

Longer lives are therefore a cause to celebrate: an opportunity for individuals and for those who provide them with goods and services. However, the shift in the balance of the population between people of traditional "working age" and those in retirement creates a range of economic, cultural and political challenges, especially the need to improve the economic "dependency ratio", by extending working life for many, or all, people.

For the manufacturing sector there are two major challenges. If manufacturers fail to develop more effective strategies for using older workers, they will find themselves facing increasingly severe labour shortages. If they fail to understand the needs and aspirations of a growing older population (including both the active retired and the dependent elderly), they will lose an increasing proportion of their markets to competitors. Both are avoidable, and some of the UK's distinctive strengths in this emerging world are outlined below. There are also some signs that manufacturers are responding, but probably not yet with sufficient priority or urgency.

11.1 A likely future

Predictions are necessarily risky, and must necessarily be based on extrapolation of current trends, modified by known or likely changes. On this basis we would suggest that policy can reasonably assume that:

- both life expectancy, and healthy life expectancy will continue to rise for the foreseeable future, bringing a growing population of active people, potentially available for work;
- inequality will not reduce, either in the workplace or outside it. The labour market will be increasingly polarised between the high and low skilled, and between the secure employed and those who spend much time in transitory work and unemployment (health and life expectancy are already closely related to occupation and social class);
- this will be mirrored in the wider society where the gap between rich and poor is likely to continue to expand. It is therefore not clear how far the improvements identified above will be equally accessible to all older people;

- real retirement ages will continue to rise, partly through Government intervention, but also because older people seek interest, purpose and meaning in life, and social engagement with others, all of which work can provide, and because growing numbers will face financial pressure with the decline in value and availability of occupational pensions.
- this population will demand products which support their more flexible and prosperous lifestyles, while allowing for the gradual decline in physical, and perhaps, mental capabilities (which they share with some young people).
- there will also be a growing demand for products aimed specifically at those with seriously limited capabilities, especially those which enable people to remain independent and active in their final years.
- manufacturing employers will face growing shortages of labour and skills as the size of the population of traditional working age declines, and larger cohorts retire. At the same time they will face increasing competition from other sectors, as they too face shrinking labour supply.
- making better use of older people is the most likely strategy to meet these growing needs, because immigration will make only a modest contribution to filling the gaps, and better deployment of women and disabled people cannot make as large an impact as retaining older people.
- to address this challenge, employers will need to make work more attractive, particularly more flexible to allow gradual phasing into retirement.
- a number of other developments are likely. Medical and electronic technologies will enable people to overcome many of the potential physical constraints of later ageing. Scientific research and development will produce treatments for some of the diseases of old age.

Other changes are less certain. It is not clear how far the current recession, and its causes, will lead to a reshaping of global economic models and systems, how Governments will respond to the financial implications of an ageing society, including issues of intergenerational equity, which will affect policies for the redistribution of income and wealth between generations, through pensions and taxation – and whether intergenerational tensions will affect this. Environmental pressures may also affect what is consumed, and where it is made, perhaps leading to some manufacturing which has moved offshore in recent years relocating back to the UK.

11.2 The importance of an inclusive response

Although there are services and products which need to be designed for people with very specific needs associated with health and care, the majority of the new older population will remain healthy and active for many additional years. An inclusive approach to product development and marketing is therefore important.

Although most people remain relatively healthy and active well beyond current state pension age, there are seven abilities which decline with age:

- Visio
- Hearing
- Thinking
- Communication
- Locomotion

- Reach and stretch
- Dexterity

Although everyone experiences a decline in most of these at some point, the age at which individuals do so varies greatly. Some limitations have a major impact on living and working, while others are trivial, and many people develop strategies for overcoming these difficulties, assisted increasingly by a range of technologies, in work and outside it. Improvements in health and working practices mean that there are now few jobs which are beyond the capacity of the average 70 year old.

Since the timing of decline is unpredictable, but the proportion of the population with some declining abilities will grow, it is important to take an inclusive approach to the development of all products and services, and to employment practices. Such an approach builds the possibility of limitations into all design, not just to products for "the elderly" or "the disabled". A label which is easy to read for people with limited eyesight is easy for everyone to read, and in general, working conditions, and products, which are well designed for people with declining capabilities will be good for everyone.

