Scoping study for a foresight on new and emerging occupational safety and health (OSH) risks and challenges

European Risk Observatory

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Authors:

Annette Cox and Luke Fletcher, Institute for Employment Studies, Martin Rhisiart, University of South Wales

Project management:

Emmanuelle Brun, Katalin Sas, European Agency for Safety and Health at Work (EU-OSHA)

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1 Approach and method

This report presents findings from the first two elements of a research project commissioned from IES by EU-OSHA to undertake an exercise which will make recommendations about which new emerging OSH trends and challenges are relevant to explore in the next proposed large-scale foresight study, accompanied by recommendations concerning the most suitable methodology. These will then be finalised by EU-OSHA in consultation with its stakeholders.

1.1 Background

To fulfil its mission, EU-OSHA requires intelligence concerning the emergence of new risks to occupational health and safety, and has been developing a work stream of research on these topics since the early 2000s. By virtue of its status, EU-OSHA is in a unique position to develop a pan-European 'helicopter' view of common trends and challenges, thus informing EC strategy and actions of individual Member States' governments, employers and social partners to help them anticipate and take action to mitigate risks. Such risks are defined as either previously unknown risks caused by social/technical change or scientific discovery, or an existing issue that is now considered as a risk due to changed public perceptions. They are rated as increasing if prevalence of hazards creating the risk is increasing, individual exposure to the hazards is increasing or the impact of the hazard on health is increasing (EU-OSHA, 2005).

Some of EU-OSHA's most recent work has included a foresight study to advance our understanding of emerging risks, focussed on green jobs, https://osha.europa.eu/en/topics/green-jobs. The purpose of this project is to provide recommendations for the topic(s) to be covered in a future study of this kind and to advise on the most appropriate futures methodologies to undertake that exercise. This needs to be placed in the context of rapid and unpredictable changes in the nature of work, linked to continued economic uncertainty as a result of the global financial crisis, and changes of a societal, political, economic and technological nature. Literature shows shifts in the types of risks to which workers are exposed due to a range of socio-economic and technical factors which affect working life (EU-OSHA, 2005b, 2013b). These include the development of new technologies which enable increases in the practice of mobile working, expansion of the service sector economy, changes in employment models including increased self-employment, population ageing and increased female participation in the labour force, work intensification and changes to organisational structures (EU-OSHA, 2005b. Since then, the uncertainty of the European work context has intensified, which any foresight exercise will need to reflect in the topic(s) focus. Indeed, recent research identifying priorities for occupational health and safety research over the next seven years places considerable emphasis on the need to understand impacts and risks arising from the changing nature of work, covering demographic change and globalisation, as well as changes in the nature of technological hazards (EU-OSHA, 2013b).

1.2 Objectives

The aims of this project are to:

- Recommend the most important topic(s) of study concerning new or emerging OSH risks for a future foresight exercise.
- Advise on the methodologies which would be most appropriate for the selected topics.

EU-OSHA has already undertaken a number of studies on emerging sources of OSH risk and this project therefore seeks to avoid replication of those studies, and is concentrating on identifying themes which have not been discussed in detail before.

Within the overall scope of the objectives, the following focus was taken:

- The primary area of interest is the application of foresight methodologies to the area of OSH, but we anticipate the need to include studies that relate to impact of change on working life more generally. More general foresighting studies related to societal change will be excluded.

- Material which has been produced after the beginning of the financial crisis will be prioritised for review, since it is likely to have an ongoing and future major impact on the type of health risks that workers face, perceptions and priorities accorded to addressing different types of risk and the systems and resources used to address them.
- Literature reviewed focussed on one or more countries within an European or OECD societal context.
- The literature review was not exhaustive, and a targeted literature search sought to identify literature of interest to the research.
- Experts selected for initial consultation were chosen for their insight into either changes in the nature of work and OSH risks, experience of foresighting methodologies or both.
- The future time frame for the emergence of future risks is limited to approximately 10-20 years because the longer the time frame, the greater the degree of uncertainty in developing scenarios about the future of work and OSH implications.

1.3 Method

The project has five phases:

- Literature review of foresighting research with a focus on OSH as well as literature that throws a light on any aspect of the future of work that may have consequences for OSH.
- Telephone interviews with up to 20 stakeholders.
- Electronic online survey of EU-OSHA Governing Board members, EU-OSHA Focal Points and any other experts including stakeholders agreed with EU-OSHA.
- Expert consultation on choice of foresighting methods.
- Analysis and final reporting.

This report provides findings from the first two of these activities: the literature review and the expert telephone interviews.

1.3.1 Literature review method

IES conducted an initial literature search based on the sites and search terms identified in the proposal and focused on academic databases. More details of this process are given in Appendix C.

Overall, the primary area of interest was the application of foresight methodologies to the area of OSH, but this is a very narrow area, so the literature review was extended to include studies into the impact of change on working life more generally. Particular attention was given to material produced after the beginning of financial crisis in 2007, since it is likely to have an ongoing and future major impact on the type of health risks that workers face, perceptions and priorities accorded to addressing different types of risk and the systems and resources used to address them. Literature was included in the review if it related to one or more countries within an European or OECD societal context.

Priority searches focussed on identifying grey literature including policy reports and unpublished sources from national and international researchers and bodies through web-based searches. There is a relatively well-developed body of material, much of it produced by EU-OSHA, including the findings from ESENER, the Eurofound EWCS, "Horizon 2020 – The Framework Programme for Research and Innovation"', and the US National Occupational Research Agenda (NORA). A range of material and sources was provided by EU-OSHA.

Some examples of websites interrogated included:

- Risk Radar from Suva in Switzerland http://www.suva.ch/startseite-suva/die-suva-suva/medien-suva/suva-dossier-suva/frueherkennungsradar-suva.htm
- United Kingdom Foresight Programme through HSE/HSL http://www.hse.gov.uk/horizons/
- INRS Future Scanning and Foresight in France http://en.inrs.fr/

- Futur Programme in Germany http://www.bmbf.de/en/18378.php
- EU Foresight Monitoring Platform http://www.foresight-platform.eu/
- International sources (e.g. OECD, ILO, Cedefop, Eurofound, European Commission)

The literature review found that 'grey' literature sources were far more relevant to the objectives of the research because the publications were more likely to combine the three areas of project interest – work, OSH and future trends and challenges.

The academic literature search generated a large number of items but screening them on abstracts and keywords showed some deficiencies in the literature. Many items did not draw out OSH implications, some focussed on current trends and assumed these would continue into the future without justification or evidence, a number had already been covered by EU-OSHA and some were too technically specific.

Following the construction of a short-list of evidence for review, we developed and use a proforma shown in Appendix D to ensure consistency of approach in reviewing the literature and extraction of evidence which was agreed with EU-OSHA based on its requirements and our prior experience. The proforma covered study characteristics, context, quality and findings and an assessment of the level of 'scientific rigour' of each article, based on transparency of description of research methods used, their rigour and use of evidence to support conclusions drawn.

1.3.2 Stakeholder consultation

This phase of the study involved telephone interviews with 19 stakeholders including a mixture of those who participated in workshops for the green jobs foresight study, members of the Prevention and Research Advisory Group at EU-OSHA, national policy makers in the OSH area, national OSH research organisations, and more general futures/foresight experts. Interviews were conducted in English, took place between December 2013 and February 2014, and lasted around 30-45 minutes. The list of experts interviewed is shown in Annex A. The interviews were conducted on the basis of offering individual anonymity so views expressed in this report are not attributed to named experts. Interviews were recorded and researchers made detailed notes from the recordings. The topic guide used is shown in Annex B and was accompanied by a detailed briefing document which interviewees were asked to read in advance to help aid their thinking about the question areas. The interview guide and background document piloted with 3 interviewees. As a result some minor changes were made to question wording. The number of topics to be discussed in the interview was found to exceed the length of time experts were usually able to offer for interview, so interviewers focussed on those topic areas about which each interviewee had most knowledge and which were most central to the study. A number of interviewees were unable to read the briefing document in advance due to their other work commitments so interviewers referred to them to the relevant parts of it during the interview. In broad terms, the interviews asked experts to:

- Comment on emerging OSH risks based on their professional understanding and expertise
- Comment on the appropriateness and feasibility of topics for a foresight study which emerged from the literature review
- Prioritise the topics in terms of significance, based on criteria such as likelihood, increasing chance of happening, impact, range of workers affected, numbers of countries affected, capability of different member states to address potential risks associated with the topic
- Add any additional topics for consideration which were not revealed by the literature review or refine the scope of topics identified
- Comment on their experience of foresight methods, their strengths/weaknesses and any implications.

1.3.3 Stakeholder survey

Following the round of stakeholder interviews, a short online survey was designed to gather the views of a range of stakeholders with interests and knowledge of OSH on possible foresighting topics. The

survey took approximately 10 minutes to complete and consisted of approximately 40 questions asking respondents to rank individual foresight topics and sub-themes identified from the literature review and stakeholder interviews, as well as suggesting other topics for a foresighting study. The survey was conducted in English and was piloted on seven individuals with knowledge of the subject area, including a mix of native and non-native speakers of English. As a result, some minor alterations were made to the wording of the survey instructions. The survey was issued at the beginning of April 2014 and remained open for two weeks, with two email reminders to complete it sent out by EU-OSHA.

The survey link was sent via an introductory email inviting participation to 125 stakeholders identified by EU-OSHA through their own databases. These stakeholders included EU-OSHA Governing Board members, EU-OSHA Focal Points, PEROSH members and a few other experts.61 respondents completed the survey. The distribution of respondents by country is shown in Table 1 in the Appendix E. A notable proportion (28 %) did not indicate which country they were based in. The distribution of responses was fairly well spread across countries, although no responses were received from Estonia, Greece, France, Hungary, Lichtenstein, Malta and Slovakia. The highest numbers of multiple responses were received from Austria, Germany and United Kingdom but the numbers from each were sufficiently small as to be unlikely to skew the results.

1.4 Report Structure

The remainder of this report consists of three sections. Section 2 outlines the findings from the literature review on major themes concerning the future of work and OSH implications, including supplementary observations from expert interviewees about drivers of change, where relevant. Section 3 provides the findings from expert interviewees on recommended choice of topics for foresighting together with analysis of the literature review, and recommendations concerning foresighting methodology. Section 4 summarises the conclusions of the scoping study.