11.3 Ageing and employment

For the next twenty years the overall number of workers required in manufacturing is expected to decline. However, unless current patterns of retirement change dramatically, almost all sub-sectors will face significant labour demand, to replace the large groups retiring. This will hit some sub-sectors much harder, or at different times, than others.

- Maintaining a viable manufacturing workforce will therefore depend on raising real retirement ages, and there is good evidence that many people would like to work longer. However, most older people have some choice about whether or not to do so, and will only choose to work if it is attractive, which means accommodating a variety of aspirations.
- Making work flexible – making it easier for people to combine work with other commitments (especially caring for older dependents) - offering part-time, seasonal, and consultancy options;
- Making work satisfying – interesting, giving a sense of purpose, status and respect, and recognising that some people will welcome new challenges;
- Encouraging social engagement and working across generations – one of the most common reasons for staying in work is the social networks around work, which provide companionship, and status within the community. One way of encouraging this is by developing models of intergenerational mentoring;
- Making work healthy - avoiding excessive physical and mental demands, and enabling workers to move, if they wish, to less demanding work as they age;
- Paying adequately – though this is not a high priority for all (since many will be drawing an occupational and/ or state pension while continuing to work);
- Designing working practices and environments inclusively - avoiding arrangements which are especially difficult for those with limited capabilities, whatever their age;
- Managing well - making good use of skills and experience, through good training, career and performance management;
- Recruiting creatively- recognising the skills and experience of workers displaced through redundancy, and being willing to invest in training older recruits;

- Enabling phased retirement, to allow employees to adjust gradually, and employers to retain scarce skills and experience and knowledge.

In recent years, opportunities to stay longer in work have improved for those in secure employment, but age discrimination in recruitment remains a very serious issue. As the size of the potential labour pool shrinks, employers will need to address this, by ensuring that their recruitment practices are non-discriminatory, but also considering a wider range of applicants, and being prepared to invest in retraining for new recruits, building on their previous skills and experience from other fields.

Some sub-sectors of manufacturing will be more vulnerable than others, and this will be a particular issue in sectors where workers require high qualifications, and much experience, like nuclear manufacturing. Employers who continue to invest in the skills of their employees in mid and late career, can capitalise on their experience and tacit knowledge, reducing the lead time to respond to changing demands. Some sub-sectors will face severe shortages, despite expected overall workforce shrinkage, because of high levels of retirement. These include manufacture of machinery, fabricated metal products, basic metals, electrical equipment, and "other transport", which currently account for a third of manufacturing jobs. In other sub sectors, like furniture, there may continue to be demand for high skilled and experienced craftspeople for niche markets.

11.4 Ageing and product demand

The ageing population, in the UK and globally, represents a real opportunity for manufacturers, through a rapidly growing market for goods and services, now that older people have more money to spend than they had in the past, and the market for specialised products for those with health and disability problems is growing. However, marketing strategies generally continue to focus heavily on the young, and there remains a paradox: although an ageing population will require changes to product design and delivery, most older people resist being labelled as "old". Maintaining independence and autonomy is vitally important to most people, and this is no less true for older people. It is also important to remember that declining capability is unpredictable, and varies greatly between individuals, inclusive design is more important than design for "the old".

The biggest growth market, for at least the next decade, will be older people who are still active and healthy, and with more discretionary time and income, but with some growing limitations and perhaps higher expectations than previous generations. Successful manufacturers will need to take an inclusive approach to product development, considering how usable all their products are to people with a variety of developing limitations. Inclusivity will need to be as fundamental to product design and development as health and safety is today. Although this group may, in the longer term, be outnumbered by those with more severe limitations, their spending power is likely to remain strong.

Nevertheless, there will also be a rapid growth in the numbers of people experiencing severe limitations. This can happen to people at any age, but is increasingly common as people move into their 70s and beyond. Here, the focus will need to be on products which minimise the impact of those limitations, recognising that, whatever their level of disability, people wish to remain as independent as possible, continuing to seek a sense of control and purpose in their lives, and to interact with other people. A variety of technologies have potential to address these issues, including pharmaceuticals, and

medical technology on one hand, and developments of ICTs such as telecare and improvements in communications and social networking.