2 Trends and future changes in the nature of work and OSH

The evidence in the literature coalesces around a number of key themes identified in the long list of literature topics shown in Appendix E. The discussion below is structured around a discussion of findings; views from expert interviews included where relevant throughout each topic, making clear where experts agree or disagree with any aspect of the theme discussed. Within each section, we first explore the nature of the theme, any associated definitions and describe its key features, review any empirical evidence of emerging trends relevant to the theme, their scale and the factors driving its development. Second we then explore the possible consequences for OSH and OSH management, and any challenges or gaps in knowledge identified as a result. Evidence is not necessarily available for each aspect of every theme.

2.1 Rationale for choice of these themes

The choice of themes covered by the literature review has been guided by the quality of evidence available to make the case for inclusion of each topic, the strength of arguments made in favour of the topics, level of concern raised by experts and whether a foresight study has the potential to make a distinctive contribution by filling a gap in the existing knowledge base. EU-OSHA has already conducted a substantial amount of research into some topics that may be relevant to this scoping study. Following advice from EU-OSHA, a series of topics were noted as unlikely to be of central interest as potential topics for foresighting unless new evidence was found or experts offered a substantially new angle or insights in addition to research already published. Therefore the themes discussed in more detail below do not include population ageing (EU-OSHA started a major project on OSH and older workers in 2013 finishing in 2015), migration (EU-OSHA, 2007b), stress at work, workplace violence and harassment (see EU-OSHA's information at: https://osha.europa.eu/en/topics/stress), health of women at work (EU-OSHA, 2013d) or new technologies in green jobs (EU-OSHA, 2013c). A number of topics also received mentions in the literature but appeared important as contextual factors or drivers of change and not on a sufficient scale to suggest that these should be possible topics for foresighting. These included the privatisation of health and safety provision e.g. in relation to personal security, women exiting the workplace mid-career, climate change leading to heat stress in parts of Europe, migration of refugees into Europe, sustainable energy issues. Nanomaterials emerged as an important topic in the literature but because it is very specialist and technical where a lot of research and other activities are on-going (see EU-OSHA's information at: https://osha.europa.eu/en/topics/nanomaterials) it was not retained as a suitable topic for a foresight study.

2.2 Impact of financial crisis on the nature of work and OSH, and OSH management during and after recovery

The financial crisis of 2008/9 has had profound and ongoing effects on the nature and availability of work across the EU, although very little literature exists discussing OSH management during and after recovery. The main effects can be divided into:

a) changes to levels of employment and employment contracts including working time

b) changes in the types of firms growing/declining

c) changing in the nature of work and structure within existing firms, for example as a result of downsizing

In addition, experts noted that the privatisation of parts of the public sector may have implications for how work is organised, the Human Resources Management practices adopted and the implications for OSH.

The first main feature of the financial crisis is its impact on the availability of work. Youth unemployment rates have reached unprecedented levels, averaging 23% for the EU as a whole. The rates for young people (aged 15-24) not in employment, education or training (NEET) are 22.4% in the

South and peripheral EU countries, and 11.4% in the north and core of the EU (European Commission, 2013). In a pattern intensified by the crisis, structural unemployment has been growing and unemployment varies from 17.3% in the South of the EU and peripheries in 2012, to 7.1% in the north and central countries (EC, 2013). A large proportion of jobs destroyed were in mid-paid manufacturing and construction occupations (Eurofound, 2013). However, recovery has now started and some experts were concerned about the long-term potential for economic recovery, perceiving it as fragile, with particular worries about long-term unemployment in southern EU countries. One expert, in contrast, believed that economic recovery would be sustained and the labour market would improve to pre-recession performance levels.

As a consequence of reduced employment opportunities, poverty has increased in the EU since 2007. Household incomes are declining and 24.2% of the EU population is now at risk of poverty or exclusion. Children are particularly affected as unemployment and jobless households have increased, together with in-work poverty (EC, 2013). This has implications for quality of life and general population health beyond workplace health and safety due to the impact on personal finances.

Not all the employment outcomes of recession are necessarily entirely negative in the long-term though. For example, low paid, low skilled jobs which disappear in the short-term could be replaced by high skilled, higher paid jobs in the medium-term, depending on how national economies regenerate. Higher unemployment levels of low-skilled workers may therefore lead to them becoming more vulnerable and more likely to accept jobs with poorer working conditions, hence an increased skills polarisation in the workforce. Employment creation has been skewed towards high-paying higher-skilled jobs in the service sector such as business consultants and medical professionals (Eurofound, 2013). In addition, there has been some evidence of improvement in women's position in the labour market. Women have increased their share in intermediate and good quality jobs because they are over-represented in growing sectors such as health where these jobs are commonly found and are under-represented in declining industries such as construction. The share of temporary contracts, which often have poorer pay and working conditions (Eurofound, 2012e), has also fallen in the EU because they bore the brunt of labour market contraction (EC, 2013). This may explain why large scale surveys of workers across Europe are finding that high levels of job control and lower levels of job strain are generally spreading (Eurofound, 2012d).

It is not certain how far well-paid and secure employment in public sector organisations will continue though, because the impact of austerity measures has largely stalled employment growth in sectors such as education and health (Eurofound, 2012d). The growth areas of the economy are private sector service firms, especially those made up of the self-employed, outsourcing services and micro and SMEs (EU-OSHA, 2010a; European Parliament, 2013). Formal OSH management systems are less common in these kinds of firms, where poor quality jobs are also most likely to be found (Eurofound, 2012d). These types of organisations are less likely to have formal employee representation structures and processes, which are associated with effective management of OSH (EU-OSHA, 2010a). The nature of organisations has been changing; many large organisations have decreased in size as they have shed staff and this has implications for the health and safety of both workers who depart the organisation and those who stay which are explored in Section 2.5 below. One expert interviewee drew attention to the likely rise in project-based self-employment for firms who want to hire an individual to complete a particular piece of work rather than as a permanent employee.

The types of employment available following recession have been changing. Certain forms of more precarious jobs including part-time work, especially where this is involuntary, have been increasing, because job seekers are unable to find suitable full-time work. Part-time employment grew consistently in 2011 and 2012 and now accounts for at least 20% of EU-27 employment. There is also an increasing share of men working part-time, although women dominate the profile of part-time workers (Eurofound, 2013). A rise in modest levels of self-employment (SUVA, 2011; European Foresight Programme, 2012) is noted in analysis, triggered partly by people who cannot find employment setting up their own businesses. There is growing variety in the contractual status of workers, evident for example, in the growth of internships and other forms of potentially unpaid work (Eurofound, 2012e).

More worryingly, there is evidence of some undeclared work. This currently accounts for 18.8% of GDP in the EU-27 and over 30% in certain countries and there has been a marked rise in bogus self-employment, particularly in the construction sector and domestic services (European Parliament,

2013). These workers are often from vulnerable categories such as immigrants, young people, women and those with low levels of skills and low or no qualifications.

For people who have managed to retain employment, working time patterns and overall hours worked may have changed. There is evidence of polarisation in working time patterns with 11% of people working fewer hours and 18% working more hours as a result of recession (Eurofound, 2012e). These variations in working time bring different kinds of pressures and potential attendant OSH problems for workers which are discussed in the section below.

2.2.1 OSH implications

Some changes in the nature of employment contracts and working time arrangements are associated with potentially damaging effects on worker health and wellbeing. Workers engaged in insecure and flexible contracts with unpredictable hours and volumes of work are more likely to suffer occupational injuries (ILO, 2011). Workers on fixed-term contracts are commonly found to have inadequate working conditions by comparison with permanent employees (European Parliament, 2013).

A number of types of workers may face personal financial difficulties with potential adverse health consequences. Those engaged in undeclared work are very likely to experience financial and social hardship, with no income and social insurance security, and also a negative psychosocial impact from fear of being caught (European Parliament, 2013). Workers experiencing either an increase or decrease in their working hours may suffer from stress. Those facing an involuntary reduction in working hours may suffer from a drop in income and resulting in-work poverty, while those facing pay freezes or forced early retirement will similarly lose earning and may have consequential difficulty in meeting housing and living costs (ILO, 2013). These types of difficulties are estimated to have affected nearly a quarter of the EU population so far (Eurofound, 2012a). Workers experiencing increased working hours due to increased workload caused by cuts to workforce numbers may suffer from stress and lack of time to relax and balance work and personal life (European Parliament, 2013). Long irregular working hours and demands to deliver work to short deadlines may exacerbate stress (ESENER, 2010). Work intensification due to greater management emphasis on productivity was noted as a source of concern by two experts, who felt that public sector workers were at particular risk due to the impact of public funding cuts. Work intensification may also contribute to less focus on OSH management as an activity which becomes of secondary importance to short-term production efficiency (ILO, 2011). More broadly, labour market change may have generalised effects on workers regardless of whether they have personally experienced contractual changes or alterations in their job content. A broader climate of job insecurity can create fear and stress among workers (European Parliament, 2013). One interviewee noted that the experience of holding multiple jobs at the same time could cause stress among workers because of the need to become used to and switch between different organisational cultures. Another expert noted that job insecurity is likely to be a major cause of psychosocial risks but is difficult to tackle through OSH policy and needs to be tackled through economic policy and labour market institutions

In contrast to OSH management before recession, the financial crisis has affected development of OSH policy and management systems, both at national government and enterprise levels. Analysis shows that the level of resourcing for OSH has decreased (EU-OSHA, 2013c; ILO 2011; PEROSH 2009), as organisations are facing intensified globalised competition and cost pressures, resulting in them being selective and prioritising the types of activity in which they will invest (SUVA, 2011). Among the expert interviewees, there were mixed opinions. Three strongly endorsed the view that OSH was receiving less political attention and was being challenged to prove its worth. Another expert argued that the level of support for OSH was generally stable, likely to continue and did not envisage further deregulation. One expert distinguished between different parts of the EU and argued that in Scandinavian countries, investment in OSH would increase because companies would prioritise it as a means of achieving greater economic productivity. One interviewee believed that newer EU member states face challenges because their economies and resources are not as strong or as well-developed as established states to cope with the needs and developments in OSH. Therefore, such countries may not prioritise OSH as highly as other more established states..

A similar reduction in resources is also evident among national governments (EU-OSHA, 2013c), with a widespread trend of lower investment in labour inspections. Since regulatory pressures are an

important influencing factor on organisational-level OSH management practice (EU-OSHA, 2010a), this suggests some potential weakening of preventive OSH systems at a time when risks from changes in the nature of work are growing. One expert interviewee felt that politicians are pushed in two directions, one to keep people safe at work, and the other of not imposing overly strict rules onto companies. One expert noted that there have also been cuts in resources available for OSH public bodies more generally, with a subsequent impact on OSH research and campaigning capacity.

In addition, the types of enterprises that are growing, including self-employed traders, firms offering outsourcing services and SMEs (EU-OSHA, 2010a; European Parliament 2013) typically have less knowledge of OSH risks and challenges, attach lower importance to OSH, have lower levels of resources for investment in OSH services and are seeking a quicker return on investment than preventive OSH management may provide (EU-OSHA, 2013c; DG Employment, 2013; European Commission, 2009). One expert pointed out that self-employed workers tend to focus on making their businesses successful and to ignore OSH risks and have no support around them to help manage workloads if they become ill, although they have more influence and control over how they work. Stakeholders participating in major research projects drew attention to particular risks of subcontracting in sectors where OSH risks are high, including construction (DG Employment, 2013). It is not clear how thoroughly OSH policy and legislation is applied in the growing numbers of small firms and among self-employed traders. In these kinds of enterprises, workers find it harder to access help concerning OSH (EU-OSHA, 2013). This is heightened because there is greater individualisation of employment relations with less formal employee representation mechanisms. In consequence, some research argues that people who are in most need of help with OSH concerns such as those in smaller, private sector enterprises or in workplace settings without union recognition do not receive it (ETUI, 2010). Three experts interviewed pointed to a continued decline in trade union membership, and two noted this was a particular concern among private service sector firms (e.g. in the cleaning industry) and therefore potentially less effective employee representation on OSH issues. It is also practically more difficult to undertake full OSH surveillance for some types of workers including those working in subcontracting organisations or those working irregular or non-standard hours, and so requires greater effort and dedication on the part of managers to ensure that these obligations and good practice are fulfilled (EU-OSHA, 2013).

Within firms that have come through the financial crisis but have undergone major organisational change to survive, a number of OSH risks for staff may increase. Sectors most commonly affected by restructuring have included financial services, manufacturing, health, transport, and public administration and defence (Eurofound, 2012a). Downsizing leads to psychosocial health risks, especially if this involves multiple rounds of job cuts, while increased workloads can involve role ambiguity and role conflict (ILO, 2013) and poorer work-life balance and work-related stress. Analysis of the literature on the "psychological contract" focuses on the implicit obligations and expectations held by workers and managers of each other's rights and duties beyond the terms of a written contract (Rousseau, 1995). Research shows that workers can experience anxiety even if they are not personally affected by restructuring (ILO, 2013; DG Employment, 2013). Interpersonal relationships between colleagues may deteriorate and a number of studies have noted that stress, harassment and violence at work are likely to become more significant following financial recession as employment becomes more precarious, and workloads and working hours increase (EU-OSHA, 2010a; ILO, 2011). Evidence shows this is a long-term continuing trend: work-related stress has been increasing over a 10 year period (DG Employment, 2013). Even where relationships do not worsen to the point of aggression, trust may diminish between colleagues especially in situations where labour turnover increases and staff know each other less well (SUVA, 2011), which can inhibit people's willingness to reveal and discuss any sensitive OSH issues. The central issue at the heart of OSH management in these challenging circumstances is the approach taken to managing human resources. This includes the decisions that managers take about how to persuade workers to exert effort and work hard, and whether fair employment practices with due consideration for OSH are applied for workers on part-time and/or fixed-term contracts or otherwise insecure jobs.

2.3 Information and communication technology impact on work and OSH

The potential impact of information technology on work and OSH takes three forms. First is the emergence of new technologies which may affect how people do their jobs (e.g. individual devices attached to clothing which can monitor worker's movements and physiological state), second is the growth of existing technologies e.g. mobile IT devices, and third is developments and evolutions in how technology enables organisations to structure themselves and to organise work. One expert interviewee discussed how the use of wearable technology could be a key area of future change with both positive and negative consequences. Already workers may choose to use smart watches or simple pedometers to measure how far they walk and calorie expenditure. Future technological development would enable workers and firms to monitor individuals' blood pressure, stress levels, calorie intake and physical position through motion sensors. GPS sensors could be used to track workers around offices, assess how many breaks they take and email can be used to monitor their social and professional communications made via ICT. This is an extension of how GPS sensors are already used in the transport sector. For example, clients waiting for urgent deliveries can find the location of their goods, and track the route and position of the truck and its driver at the same time. Advances in medical technology may also positively change the shape and nature of the workforce because people who are currently unable to work due to injury or long-term serious health conditions may be enabled to remain in work through so-called exoskeleton or bio-regenerative technologies. These might include robotic and neurological implants to replace limbs or improve brain function, and also oral medications.

New ICTs which have implications for the nature of work include automation and greater use of robotics (EU-OSHA, 2013). Automation could reduce employment in some occupations and protect others from harm (PEROSH, 2009). A number of experts pointed out the potential for automation to erode demand for higher skilled occupations in professional and financial services as legal and financial transactional work may have potential to be undertaken by computers. Equally, another expert pointed to the larger potential role for automation in distribution and warehousing, where automation controls the pace of work and can undertake the roles performed by humans in some cases.

There has been a steady increase in the share of people using computers at work over past 20 years (Eurofound, 2012a) and the volume and details of information available for people to draw on in performing their jobs is increasing. One example of this is the potential availability of 'Big Data' where analysis of very large volumes of data generated by chance or design may be analysed for a wide range of purposes including policy development and consumer marketing.

The increasing prevalence of IT and its potential to generate data is leading to challenges in working in 'information intense' environments. This brings with it problems of large volumes of data but challenges in co-ordinating how the data is interpreted and used, leading to fragmentation of knowledge. ICT offers the potential capability to work wherever convenient and best suited to the nature of the task, and this may in turn reveal and solve problems in our existing work spaces. Some ongoing research conducted by an expert interviewee had shown that the majority of people working on portable IT equipment in cafes using Wifi were doing so because they needed more peace and quiet to concentrate on reading and writing documents than they could obtain in noisy open plan offices.

Overall, expert interviewees expect the prevalence of IT use to increase across occupations. ICT is also enabling the creation of start-up firms which require little capital investment and so the share of SMEs in the economy may increase as new technologies dilute the economies of scale reaped by large firms (EU-OSHA, 2013). Similarly ICT enables people in firms to work together across national and geographical boundaries, fostering swifter globalisation. The challenges that this presents for OSH are discussed in the following section 2.4. on globalisation.

OSH risks

ICT developments have a number of implications for how people experience work, which may be positive as well as negative. For ICT innovations that involve automation, one expert noted that robots can be used to take danger out of some tasks, but the human-machine interface will become more complex and blurred. Some foresight research has noted that IT may increase accident risks if

workers and managers have too much trust in the infallibility of technology (SUVA, 2011), and this is a particular challenge where robots are being used to perform hazardous tasks and interact closely with humans (for example so-called cobots). Potential problems of using ICT to monitor workers noted by expert interviewees include ethical concerns that monitoring of employees may be undertaken covertly, and that data collected via these processes could be at risk of theft or being sold or used for purposes to which people have not given their consent.

A number of experts stressed very strongly that any study of ICT should consider beneficial impacts as well as risks. They noted the potential of ICT to support vulnerable workers and make workplace adaptations and also to monitor and track impacts of OSH interventions better through real time reporting which are possible functions noted in existing research (EU-OSHA, 2013). One expert interviewee believed there would be massive development and expansion in the use of customised, individualised OSH prevention software and also the potential to individualise learning about one's own personal health needs and those of immediate colleagues. This opens up potential ethical problems of data protection. There may also be potential to explore the role of MOOCs (Massive Open Online Courses) in embedding/diffusing knowledge and good practice in OSH.

Research notes that we often interact with IT on an individual basis through use of individual computers so how we experience work becomes highly individualised rather than a collective experience. This may cause feelings of social isolation (European Commission, 2009). One expert gave the example that for people working in offices, they may spend most of their day using a computer or talking on the telephone with limited face-to-face discussion or contact with colleagues. This is especially reinforced for those people who are working at home, by increasing mental workload and enforcing permanent accessibility (EU-OSHA, 2013). Depending on how work is structured and what controls are put in place by individuals and companies, it can cause loss of autonomy because workers are responding to a stream of IT driven demands for tasks to be done (EU-OSHA, 2010a).'Technostress' can result when workers experience IT failures, are unable to make improvements or face pressures of work performance monitoring through technology (Dewe and Kompier, 2008). Experts noted that the impact of ICT on workflow is not really understood and there are very few studies in general on the impact of ICT on OSH. One pointed to the increasing role of IT dictating the demands of jobs e.g. in warehouses for firms such as Amazon where electronic devices control the pace and volume of work, similar to manufacturing production lines.

Increasing interconnectedness between countries through ICT is of interest because of the potential it brings for diffusion of nationally driven workplace cultures and practices. One example here is the intense work ethic and culture of Far East countries, which may create demands on responsiveness of colleagues and through supply chains located in Europe (European Commission, 2009). Because ICT has the potential to enable a 24/7 economy this could lead to working time stress (EU-OSHA, 2013) and experts expressed concern that wider adoption of mobile handheld devices such as smart phones could lead to disruption of work life balance, excessive working hours and insufficient time for people to relax. It is already well known that use of computers can lead to an increase in fixed body postures and physical inactivity at work and musculoskeletal disorders (MSDs) (EU-OSHA, 2013). This is made worse when working with non-ergonomic mobile devices in non-ergonomic settings, for example when using smart phones, tablets or laptops. Experts believed there should be a focus on the psychosocial risks of ICTs because these are less well understood. The literature suggests that physical risks will also persist and intensify as use of ICT permeates more occupations. One potential risk is among people who may use medication to improve their work performance to cope with long working hours which are made possible by the availability of mobile IT and working outside an individual's usual place of work (SUVA, 2011). Two experts noted that there is an expectation for employees to be emotionally resilient in the face of demands placed on them by IT. They recommended that in addition to investigating risks to workers from ICT developments, it would also be useful to understand more about the realism of employer expectations of worker resilience, the inherent risks and what strategies, systems and methods can be used to help employees who face ICT demands, in addition to strategies to limit or minimise exposure.