11.5 Manufacturing in an ageing world: the UK's strengths and opportunities

Overall, UK manufacturing can expect to benefit from an ageing society, both in terms of employment and consumer demand.

Skills and labour shortages could be a less serious challenge in the UK for a variety of reasons:

- real retirement ages are already higher than in most developed countries outside Scandinavia;
- older workers in the UK are generally more satisfied with their working conditions than their peers in most EU countries, and there is good evidence that many older people could be persuaded to stay longer in work.
- UK pension arrangements and labour market flexibility make it easier to organise delayed and phased retirement, and flexible working opportunities for older people. As the OECD has pointed out, the UK has removed almost all the financial and structural incentives which make it difficult to stay later in work in many of our competitor countries (especially the EU).
- The UK also has particular strengths in fields where domestic and global consumer demand can be expected to grow as the market ages. Four sub sectors appear particularly promising, in terms of likely long term demand, and of UK expertise:
- medical technology, to enable people to maintain their independence, and to manage increasingly complex health conditions and disabilities;
- pharmaceuticals and biosciences, to minimise or prevent the medical conditions of old age;
- food and drink, to respond to growing numbers of single person households, with concerns about nutrition, product shelf life, labelling and delivery;
- automotive, to respond to drivers with limited capacities, and the mobility needs of those no longer able to drive.

11.6 Manufacturing in an ageing world: challenges for the UK

However, UK manufacturing also faces particular challenges, which need to be addressed. These include:

- competition for labour in a shrinking workforce, from sectors and firms which can make work more attractive;
- lower levels of flexible working in manufacturing than in other sectors, make working longer in other sectors more attractive to many older people;
- lower levels of training, especially in SMEs, which lead to inefficient deployment of experience, skills and capability, and high risks for those who later become unemployed, or seek to change jobs;
- underemployment and failure to capitalise on the experience and tacit skills of older workers, by better performance management and career development of older people;

- the combination of high levels of organisational change and job churn, with widespread age discrimination in recruitment, means that many experienced workers with valuable skills and tacit knowledge are forced out of work, or severely underemployed;
- recruitment processes which depend on automated scrutiny of CVs mean that older people with substantial experience and skills acquired on the job are overlooked in recruitment;
- policy uncertainty deterring long term investment in the workforce, especially in some sub-sectors (like transport infrastructure, and nuclear). This is a critical weakness in high skilled and specialised sub-sectors and occupations where there are long lead times for training and acquiring experience. Where the long term future is uncertain, better deployment of experienced older workers may be a more realistic strategy (at least in the short term) than seeking to recruit young entrants;
- leadership and management are known to be weaknesses of the UK economy generally. This is evident in the severe underuse of the skills and aspirations of many older workers, through poor or absent performance review, and failure to identify and support potential in older job applicants;
- a marketing industry heavily focused on youth, who constitute a declining proportion of the market for most manufactures, and whose share of disposable income is falling relative to older people;
- a perception that marketing to older consumers needs to focus on their age, when most wish to be seen as full members of society, not a dependent group.
- difficulty in securing digital access and usage, among a proportion of older people, given the increasing importance of online services in many aspects of life, including purchasing and service delivery.

References

- ACAS (2011) *Age and the Workplace*. ACAS: London.
- Age Concern (2008) *Lifestage: The Older Consumer*. Age Concern: London.
- Age UK (2011) *Modern Workplaces, Flexible Working*. Age UK: London. Available at: [http://www.ageuk.org.uk/Documents/EN-GB/Ref4711_Modern_Workplaces_Flexible_Working_\(August_2011\).pdf?dtrk=true](http://www.ageuk.org.uk/Documents/EN-GB/Ref4711_Modern_Workplaces_Flexible_Working_(August_2011).pdf?dtrk=true) [Accessed 19-Aug-2012]
- Arthritis Care (2012) *Tsunami of pain predicted as cases of osteoarthritis set to soar by 2030* Available at <http://www.arthritiscare.org.uk/NewsRoom/Statementsandpressreleases/oanation2012> [Accessed on 26-Oct-2012]
- Barham, P., Oxley P., & Board, A. (2006) *Review of Class 2 and Class 3 Powered Wheelchairs and Powered Scooters (Invalid Carriages)*, Reference PPAD 9/72/89, Final Report on Stage 1 by Transport & Travel Research Ltd for Department for Transport, p26-27
- BIS (2009) *Is Business Ready for an Ageing Population?* BIS: London.
- BIS (2010a) *Manufacturing in the UK: An Economic Analysis of the Sector*. BIS: London.
- BIS (2010b), *Internationalisation of Innovative and High Growth SMEs*, BIS: London.
- Black, C. (2008) *Working for a Healthier Tomorrow*. The Stationery Office: London.
- Botsman, R, and Rogers, R. (2010) *What's Mine is Yours: How collaborative consumption is changing the way we live*. Collins: London.
- Box, Gandolfi and Mitchell (2010) *Maintaining Safe Mobility for the Ageing Population*, RAC Foundation: London.
- Cabinet Office, Performance and Innovation Unit (2000) *Winning the Generation Game*. HMSO:London.
- CIPD (2012) *Labour Outlook*. CIPD: London.
- Clarkson, P.J. et al. (2010) *Towards Better Design*, Colchester, UK Data Archive: Essex. SN: 6997, <http://dx.doi.org/10.5255/UKDA-SN-6997-1>
- Coleman, R. (2003) *Living Longer*, Chapter in *Inclusive Design: Design for the Whole Population*. Springer-Verlag: London.
- Cory, G. (2012) *Unfinished Business: Barriers and opportunities for older workers*. Resolution Foundation: London.
- Cracknell, R. (2010) *The Ageing Population*. Available at http://www.parliament.uk/documents/commons/lib/research/key_issues/Key%20Issues%20The%20ageing%20population2007.pdf [Accessed 26-Oct-2012]
- DH (2007) *Raising the Profile of Long-term Conditions Care*. DH: London.
- DTI (2000) *Foresight: Making the Future Work for You*. DTI: London.
- DWP (2001) *Ageism: the Attitudes and Experiences of Younger People*. DTI: London
- Ebbinghaus, B. (2001) *When labour and capital collude: the political economy of early retirement in Europe, Japan and the USA* in *Comparing Welfare Capitalism: Social policy and political economy in Europe, Japan and the USA*. Routledge: New York, 76-104.

- Economist (2012a) The third industrial revolution. Available at <http://www.economist.com/node/21553017> [Accessed 19-Aug-2012]
- Economist (2012b) All together now: the advantages of crowd-sourcing. Available at <http://www.economist.com/node/21552902> [Accessed 19-Aug-2012]
- EEF (2011a) *Flexibility in the Modern Manufacturing Workplace*. EEF: London.
- EEF (2011b) *Written Submission to the Commons Select Committee on Business, Innovation and Skills: Apprenticeships*. HMSO: London. Available: <http://www.publications.parliament.uk/pa/cm201012/cmselect/cmbis/writev/1843/app116.htm>.
- EEF (2008) *An Ageing Workforce – How are Manufacturers Preparing*. EEF: London.
- ENI and Capita (2011) *The Case for Recruiting and Retaining Older Workers: A Business Imperative for the Manufacturing Sector*. DWP: London.
- European Commission (2010) ICT and Ageing: European Study on Users, Markets and Technologies. Available at: http://www.ict-ageing.eu/ict-ageing-website/wp-content/uploads/2010/D18_final_report.pdf [Accessed 19-Aug-2012]
- Eurostat (2011) *Active Ageing and Solidarity Between the Generations.: a statistical portrait of the European Union 2012*. EU: Luxembourg.
- Foster, S. and Casebourne, J. (2011) *Integrated Employment and Skills*, Centre for Economic and Social: London.
- Frerichs, F. and Sporket, M. (2007) *Employment and Labour Market Policies for an Ageing Workforce and Initiatives at the Workplace - National Overview Report: Germany*. European Foundation for the Improvement of Living and Working Conditions: Dublin.
- Gettinby, M. (2012) Interview with Mark Gettinby, General manager for group product development at AgeUK, 16-Aug-2012.
- Gilhooly, M. Hamilton, K. O'Neill, M. Gow, J. Webster, N. and Pike, F. (2003) *Transport and Ageing: Extending Quality of Life for Older people via Public and Private Transport*. ESRC Growing Older Programme.
- GMB (2012) *Annual Population Survey*. GMB: London.
- Griffiths, A., Knight, A. and Nor Mohd Mahudin, D. (2009) *Ageing, Work-related Stress and Health*. TAEN: London.
- Harper, S (2007) *The Future of Retirement: the new old age*. HSBC London.
- Health and Safety Executive (HSE) (2007) *Managing the Causes of Work Related Stress*. OPSI: Surrey.
- Helen Hamlyn Centre for Design (HHCD) (no date) Working at Home - Insights. Available at: <http://designingwithpeople.rca.ac.uk/activities/working-at-home> [Accessed 19-Aug-2012]
- Hirsch, D. (2003) *Crossroads after 50: Improving Choices in Work and Retirement*. Joseph Rowntree Foundation: London.
- House of Commons Transport Committee (2010) *Mobility scooters, Ninth Report of Session 2009–10*, HC414 Report together with formal minutes, oral and written evidence [printed 24 March 2010]
- HWB International (2005) The Demographic Structure of UK Car Markets. Available at http://www.hwbinternational.co.uk/pdfs/HWB_Brief_3_06_6.pdf [Accessed 19-Aug-2012]