In addition to the obvious and well-researched physical OSH risks from spending large amounts of working time sedentary and using a computer, one expert noted less obvious occupational health and safety issues arising from Wi-Fi services. The expert believed that adequate OSH management for people working at home is an aspiration rather than a reality, and the potential of ICT for monitoring this could be investigated. Similarly the OSH risks for people increasingly working in a diverse range

of public spaces such as cafes and airports and how these can be managed is not well understood. Other research has suggested that it is worth developing a better understanding of the physical risks of exposure to noise and electromagnetic fields from mobile phones, transmitters and electronically controlled home environments (European Commission, 2008).

2.4 Impact of globalisation on work and OSH

Globalisation of trade has a number of dimensions that may have important consequences and impacts for the future of work and OSH. One dimension refers to the opening up of possibilities for trade across geopolitical boundaries meaning that product markets for goods and services are extended beyond country borders. This creates opportunities for organisations to divide up and spread their activities across long and complicated supply chains in different countries and has led to the development of powerful transnational enterprises which can exert considerable influence over markets and other firms in their supply chains. Firms may be selective in deciding where to locate their workplaces for reasons of sourcing expertise, manufacturing of final goods close to the main customer markets to reduce transport costs, or to locate manufacturing deliberately in a low wage and therefore low cost environment to make goods cheaper to produce. This can result in deliberate relocation of operations both to countries within Europe which have lower labour costs, and also countries in cheaper parts of the world such as developing countries in Asia and South America. It is estimated that the impact of globalisation has led to 14,000 cases of large companies restructuring, through reorganisation, closures, mergers, acquisitions, downsizing, outsourcing or relocation (EU-OSHA 2013). One expert interviewee stated that globalisation is causing work to become more intensive in Western European countries such as Germany, due to increased competition from Asian economies such as China and India (e.g. automotive manufacturing). As such, work pressures are greater than they were 10-15 years ago due to organisations adopting strategies to achieve better, faster, cheaper and more efficient production. Another expert believed that investigating the role of global economic factors on work and OSH would be a 'waste of time' because there are too many factors to consider and their effects on OSH are too complicated to identify.

The choices of transnational companies are becoming increasingly important in their effects on boosting capital mobility and international trade. Foreign Direct Investment is twenty times larger than it was in 1995 (European Commission, 2009) and China is growing in importance as an exporter. The overall volume of global trade is predicted to quadruple in size between 2008 and 2025 (European Commission, 2009) but there is likely to be a shift in the characteristics of consumers. The growing middle classes of BRIMIC countries (Brazil, Russia, India, Mexico, China), Indonesia, Turkey and South Africa, together with emergence of this type of consumer in Africa (EU Foresight Programme, 2012) are predicted to account for an increasing share of consumer power. Analysis suggests that the dominance of international companies is shifting from the triangle of USA-Europe-Japan to a large network of nations grounded on regional partnerships and centred on the Indian and Pacific Ocean (European Commission, 2009, EU Foresight Programme, 2012). Manufacturing has declined as a share of economic activity in the EU15 from 21% in 1995 to 16% in 2013 (Eurofound, 2013).

The effects of companies permeating traditional national borders is to make economies of different countries more connected with each other, more interdependent (EFP, 2012) and a network of ownership and influence that has the potential to shape decisions about how OSH is managed (EU-OSHA, 2010a). These firms are also more likely to employ migrant as firms become more integrated along supply chains. These people will be employed in both high skilled and low skilled work (EU-OSHA, 2013) but overall they are more likely to experience negative OSH effects because immigrant workers are known to be found in jobs with higher health and safety risks.

At the same time, there are interactions with the shifting nature of industrial sectors with a decline in manufacturing replaced with growing segments of a knowledge economy across many EU countries. This is characterised as an increase in intellectual investment to develop companies compared to physical investment (European Commission, 2009). This further opens up opportunities for companies to use information technology (see Section 2.3) to connect with each other across supply chains and therefore gives increased choice about where to locate different elements of their operations.

2.4.1 OSH implications

Globalisation tends to generate outcomes which are either strongly positive or strongly negative for countries and companies. This means that the implications in terms of increased or decreased job opportunities are marked (European Commission, 2009). The quality of jobs generated and associated consequences for OSH are much more variable and depend on a number of factors. In countries which benefit from the spread of higher skilled and well-paid jobs, the outcomes for workers may be positive, providing that no other negative factors reduce the quality of work (see e.g. pervasive trends in ICT in section 2.3). But globalisation exacerbates competitive pressures on firms, in addition to the reduced profit margins that many faced as a result of needing to keep competitive during recession, which can make companies willing to consider reducing spending on health and safety measures (EU-OSHA, 2010a). These problems are also heightened by trends in relocation of production to cheaper BRICS countries (Brazil, Russia, India, China) where consumer demand is growing but lower health and safety standards prevail. This has potential implications for job quality in the EU because European firms experience squeezed profit margins in exports (Dewe and Kompier, 2008), and therefore may seek to reduce labour costs through lowering labour standards, and possibly through cutting back investment in preventive OSH management activity. One expert interviewee also pointed out that companies may make tactical decisions in the destinations they choose for outsourcing. Firms may select elements of the production process to outsource if they are judged high risk in terms of difficulty of process or delivery or potentially high risk in terms of health and safety, so they do not have to take responsibility for any adverse outcomes. However, it is difficult to estimate how prevalent this kind of behaviour is.

From a policy perspective, globalisation creates challenges in how to regulate and manage OSH through supply chains as noted by the European Commission in a recent report on the role of labour inspections (European Commission, 2013, see also DG Employment, 2013), a problem which was endorsed as of particular interest by three expert interviewees. EU strategy is also endorsed in the literature as a particularly important tool to create political pressure to address OSH (DG Employment, 2013). This is a particular problem in firms whose parent company may be located in another country or outside the EU and therefore not subject to national and EU level OSH regulation. It is not clear how these relationships can be regulated effectively at a transnational level and whether it is possible to undertake and enforce any action required through labour inspections. One expert interviewee felt that it would be important and useful to map and understand the coverage and degree of alignment between EU and non-EU OSH policies and practices, including a focus on legislation and social policy as well as company-level policies/practices such as corporate social responsibility and individual and fund investor policies. Another two felt that understanding the challenges and possibilities for managing OSH effectively through global supply chains with at least one link in the chain in the EU was important. Lastly, one expert pointed out that 'fuzzy' business relationships based on networks as well as direct supply chain links could be important in influencing OSH and worker well-being, and believed these should be investigated in the transport and construction sectors particularly.

On a voluntary basis, some firms may use OSH indicators as part of their selection and performance management criteria for suppliers, following international voluntary codes of practice based on corporate social responsibility. However, others may select suppliers solely on price with limited concern for OSH. Co-ordinating and ensuring adequate worker representation in multi-national companies and along supply chains involving smaller firms at the lower tiers is also challenging. Large global companies will also be managing an increasingly dispersed and diverse workforce, potentially including workers from a wide range of backgrounds and with a variety of health conditions according to varying demographic trends. One expert interviewee felt that examining the risks of disease being spread through supply chain contact was an important topic to investigate. As a result of workforce diversification, it is likely that organisations will need to become more sophisticated in their approaches to customising OSH interventions, but the challenges involved and the adaptations that may be required are not yet understood. Lastly, one expert interviewee noted that working time arrangements may be affected by increasingly globalised operations facilitated by more sophisticated ICT services, which can extend the working day into unsocial hours by creating expectations of worker availability for contact with colleagues and customers located in different time zones.

The European Parliament has noted that globalisation has had negative effects on the safety and fairness of labour relations (European Parliament, 2013).

2.5 Impact of changing location of work on OSH

The location of work is defined as the type of environment and location where a worker performs their job role. An worker can work in one or many locations (e.g. a call centre operator works in the same office each day whereas the area manager for a retail supermarket may travel to different shops); carry out their work role in the same or different location as a non-work role (e.g. home worker vs. office worker); be based in a single physical space or work with colleagues dispersed across many locations (e.g. a web-based team of graphic designers versus a manufacturing production line); and be located within a small or larger geographical span (e.g. a sole trader serving the local community or senior manager of a multinational corporation). In addition, pressures on some people to take multiple jobs as a result of growth in short-time and short-term contracts and reduced income as a result of financial crisis may increase the numbers of locations where they work. It also means they be exposed to a diverse range of hazards, and it becomes harder to trace back any source of harm to a single location. These various dimensions of work location create a diverse range of OSH needs. There are particular societal, technological and economic trends that are influencing emerging trends in the location of work for many different types of occupations. One of the major influences is the enabling potential of ICT discussed in Section 2 above, because it no longer requires people to be located in the same place to communicate and exchange documents and information. Similarly, globalisation has contributed to a need for people to work across conventional national and organisational boundaries, which until the late 1990s was undertaken through travel to face-to-face meetings. The development of real-time, face-to-face communication technologies (e.g. videoconferencing), and tools for exchanging information electronically (email, etc.) can enable people to travel less, but may affect their working time patterns instead as discussed above.

Recent trends in work location include the continued urbanisation of European countries (EF Germany, 2005a) and the increased needs and demands of 'commuting' to work (EFP, 2012). Cities across Europe are continuing to expand in size and increase in population as people migrate from rural to more urban areas for work and potential employment opportunities (EF Germany, 2005a). It is currently estimated that 75% of EU citizens now live in urban environments (EFP, 2012). Public transport systems have struggled to develop in line with these changes; leading to rapid deterioration of such systems in rural areas and an increasing pressure on 'commuter' transport services in urban areas (EF Germany, 2005a; EFP, 2012). However, significant developments in technologies may enable smarter, more flexible, and more ecologically sustainable means of arranging and using transportation, particularly public transport systems (EFP, 2012). This could help people commute efficiently to and from work/home locations, and enable people to work across sites or countries more easily and effectively. This is particularly important in the context of economic and political needs for European citizens to access the free labour market of the EU. Currently only 4% of the working age population within the EU actually comes from a different member state to where they work (European Commission, 2013).