ILC-UK for AgeUK (2010) *The Golden Economy: The Consumer Marketplace in an Ageing Society*. Available at www.ageuk.org.uk/Documents/EN-GB/For-professionals/Consumer-issues/The%20Golden%20Consumer%20October%202010_pro.pdf?dtrk=true [Accessed 19-Aug-2012]

ILC-UK (2007) *Asset Accumulation across the Life Course*. ILC-UK: London.

Ilmarinen, J. (2007) *The Work Ability Index (WAI)*, Occupational Medicine-Oxford,57(2) 160.

Inclusive Design Toolkit (no date)<http://www.inclusivedesigntoolkit.com>

Institute of Manufacturing (2010) Value of Food and Drink Manufacturing in the UK. Cited in BIS, 2010a.

Johnson, M. Mena, C. (2008) *Supply chain management for servitized products: a multi-industry case study*, International Journal of Production Economics, 114(1), 27-39.

Kunur, M. & Gheerawo, R. (2007) *Connections: Mobility, Ageing and Independence*. Helen Hamlyn Centre, RCA: London.

Lavery, K. (2012) Interview with Kevin Lavery, Mature marketing specialist, 16-Aug-2012.

Leach, R et al (no date) *Boomers and Beyond: Intergenerational Consumption and the Mature Imagination* cited in ILC-UK, 2010. *The Golden Economy* ILC-UK: London.

George and Linda Lennard Associates (2010) *Equipment For Older And Disabled People: An Analysis Of The Market*, Consumer Focus, London.

Loch, C., Sting, F., Bauer, N. and Mauermann, H. (2010) *How BMW is defusing the demographic time bomb*, Harvard Business Review, March, 1-6.

Maltby, T. (2012), *'Work Ability': a practical model for improving the quality of work, health and wellbeing across the lifecourse?* In *Work, Health and Wellbeing*, S. Vickerstaff, C. Phillipson, and R. Wilkie ed., Policy Press, 187-206.

Metcalf, H. and Meadows, P. (2007) Survey of Employer Policies and Practices Relating to Age. DWP: Sheffield

McNair, S. (2012) *Older People's Learning in 2012: a survey*, NIACE: Leicester.

McNair, S (2010) *A sense of a future: learning and work in later life* (research report for the Nuffield Foundation), NIACE: Leicester

McNair, S. and Flynn, M. (2006) *Managing an Ageing Workforce in Manufacturing*. DWP: Sheffield.

McNair, S. and Flynn, M. (2005) *The Age Dimension of Employer Practices: Employer Case Studies*. Department of Trade and Industry: London.