The second factor is the rise of telework and remote working, where public spaces, homes, and temporary office environments are used as work environments by people whose work does not require them to be present at the point of delivering a product or service (EF Germany, 2005a). The rise of mobile technologies such as email, teleconferencing and remote desktop access, over the last decade, has enabled work activities to be conducted, partly or wholly, through virtual means (EFP, 2012). Although this form of working is often limited to types of work that do not need physical equipment or direct/frequent physical interaction with people, it has significantly expanded and diversified the range of locations where many job roles can be performed (EF Germany, 2005a).

2.5.1 OSH Implications

With the continued increase in remote working and use of multiple work locations, people are likely to face increased time spent travelling for work purposes. One expert interviewee referred to this as 'borderless' work where workers can work from anywhere at any time. Another noted contradictory trends in the growth of office-based jobs in the service sector where staff may be 'chained to their desks' and consequently suffering from health risks of spending a long time in a fixed physical posture versus the increased flexibility of work arrangements for staff who are always 'working on the go'. These issues have important implications because mobile working may make it more difficult to

assess OSH risks consistently and regularly. This was highlighted by three expert interviewees, who discussed the need to explore the long-term pressures and risks involved in remote forms of working. One expert interviewee noted that new psychosocial risks for workers who commute to work or use remote forms of working may emerge. One expert commented that we have not yet seen a huge increase in the scale of home work in its most complete form, but we have seen more flexibility so people may start to spend more of their time or more of their days at home. The expert noted that it is not certain how organisations set up their systems and procedures to manage accountability for OSH and for work outputs. It would be useful to understand the potential for how these systems could be linked and monitored and the information this may provide to foresee and mitigate health risks.

The emergence of a range of work locations has made it more difficult for organisations to monitor, meet or support people's basic physiological and psychological needs e.g. food, exercise. This is because people who do not have a permanent work location do not necessarily have managers present or frequently visiting them with scope to control their environment. One interviewee noted how organisations may unintentionally neglect the importance of food and exercise for remote workers' wellbeing although some employers also do not consider these issues for staff working from a fixed location, and another noted that organisations may ignore teleworkers' needs. Organisations should consider the implications that the work locations of their staff have on energy consumption and the natural environment (EF Germany 2005b). These wider issues of resource scarcity and sustainable living will require addressing. For example, this could involve encouraging and developing business models that focus on sustainability and harnessing advancements in technology (EFP, 2012). There may be particular implications for the OSH of workers in parts of Europe which are exposed to extreme or changing climatic conditions which create both needs and risks from too much or too little light and extreme temperatures.

2.6 Trends in HRM practices affecting worker well-being and OSH

Human resource management (HRM) is the function through which the organisation can gain increased organisational performance and competitive advantage via the selection and deployment of workers (Guest, 2011). In recent years, much attention has focused on 'bundles' of HR practice, referring to combination of practices such as employee communication/representation, job design, reward systems and career development practices and how they can be used to elicit higher levels of individual performance. Different 'bundles' of practices may suit firms trying to achieve different business objectives and with different kinds of staff needs and preferences, and there are major differences in how HR practices are used and applied across EU member states (Eurofound, 2013). The relationship between workers and employers is often observed to be increasingly individualised. This is because the incidence and intensity of collective industrial relations activity and mechanisms is decreasing in some parts of EU member states economies. In this context, some employers may be seeking to transfer OSH risks to workers, especially where firms are experiencing pressures of globalisation through supply chains as discussed in Section 2.4.

Some approaches to HRM emphasise practices that enhance the wellbeing and personal development of workers, and align them with the goals and values of the organisation. These would include policies and practices regarding: a) fair treatment, equal opportunities and selective hiring; b) participation, involvement and employee 'voice' about working conditions; c) training, learning and career development; d) health, safety and work-life balance; e) rewards, recognition and performance incentives. These practices have important implications for OSH. Another important HRM trend occurring is the changing management structures within companies and the role of OSH within such structures. An organisation's willingness to act on OSH issues within its workplace depends on a wide range of structural and contextual factors such as how seriously OSH features within organisational values and how important the company views compliance with national/EU legislation (EU-OSHA, 2010a). Literature shows that there has been a trend towards developing leaner, flatter management structures which consequently affect the organisation of work and the design of jobs, giving individual workers greater autonomy and responsibility, but sometimes added work pressures (EU-OSHA, 2010a). Many large organisations, across both public and private sectors, have undergone significant downsizing and restructuring that have given rise to non-standard employment contracts, outsourced or subcontracted services, and home/remote working arrangements (EU-OSHA, 2013). At an organisational level, one expert noted that some OSH experts working as practitioners for employers

feel insecure about the status of their roles and how they are perceived, particularly in tough economic circumstances, so they may respond by making their activities as 'forgivable' as possible, with the potential consequence that the extent and depth of OSH activity and its effectiveness is reduced.

2.6.1 OSH implications

The first major consequence of the trends discussed in the section above is the increasing prevalence and scope of psychosocial hazards in the work environment. This partly results from broader changes in the nature of work e.g. the rise in use of ICTs and the other themes addressed in sections 2.2 to 2.5, but also partly as a result of management decisions to monitor workers more strictly through performance management techniques, setting of targets and measurement of outputs (see e.g. Cox et al., 2012). These include problems arising from job content such as less job variety and reduced skill utilisation, increased workloads and work pressures, more unpredictable and inflexible work schedules, less control over how the job is carried out. Other problems relate to the work context and include poorer quality work environments and inadequate equipment, poorer communication and support from the organisation, increased social isolation and interpersonal conflict at work, increased ambiguity and uncertainty of one's role in organisation, increased job insecurity and career stagnation, and increased conflict between home and work lives (EU-OSHA, 2010a). In particular, increasing evidence has emerged in the past decade of psychosocial risks from increasing work intensity of the volume of work required to be done in a set time period, made worse by heightened information demands, speed/ pace of deadlines, and conflict between demands (EC, 2013; Eurofound, 2012b; EU-OSHA, 2005, 2007c). These increased risks have led to people working longer hours and to experience less job control and autonomy (EU-OSHA, 2010a) and are likely to aggravate emerging psychosocial health problems such as stress, depression and ill-health. This may subsequently lead to increased absence from work (EU-OSHA, 2005). All of these conditions predict early workforce exit (EU-OSHA, 2013). Therefore, it is essential that HR staff and managers with OSH responsibilities monitor these trends carefully and take appropriate action to prevent and mitigate them.

Monitoring and dealing with psychosocial hazards on an everyday basis involves frontline managers and supervisors playing a critical role. However, for managers the long-term implications of trends in psychosocial risks, how they will affect worker well-being and the consequences for OSH, are not yet known. Therefore identifying the concerns and perceptions that managers have of OSH is important to help identify the potential long-term implications. In a study on psychosocial risks across Europe, around half of 28,649 managers interviewed were particularly concerned about time pressure and having to deal with difficult customers, patients, pupils etc.; and approximately a quarter were concerned by poor communication between managers and employees, poor co-operation between colleagues, job insecurity and long/irregular working hours (EU-OSHA, 2010a). These concerns tended to be fairly uniform across the EU-27 states. One expert interviewee discussed how the role of managers would be crucial at reducing such risks and hazards in the coming few years, particularly if they are trained and motivated to do so.

Apart from the role of line managers, specific HR practices may also be useful to help manage psychosocial risks. The most common practice employed by European organisations to deal with psychosocial risks according to a large scale survey was the provision of training in 52% of workplaces (EU-OSHA, 2010a). This was followed by changes in work organisation, work design and working time arrangements in approximately one third of establishments, and use of confidential counselling and conflict resolution procedures in approximately a quarter. The majority of these practices, particularly training, procedures and counselling/support services, were also emphasised as important for the management of OSH (EU-OSHA, 2013). One expert interviewee argued that, given continuing technological advances in combining different forms of HR and personnel information through software packages, there is a need to integrate OSH policies and services with HR practices.

Another approach identified within the literature for managing OSH is to target recruitment and selection of 'safety conscious' employees (Walter, 2007). This could entail OSH professionals within companies partnering with HR staff to screen potential candidates for positive health and safety values and behaviours. However, the ethical implications of this type of practice need further examination, as there is a strong risk of unethical discrimination in recruitment and selection processes when hiring new staff. In addition, employers may experience a temptation of transferring responsibility for OSH risks onto workers rather than organisations to maximise productivity.

The second main potential driver of trends in HRM for managing OSH is increased workforce diversity. This is evident, for example, in the differences between the health and safety needs of older and younger employees and a much greater age difference developing between oldest and youngest workers due to people remaining at work for longer. Similarly, immigration within EU countries and from other parts of the world to the EU may bring a flow of new workers who are prone to different health risks due to communication issues arising from workers speaking different languages, to holding different cultural attitudes to OSH risks, and different values and cultures in managing OSH. The health risks between permanent, temporary and flexible workers also vary. In the future, younger workers may be more prone to early-onset of cardiovascular diseases due to emerging lifestyle trends typified by low physical activity and poor dietary habits (PEROSH, 2009). This would restrict some young workers accessing particular occupational roles and employment prospects. One expert drew attention to how changes in personal lifestyles including obesity and exposure to higher noise volumes may affect OSH and the prevalence of accidents. These may, of course, be exacerbated by workplace influences contributing to these kinds of OSH risks such as sedentary occupations affecting obesity rates and the prevalence of open plan offices and design of factories influencing noise levels.

For older workers, the effects of an ageing workforce would mean that this group may be required to work past traditional retirement age. Overall, the trends for both younger and older workers means that more people in the workplace will have a long-term health condition (PEROSH, 2009) and there has already been a rise in chronic but treatable diseases that require long-term management (EC, 2009). This type of health management may require radically different models of care, with an emphasis on self-management of conditions by 'expert' patients who may be trusted to monitor their disease indicators and adjust their medication and treatment regimes accordingly, formal support structures and access to information/advice (EC, 2009). It is not certain how prepared HR departments and managers will be to adjust the workplace to accommodate these health management needs, given previous reliance on pre-screening workers to make sure they are fully fit for the needs of the organisation. Moreover, the continuing rise in 'flexible' and 'remote' forms of working has led to further segmentation of the workforce (see Section 1 on implications of financial crisis and Section 4 on work location) and globalisation has fostered the development of long supply chains and subcontracting arrangements (see Section 3). This creates an additional challenge for HR staff and general managers with OSH responsibilities of addressing an increasingly diverse set of OSH needs across workers distributed over numerous locations, with diverse working hours and types of contract and differing levels of ultimate responsibility and influence over OSH behaviours.

One important element of trends in HRM practices relates to worker representation and participation through collective and individual methods. If the workforce is becoming more diverse and segmented, it will become more difficult, yet more important to understand the psychosocial risks and OSH issues for different groups of workers. A key way of helping to address OSH issues across the workforce is through worker representation and participation mechanisms (EU-OSHA, 2010a). However, it may become particularly important, given the increasing diversity of OSH needs, to examine the variations in risks, challenges and opportunities presented by different forms, scope and aims of employee representation and subsequent impact on OSH outcomes. Foresight scenarios produced concerning worker participation show multiple possibilities ranging from renewed solidarity to social polarisation due to the impact of deteriorating living standards and globalisation (ETUI, 2010). These have varying implications for trade unions from marginalisation to development of professional services. Methods of employee representation and participation are likely to vary significantly and involve differences between formal representation through trade union membership and informal representation through direct consultation and involvement, as well as between SMEs, large organisations and multinationals. For example, EU-OSHA (2010a) found that formal employee representation was associated with the organisation having clear procedures for managing OSH issues and this form representation had a larger impact in smaller organisations than larger ones, but was less likely to be used in these smaller organisations. A number of expert interviewees drew attention to the decline in formal union representation and trade union membership across the EU and predicted that this would continue, thus posing the question of how best to ensure that workers' view on OSH issues can be gained. Further differences between small, medium and large sized organisations were highlighted by one expert interviewee, who noted how micro and small businesses often do consider OSH issues as seriously as larger organisations but have fewer resources to devote to OSH policies and services. The expert argued for a 'knowledge base' of best practice that considers the different needs and challenges within each type of organisation. In addition, there remains a particular difficulty in

understanding and meeting the OSH needs of migrants, who often remain undeclared or hidden from the public sphere and are a particularly vulnerable group of workers (EU-OSHA, 2007).

The third consequence is how the changing structure of organisations has influenced the way in which OSH can be managed. The move towards restructuring organisations to become leaner and flatter can lead to reduced job security and tenure, poorer work-life balance, and more uncertain working hours (EU-OSHA, 2010a); all of which are associated with increased ill health and psychological disorders (EU-OSHA, 2005). Moreover, the financial crisis has exacerbated these issues by triggering a growth of unpaid, uncertain and/or temporary employment contracts which are associated with inadequate working conditions and high levels of work intensity (EF, 2012; EP 2013). However, as one expert interviewee highlighted, some governments are re-focusing policy attention on ergonomics and technical aspects of safety instead of psychological processes that determine broader health and wellbeing outcomes. Three of the expert interviewees argued that understanding the challenges of managing OSH under pressures from internal and external structural influences was important. The first discussed how corporate social responsibility (CSR) agendas and the decisions of company investors may become more powerful in the coming decade; the second noted how HR departments are increasingly focusing on ways to enhance the productivity of staff and so there is a need to examine how organisations will account for the outputs of staff in the future. The third highlighted the importance of company networks and how social policy might affect such networks. Another expert believed that OSH policy and services should be further integrated into HRM practices and the risks of continued segmentation should therefore be explored.

2.7 Service sector growth

Over the last decade there have been gradual, yet significant changes in the proportion of people working in particular sectors and occupations, for example more EU workers are in sales or service occupations (17% in 2010; 13% in 2005) and less EU workers are employed within the manufacturing sector (17% in 2010; 19% in 2005) (Eurofound, 2006; 2012d). The most notable of these are the growth of jobs and workers within the service sector (EU-OSHA, 2010a) including industries such as finance and insurance, education and health, tourism and hospitality, retail and sales, and media and ICT. The continued shift towards a 'knowledge-based' economy has rapidly increased demand for intangible products (EU-OSHA, 2013; SUVA, 2011). Changing types of consumer demand and change of modes of purchasing through e.g. use of internet and on-line shopping is contributing to the emergence of new types of services, e.g. such as warehousing, transport and distribution functions for online purchases or more local 'click and collect' delivery options for online shopping, typified by the growth of companies such as Amazon. The service sector consists of many different types of jobs (EU-OSHA, 2013). At one end there are highly skilled, highly paid occupations for workers who develop and create intangible goods/services, such as ICT and marketing consultants, web designers, researchers and technology developers. In contrast, the other category consists of low skilled, low waged occupations made up of workers who deliver operational and process transactional aspects of such services, such as call centre operatives, retail and hotel workers, and healthcare assistants. The highly skilled, highly paid occupations tend to experience high levels of job quality (i.e. high levels of earnings, autonomy, skill use, social support; low levels of physical risks and low intensity of physical demands), whereas low-skilled, low-waged occupations experience much lower levels of job quality (Eurofound, 2012). A substantial number of experts interviewed noted the service sector as accounting for the largest share of jobs over the next 10-20 years, and this is endorsed by studies such as those of Cedefop into future occupational growth and skills needs (Cedefop, 2008). Several drew attention to the likely large expansion in care work and care services, which they noted was being driven by population ageing and improved medical treatment which was enabling improvements to longevity, although people would be living with long-term chronic health conditions. Some noted that the scale of potential expansion in this sector would be dependent on whether funding would be available to pay for such services. In other service sector industries, one pointed out the growth potential in creative industries, R&D and leisure/entertainment sectors, while two pointed out likely growth in knowledge intensive service industries such as business and professional services, insurance/actuarial services.

2.7.1 OSH Implications

Firstly, OSH policy and practice has overlooked low quality job roles (i.e. low levels of earnings, autonomy, skill use, social support; high levels of physical risks and intense physical demands) that make up critical areas of service work (EU-OSHA, 2005b; Eurofound, 2012). Many of these workers, in industries such as healthcare, catering and cleaning, handle dangerous substances and chemicals, or are female-dominated occupations requiring a lot of time spent standing or holding static postures or doing a lot of manual handling, sometimes of heavy loads (for example in the healthcare sector), and are often employed by organisations that do not implement formalised OSH policies and practices (EU-OSHA, 2005; Eurofound, 2012). Workers in these types of jobs have lower levels of morale and wellbeing, and increased risk of health problems compared with highly skilled, highly paid service sector roles (Eurofound, 2012). For example, 37% of those in low quality jobs report that their work causes them significant health issues, compared with 18% of those in high quality jobs (Eurofound, 2012). One expert interviewee acknowledged the need to identify which psychosocial risks are most significant to these 'low quality' service sector roles, particularly in the private sector where trade union representation is still decreasing. This decrease in representation may have important implications for OSH because organisations that use formal worker representation are more likely to implement clear procedures for managing OSH issues than those that do not (EU-OSHA, 2010a). In addition, societal trends such as online shopping are leading to the emergence of new trends in the service sector and demands for warehousing and distribution work for consumer goods, typified by organisations such as Amazon. These may lead to the expansion of OSH risks associated with work intensification, manual handling and unsocial hours typically found in manufacturing settings into a service sector environment.

A second implication which receives substantial attention in the literature is the increasing demand for workers to perform 'emotional labour' and the consequent negative effects of burnout and stress. 'Emotional labour' describes the requirement to manage and control one's real emotions within the workplace (Hochschild, 1983). It takes place when a worker experiences a situation causing an emotion which differs from what the organisation expects them to feel, or where they have to express an emotion for customer service purposes e.g. being cheerful, when that emotion is not genuinely felt (Hülsheger and Schewe, 2011). Workers may have to control and manage their real emotions throughout the time spent at work depending on the number and type of interactions they have with other people. For example, a customer service assistant may feel angry and upset with a rude customer, but may be required not to show anger, and instead to suppress their feelings and remain calm and polite instead. Indeed, dealing with difficult customers is a major management concern across Europe (EU-OSHA, 2010a). This is because experiencing emotional labour is linked to negative psychological states, such as burnout and stress, as well as reduced job performance (Hülsheger and Schewe, 2011). As the service sector requires interactions between workers delivering the service and customers, clients, patients or service users, the effects of emotional labour are particularly acute and high levels of stress are associated with work activities that involve interacting with the public (EU-OSHA, 2005). Exposure to violence and emotional stress from these interactions is predicted to increase (EU-OSHA, 2013; PEROSH, 2009). These risks are significant for healthcare, social work, education and public administration occupations (EU-OSHA, 2010a). Five expert interviewees discussed the emotional effects of employee-client interactions with a particular focus on healthcare workers and those providing services within people's homes (e.g. cleaning, care), and noted how further examination of the risk factors and effects of emotional labour within the services sector may be needed.

Lastly, there is a need to develop long-term OSH strategies and interventions for high-risk groups in the service sector (EU-OSHA, 2005). These groups not only experience high levels of emotional labour (EU-OSHA, 2010a), but also limb disorders and skin irritations that often lead to sickness absence in occupations such as hairdressing and cleaning (EU-OSHA, 2005). Three expert interviewees discussed how specific OSH strategies or interventions for these 'high-risk' occupational groups would be needed in the future. One focused on how both line managers and senior management can support staff that may be 'high-risk'; another questioned how wellbeing strategies and interventions (rather than traditional risk assessments/safety practices) can be developed to meet the needs of 'high-risk' workers; and the last interviewee concentrated on how OSH strategies can be adapted to meet the needs of 'lone' workers who work one-to-one with clients, e.g. workers who provide personal care within peoples' homes. Given that OSH is often seen by organisations and

governments as costly, resource heavy, and bureaucratic (EU-OSHA, 2013), the need to identify efficient and effective OSH strategies becomes particularly salient.

To summarise, low-skilled, low-waged occupational groups who deliver/process services will experience increasingly frequent and intense forms of emotional labour as well as heightened exposure to violence and aggression, specifically through interacting directly with customers. Ultimately this will lead to OSH related issues such as burnout and stress, and so, as identified by several expert interviewees, examining the risk factors and effects of emotional labour within the services sector, particularly for workers providing personal and private healthcare services, would be useful. Moreover, there is a need to develop long-term OSH strategies and interventions (such as line management support, wellbeing initiatives) for these workers, in particular those that carry out healthcare, catering, cleaning, hospitality and household activities.