McNair, S., Flynn, M. & Dutton, Y. (2007) *Employer Responses to an Ageing Workforce: a qualitative study*, DWP: London.

McNair, S., Flynn, M., Owen, L., Humphreys, C. and Woodfield, S. (2004) *Changing Work in Later Life: a Study of Job Transitions*. CROW: Guildford.

Metz, D. and Underwood, M. (2005) *Older Richer Fitter: Identifying the customer needs of Britain's ageing population*. Age Concern: London, p21.

- Moilanen J, Vadén T, (2012) *Manufacturing in Motion: First Survey on 3D Printing Community*. In Statistical Studies of Peer Production website. Available at <http://surveys.peerproduction.net/2012/05/manufacturing-in-motion/> [Accessed 19-Aug-2012]
- Moore, R. (2010) *Nanoscience and Future Trends in Medical Technologies*. European Medical Device Technology. Available at <http://www.emdt.co.uk/article/nanoscience-and-future-trends-medical-technologies>. [Accessed 25-Oct-2012]
- Muller-Camen, M., Croucher, R., Flynn, M. and Schroeder, H. (2011) *National institutions and employers' age management practices in Britain and Germany: Path dependence and option creation*, Human Relations, 64(3), 483-505
- Naegele, G. and Walker, A. (2006) *A Guide to Good Practice in Age Management*, European Foundation for the Improvement of Working and Living Conditions: Dublin.
- NALS (2012) *National Adult Learner Survey 2012 : Research Paper 6*, BIS: London.
- Nesta (2012) *Demanding Devices*. Available at: http://www.nesta.org.uk/publications/assets/features/hot_topics_demanding_devices[Accessed 19-Aug-2012]
- Nesta (2011) *All Together Now: Improving cross-sector collaboration in the UK biomedical industry* Available at http://www.nesta.org.uk/library/documents/Report_67_Biomed_web.pdf [Accessed 19-Aug-2012]
- Norwegian Design Council (2010) *Innovating with People: The Business of Inclusive Design*. Norwegian Design Council: Oslo.
- O'Keefe, V. (2012) *To Attract Top International Talent, We Must Take Students Out of Net Migration Figures Completely*. EEF: London.
- OECD (2003) *Ageing and employment policies: UK*, OECD: Paris
- OECD (2011) *Pensions at a Glance*. OECD: Paris.
- Ofcom (2012) *Communications Market Report UK*. Available at: http://stakeholders.ofcom.org.uk/binaries/research/cmr/cmr12/CMR_UK_2012.pdf [Accessed 19-Aug-2012]
- Office of Budget Responsibility (2012) *Fiscal Sustainability Report*. OBR: London.
- ONS (2012a) *Census First Release*. Office of National Statistics: London.
- ONS (2012b) *Health Expectancies at Birth and at Age 65 in the United Kingdom 2008-2010*. ONS: London.
- ONS (2012c) *Labour Market Statistics: Statistical Bulletin, October 2012*. ONS: London.
- ONS (2012d) *Pension Trends: the Labour Market and Retirement*. ONS: London.
- ONS (2012e) *Population Ageing in the United Kingdom and its Constituent Countries and the European Union*. ONS: London.
- ONS (2011), *Living Costs and Food Survey* cited in *Family Spending 2011*. Available at <http://www.ons.gov.uk/ons/rel/family-spending/family-spending/family-spending-2011-edition/index.html>. [Accessed 3-Sep-12]
- ONS (2008) *Family Spending: A Report on the 2007 Expenditure and Food Survey*. Cited in BIS, *Issues raised during this project*, Available at <http://webarchive.nationalarchives.gov.uk/+http://www.bis.gov.uk/policies/ageing/issues-raised>, [Accessed 19-Aug-2012]