3 Conclusions on topics suitable for foresighting and methodological considerations

This section presents the findings of our analysis of the literature review, stakeholder interviews and stakeholder survey in terms of the three topics identified as being most likely to be suitable for a foresight study.

3.1 Findings from the literature review

We have considered the evidence of the literature review in terms of a number of factors:

- Frequency of appearance in literature – this is useful to consider because it is an indicator of the scale of concern about an issue based on the range and types of organisations and individual authors discussing it. It is a less useful indicator of emerging topics where very little literature has been published.

- Scale of the issue – it is helpful to understand how prevalent the issue is likely to be in terms of the likely volume of workers affected, whether particular jobs, sectors or countries are most likely to be at risk.

- Degree of impact of the issue – this is important to understand how serious the potential OSH risks could be, but this is generally not well documented in the literature

- Likelihood of occurrence – topics which are already emerging and have well documented evidence about their nature are likely to gain more attention on this criterion.

- Strength of concern about the issue – this is sometimes evident from the tone and choice of language used in the literature

Based on the literature evidence, the topics which should be the prime contenders for selection as foresighting topics are: the impact of ICT or financial crisis, with implications of globalisation and trends in HRM as potential alternatives. ICT was less well developed subject in the literature, which might be indicative of the novelty of innovations in the area, and potentially worthy of scope for analysis of unforeseen risks. Financial crisis is a topic which dominates much of the literature from EC institutions and agencies and a subject of much policy concern because of its potential impact on vulnerable groups of workers. Globalisation emerged as being of concern because of its pervasive potential influence across all EU member states and potential for generally negative rather than positive impacts. HRM trends are striking for the capacity of this topic to link to and encompass others.

3.2 Priority rankings of topics by stakeholder interviewees and survey respondents

The findings from the combined rankings of the five proposed topics by the stakeholders interviewed and surveyed are presented in Tables 3.1 and 3.2 below. We then discuss the experts' justifications for their selection (or rejection) and any suggested focus on sub-themes within a topic.

Table 3.1: Interview rankings of potential foresighting topics

	Importance rating (1st = highest)			Average Rating	Frequency	Average Ranking*
	1st	2nd	3rd			
Impact of Financial Crisis on Nature of Work and OSH	3	2	0	1.40	5	3.00
Impact of Service Sector Growth	3	3	0	1.50	6	3.50
Impact of ICT and work location on OSH	7	5	0	1.42	12	1.50
Impact of Globalisation on Work and OSH	0	3	4	2.57	7	4.00
Impact of trends in HRM and how workers are managed on OSH	4	3	1	1.63	8	3.00

* Average ranking = (rank of average rating + rank of frequency) / 2

The impact of ICT and work location on OSH received the highest average ranking of 1.5 from interviewees, followed by impact of trends in HRM and how workers are managed on OSH and the impact of financial crisis on the nature of work and OSH.

For the survey, respondents were asked to distribute 10 points across five general topics according to each topic's importance as a potential foresight subject. Possible ranking options ranged from 0 = of little/no importance to 10 = of great importance. The five topics along with the average score and distribution of points each received are detailed in Table 3.2.

The topics ranked in order were:

- Impact of information and communication technology on work and occupational health and safety with an average score of 2.53. Fifty per cent of respondents gave this topic a score of three or more, and 2% gave it a score of zero.
- Impact of globalisation on managing work and occupational health and safety, with an average score of 2.27. Thirty-seven % of respondents gave this topic a score of three or more, and nine % gave it a score of zero.
- Financial crisis and recovery with an average score of 2.13
- Trends in human resource management practices with an average score of 1.92
- Service sector growth with an average score of 1.64.

Table 3.2: Distribution of survey points across potential topics for foresight study

	Average	0 points		1 point		2 points		3 points		4 points		5 or more points		Total No. of Respondents
The impact of the financial crisis and recovery on work and occupational safety and health	2.13	12	20%	8	13%	15	25%	15	25%	8	13%	3	5%	61
Service sector growth and implications for work and occupational safety and health	1.64	6	11%	20	36%	23	42%	2	4%	2	4%	2	4%	55
Impact of information and communication technology on work and occupational health and safety	2.53	1	2%	14	23%	15	25%	17	28%	8	13%	5	8%	60
Impact of globalisation on managing work and occupational health and safety across organisations and national borders	2.27	5	9%	11	20%	18	33%	9	16%	9	16%	3	5%	55
Impact of trends in human resource management practices on work and occupational health and safety	1.92	4	7%	23	39%	16	27%	10	17%	3	5%	3	5%	59
24 people (40%) also answered other from which the major themes were:														
The rise in occupational cancers/diseases and role of chemicals as a causal agent	7.00	n/a	n/a	0	0%	0	0%	0	0%	1	12%	7	88%	8
The impact of continued demographic changes on the workforce, particularly age and retirement	4.80	n/a	n/a	0	0%	0	0%	3	60%	0	0%	2	40%	5
Regulation and enforcement of OSH	7.67	n/a	n/a	0	0%	0	0%	0	0%	0	0%	3	100%	3
New forms of industry/manufacturing, particularly use of robotics	6.00	n/a	n/a	0	0%	0	0%	0	0%	1	33%	2	67%	3
The impact of climate change, particularly natural disasters	6.33	n/a	n/a	0	0%	0	0%	1	33%	0	0%	2	67%	3

Comparing the overall rankings of topics by survey respondents with interviewees shows that the impact of information and communication technology on work and occupational health and safety was consistently rated as being of highest importance by both groups. The impact of financial crisis was ranked third by both groups, while interviewees ranked impact of trends in HRM as second and survey respondents ranked impact of globalisation as second.

3.2.1 Impact of ICT and work location on OSH

The topic which received the highest ranking and greatest number of recommendations was a combination of ICT and work location. Interviewees drew attention to the close links between the two subjects, argued that they should be considered together and focussed in their discussions on ICT as a driver of work locations. Following discussion with EU-OSHA, the two topics are therefore combined in this discussion. Even if the topics are split, ICT is still ranked as the top expert choice, because it receives the highest number of first and second place rankings (four each) and the joint highest frequency of recommendations.

Experts argued the importance of investigating ICT because of its pervasiveness across most sectors and many different types of jobs. It will also have effects across all EU member states. One felt that ICT would be present in every element of work in a way that we cannot yet predict. They noted that as ICTs become more important, even simple tasks are dependent on it. They pointed to most elements of sales or supply functions being reliant on ICT. Knowledge-based companies using ICT for product design and development are now also integrating their activities with manufacturing and production of goods and services through supply chains. Another warned of the continuing growth and potential of the internet as a driver of OSH risks connected to ICT.

Two argued that ICT was too broad for a foresight study and one rejected it entirely on those grounds. One interviewee argued that it was too broad and complex to be suitable for foresighting, unless a specific topic was chosen. This could be difficult because of the inter-relationships and influences between many forms of ICT devices. One argued that changes in work location was not worthy of attention as a foresight topic because most workers would only be doing this for some of their working time, so the expert did not perceive it as creating higher OSH risks.

Interviewees recommended that EU-OSHA should consider the following specific ICT developments within any foresighting study:

- the potential risks and benefits of using ICT in monitoring health and wellbeing. Three experts recommended this topic, arguing that benefits may arise from spotting health problems early or providing remote warnings about imminent health risks but using ICT to monitor performance may increase stress, which was also suggested by a fourth expert. These individuals argued that the benefits as well as the risks of ICT should be examined within any foresight study. This sub-theme was also noted as being of interest by survey respondents who gave it an average point score rating of 1.72. In addition, two survey respondents separately nominated the sub-them of monitoring/controlling workers' performance via ICT and gave it an average score of 6.

- the impact of increasing robotisation of work. Three experts recommended investigating this topic in detail. One suggested a focus on the healthcare sector, and one suggested examining use of robots in logistics. Another expert recommended a broad focus covering how robotisation might affect job demands, personal wellbeing and impact on worker identities.

- impact of ICT especially that of smart phones on work life balance, where two experts were concerned that expectations of constant availability was leading people to work longer and unsocial working hours and to affect their work life balance even when they were not supposed to be officially working. Survey respondents shared these concerns and gave this sub-theme an average point score rating of 2.47. Forty-three per cent of respondents gave this topic a score of three or more, and eight % gave it a score of zero.

- implications for psychosocial OSH risks arising from work intensification, caused by potential demands for 'connectivity' to ICT especially from smart phones, which was raised by two experts. This is strongly related to the impact of smart phones on work life balance.

Other topics all suggested by one person each were:

- broad implications for OSH of being able to work from anywhere at any time enabled by ICT
- OSH risks from decreased job autonomy where companies choose to automate as many tasks as possible to minimise human error
- how increased mobile working could lead to disregard, or ignorance, of important OSH issues among employees who work from home. This suggestion was complemented by another expert who recommended investigating how different managerial structures and work practices for mobile workers affect whether and how people assess and report OSH risks. Another expert recommended investigating OSH risks and management of workers in public locations such as cafes and airports, with a focus on management style as well as formal OSH policies and procedures
- cybersecurity where hacking or accidental interference in automated/electronic processes could jeopardise effective OSH management or directly expose workers to risk or harm,
- implications for OSH insurance of mobile working, in terms of what activities and in which locations, provision covers and the feasibility of actions workers and firms are required to comply with to ensure insurance validity is maintained, and the potential limits and risks of OSH insurance policies
- the demands that ICTs create for emotional resilience when workers experience constant demands to 'react' to ICT. This links to the emotional labour dimension of service sector growth.
- the potential OSH benefits and risks from combining nanotechnology, ICT and biotechnology
- the influence of environmental sustainability pressures on people to working remotely and implications for management of OSH
- risks and challenges for effective OSH management for workers not based in a single designated workplace especially for health improvement activities and potentially reduced opportunities for managers to have a positive influence over workplace health.
- new psychosocial OSH risks arising from increasing time spent in travel for work, e.g. via commuting in large cities and urban environments

Two experts argued that a broad definition of ICT beyond the obvious impacts of devices such as PCs and mobile computing technologies should be adopted to produce a rich study, and that the emphasis should be on emerging psychosocial rather than physical risks, since the former are less well understood and may be growing in importance.