- Owen-Hussey, L., McNair, S. and Flynn, M. (2006) *Age Discrimination: a Lived Experience and the Employer Dimension*. European Social Fund and SEEDA: Guildford.
- Packaging News (2011) *Call for industry to develop 'frustration-free' packaging for older people*. <http://www.packagingnews.co.uk/news/call-for-industry-to-develop-frustration-free-packaging-for-older-people/>
- Parry E. (2008) *Managing an Ageing Workforce: The Role of Total Reward*. CIPD: London.
- Phillipson, C (1998) *Reconstructing Old Age: new agendas in social theory and practice*. Sage: London.
- POST. (2006) *Healthy Life Expectancy*. Available at <http://www.parliament.uk/business/publications/research/briefing-papers/POST-PN-257>
- Rethinkthings.co.uk (no date) Flo. Available at: http://www.rethinkthings.co.uk/epages/es138417.sf/en_GB/?ObjectPath=/Shops/es138417/Products/Flo/SubProducts/REFSIPNYP1202pi
- Riach, K. and Loretto, W. (2009) *Identity work and the 'unemployed' worker: age, disability and the lived experience of the older unemployed*, Work, Employment & Society, 23(1), 102-119.
- Ritson, M (2011) *M&S is right to put over-60s out to grass*, Marketing Week. Available at: <http://www.marketingweek.co.uk/ms-is-right-to-put-over-60s-out-to-grass/3028593.article>
- Sissons, A. & Thompson, S. (2012) *Three Dimensional Policy: Why Britain Needs a Policy Framework for 3D Printing*. Big Innovation Centre, London.
- Sissons, P. (2011) *The Hourglass and the Escalator: Labour Market Change and Mobility*, Work Foundation: London.
- Sky (2009) *Age OK Award*. Available at <http://accessibility.sky.com/news/age-ok-award>
- Steyn, P. and Chan, A. (2008) *Mobility Scooter Research Project: Final Report*, University of the Fraser Valley, Center for Education and Research on Aging, the Scooter Working Group of the City of Abbotsford: Abbotsford.
- Stroud, D. (2012) Interview with Dick Stroud, 50+ marketer, founder of 20-plus-30. 13-Aug-2012.
- The Poverty Site (2012) <http://www.poverty.org.uk/64/index.shtml>
- TSB (2012) *Medicines and Healthcare Strategy - 2009-2012*. Available at <http://www.innovateuk.org/assets/pdf/Corporate-Publications/MedicinesHealthcareStrategy.pdf>
- UKCES (2011a) *Working Futures: 2010-2020*, UKCES: London.
- UKCES (2011b) *Working Futures: Sectoral Report 2010-2020*, UKCES: London.
- UKCES (2012) *UK Commission's UK Employer Skills Survey 2011: UK Results*. Evidence Report 45. UKCES: London.
- United Nations (2009) *World Population Ageing 2009*, Available at: http://www.un.org/esa/population/publications/WPA2009/WPA2009_WorkingPaper.pdf
- US Census Bureau (2008) *The Next Four Decades: The older population in the United States: 2010 to 2050* Available at: <http://www.census.gov/prod/2010pubs/p25-1138.pdf>

V3.co.uk (2012) *Government announces £7m investment in 3D printing technology*

Available at: <http://www.v3.co.uk/v3-uk/news/2218977/government-announces-gbp7m-investment-in-3d-printing-technology>

Walker, A. (2006) The emergence of age management in Europe, *International Journal of Organisational Behaviour*, 10(1) 685-697

Walker, K. (2012) Why being age-friendly is everyone's business, speaking at TEDx Victoria Harbour 18-May-2012. Available at

<http://tedxtalks.ted.com/video/TEDxVictoriaHarbour-Kim-Walker>

Wilson, N. (2010) *40-70 Tomorrow's Workforce Programme: Making the most of opportunities for older workers in the South East*, South East of England Development Agency: Guildford.

Wilson, R. (2009) *The Demand for STEM Graduates: Some Benchmark Projections*, IER: Warwick.

Wolff, M. (2012) It's time to see our ageing population as an opportunity and not as a predicament Available at:

https://tomorrowtogether.innovateuk.org/discover/-/asset_publisher/d0O1/content/it-s-time-to-see-our-ageing-population-as-an-opportunity-and-not-as-a-predicame-2;jsessionid=AF98DD31F906DA9FBBAB11292E376868

Young Foundation (2012) One hundred not out. Available at:

<http://www.youngfoundation.org/publications/reports/one-hundred-not-out-resilience-and-active-ageing>