Within the theme of ICT and work location, additional topics suggested by survey respondents included:

- musculoskeletal disorders from intensive use of ICT with an average rating of 2.48. Forty-five per cent of respondents gave this topic a score of three or more, and 2% gave it a score of zero.
- stress from failures in IT services, managing information overload and lack of autonomy as IT monitors and controls pace and sequence of work tasks with an average rating of 2.30
- the role of Massive Open Online Courses in raising awareness and spreading good OSH practice with an average rating of 1.58.

A single survey respondent each suggested the additional sub-themes of non-keyboard IT interfaces, privacy issues as a result of ICT, wearable computer devices, the challenges for ageing members of the workforce who find it more difficult to adapt and learn to use new ICT, and information overload resulting from a proliferation in the amount of data people are required to handle and process in their jobs.

3.2.2 Impact of trends in HRM and how workers are managed on OSH

The second prioritised topic was the impact on OSH of trends in HRM and how workers are managed, which was mentioned by the second largest number of experts and received the second highest number of first place rankings. Three interviewees argued strongly in favour of this topic, stating that it provided a flexible but focussed lens through which some of the other shortlisted topics could be investigated, such as financial crisis, use of ICT and how work location and emotional labour implications of service sector growth. They particularly stressed the roles of managers as key decision-makers who influence how economic trends affect the nature of work and how pressures that influence OSH risks and outcomes are experienced by workers. One argued that management and leadership was such an important topic that it deserved a foresight study entirely devoted to it. For example, managers are critically important in how the effects of financial crisis, intensified customer pressures and new developments in ICT are felt by workers, because they make choices both about how to respond to these pressures in terms of business strategies and HRM practices, and also responsible for managing OSH prevention and mitigation of risks. One also noted that this focus would help draw attention to the importance of OSH within mainstream HRM and management activities for managers and policy makers.

One expert argued against the choice of this topic and felt that trends in HRM were only important in as far as the impact of tight deadlines and monitoring of work were concerned due to the psychosocial risks created. This concern was shared by survey respondents who allocated the impact of tighter performance management techniques to increase productivity the highest average point score for all topics of 2.41. Thirty-nine per cent of respondents gave this topic a score of three or more, and 5% gave it a score of zero. This concern would also constitute one of the different methods used to try to enhance productivity noted in the list below.

Interviewees recommended that EU-OSHA should consider the following specific HRM issues within any foresighting study:

- leadership of OSH and the role of middle managers in handling psychosocial risk issues
- changing financial governance of companies through foreign ownership, subsequent impact on HR and management of OSH to avoid and mitigate risks
- the consequences of different methods of trying to increase employee productivity, demands made on workers and arising psychosocial hazards as a result of a more competitive business climate
- the role of managers in managing during and after austerity, challenges and issues for engaging and training them to manage psychosocial risks effectively
- challenges of managing psychosocial risks and hazards in micro and small enterprises with up to 50 staff, where access to OSH and HR expertise is likely to be limited and firms have fewer resources to invest in OSH
- the risks and potential for large firms to act as suppliers of preventive OSH services to small firms and to sell these services through their supply chains.

Within the theme of trends in HRM and how workers are managed, additional topics suggested by survey respondents included:

- organisational cultures and attitudes, which had an average point score of 2.27. Twenty-four per cent of respondents gave this topic a score of three or more, and 3% gave it a score of zero
- influence of flatter management structures on how work is managed/organised - 2.02,
- trends in reward systems and performance-related-pay - 2.00,
- pre-employment screening of workers - 1.73.

A small proportion (5%) of respondents also suggested other topics that they considered important; one person each suggested examining the OSH risks of balancing job demands/control, the implications of employee engagement for discretionary effort and OSH risks, and the OSH risks of 'hire and fire' approaches to staffing.

3.2.3 Impact of the financial crisis on the nature of work and OSH

The third possible topic was the impact of the financial crisis on the nature of work and OSH. A small number of interviewees ranked the financial crisis in their top three topics, but those that did chose it ranked it consistently in the top two most important positions. Interviewees felt that the full impact of recession was yet to be fully understood. One believed that the effects would deepen in future years, especially in Europe, arguing that the problems in the financial sphere that caused the crisis have not been adequately tackled.

Experts identified a mixed range of possible topics for investigation resulting from the financial crisis and one stressed the importance of using a qualitative approach to understanding its impact because trends show inconsistent and contradictory evidence across different sectors and different countries. Two others however, suggested that it was more important to monitor quantitative trends and indicators than to use qualitative methods to understand its impact. One expert strongly recommended not selecting this topic, arguing that its impact would not last more than another 3-4 years and believed that the changes involved to employment contracts and working time were not particularly prevalent.

Interviewees noted that EU-OSHA should consider the following specific aspects of financial crisis within any foresighting study:

- Impact on OSH risks and management for workers in the public sector and how this filters through to the private sector either directly through contracting arrangements among firms with public sector customers or through the example the public sector sets as a 'model' employer
- Casual work, precarious work, flexible, zero hours and short-term contracts – five experts pointed to a need to understand their impact on job insecurity and potential health risks arising. One was also interested in whether negative health/accident outcomes for part-time workers also affect workers with other forms of flexible contracts. One suggested that it would be worth focussing this topic on high risk sectors and areas but was not able to specify which those should be. Among survey respondents this topic received a relatively high average rating of 2.43. Forty-eight per cent of respondents gave this topic a score of three or more, and 7% gave it a score of zero.
- Potential impact on social cohesion, OSH risks of rising inequality, reduced social mobility and reduced social/welfare provision due to austerity measures in public spending.
- How economic pressures faced by companies influence OSH risks of intensified work from longer, more pressurised working hours coupled with emotional demands placed on workers. This topic was also raised as a concern by survey respondents who gave it a rating of 2.51. Forty-four per cent of respondents gave this topic a score of three or more, and 7% gave it a score of zero. It is worth noting that work intensification also emerges as a concern among experts who selected the impact of ICTs and trends in HRM as their preferred topics for investigation, suggesting that this is a transversal theme.
- Impact of economic pressures on those delivering OSH services, what investment cuts and levels may mean for priorities in OSH services. This was a concern shared by survey respondents who gave an average rating for reduced public and private investment in resources of 2.11. A related theme which was the most common suggested by four out of nine survey respondents who nominated alternative themes was the impact of national investment levels, budgets allocated and resource shortages for OSH. These individuals gave an average score of 5.50 to this topic.

Within the theme of financial crisis, additional topics suggested by survey respondents included:

- rising numbers of SMEs/self-employed workers with an average rating of 2.14
- stress caused by role ambiguity and conflict - with an average rating of 1.25.

These are potentially significant topics with major implications for OSH. Role ambiguity and conflict fits within the theme of trends in HRM, how jobs are designed and how far workers are protected from or exposed to the consequences. The rising numbers of self-employed workers and SMEs was noted in the literature review and could be accommodated within a broader study of impacts arising from thefinancial crisis.

3.2.4 Impact of Service Sector Growth on Work and OSH

The fourth prioritised topic was the impact of service sector growth, with an emphasis on the broad psychosocial risks and emotional demands that this places on workers through interaction with customers. Experts who selected this topic were evenly divided between those who ranked it in first and second place. They argued that the service sector has been expanding rapidly, that even larger proportions of people will work in these industries in the future and that some industries within the service sector carry particularly high OSH risks for workers where preventive and mitigating OSH strategies are not well developed. Some noted that primary industrial sectors such as manufacturing and construction have received most attention within OSH policy and practice and growing risks in the service sector have been a little overlooked.

The experts all focussed on one particular industry of personal care services within the service sector as being of particular concern and more details of their justification for its selection are now provided. It should be noted though that the service sector is a very broad one and other industries may deserve attention within a foresighting study but were not prioritised by interviewees, who selected the focus of the study based on their assessment of the high OSH risks it poses for workers. Experts highlighted the growing demand for care services as a major industry within this sector that should be investigated. They pointed to the growth of an ageing population and those experiencing chronic long-term conditions, with an expectation that these services would be provided in people's homes. People working in these jobs often come from groups which tend to have higher OSH risks such as migrant workers. Additional concerns included the nature of the personal care industry where experts argued that job quality, status and pay were low, increasing the potential vulnerability of workers to accept rather than challenge OSH risks.

Experts noted that among workers who have contact with customers, the quality of those interactions is an important source of competitive advantage for companies who are seeking to differentiate themselves from other firms and who rely on quality of customer service to improve their organisational performance. They stated that there were concerns about how effective managers are at supporting staff who have difficult or demanding contact with customers or patients.

Interviewees noted that EU-OSHA should consider the following specific aspects of service sector growth within any foresighting study:

- OSH risks arising from personal services and personal care work. One expert felt that this involved a lot of personal interaction, that workers were required to operate autonomously and two felt that the mobile nature of occupations such as domiciliary or care for people in their homes meant that workers may have little access to management support. This was supported by survey responses where implications of growth in industries such as residential care homes and hospitals, home deliveries, catering, cleaning received an average rating of 2.41. Thirty-seven per cent of respondents gave this topic a score of three or more, and 5% gave it a score of zero.
- OSH risks of exposure to toxic drugs used by clients such as those required for chemotherapy.
- How to regulate and manage OSH in an environment which is not a designated workplace but a client's home.
- One expert stated that all the sub-themes listed were worth investigating.

Among survey respondents, the ratings allocated to other topics in descending order of importance were:

- stress from dealing with difficult customers, clients, patients - 2.39. Thirty-seven per cent of respondents gave this topic a score of three or more, and 2% gave it a score of zero.
- automation and robotisation of service sector jobs - 1.95
- risks of high wage, high skilled and low wage, low skilled jobs in service industries - 1.93
- new types of workplaces in the service sector - 1.84.

A small proportion (12%) of respondents suggested alternative sub-themes that they considered important. Two identified implications for specific labour market groups, such as migrants and ageing workers, and the other two highlighted excessive working hours as important. These topics received an average score of 6 to 6.50 from these individuals. Working hours are an important source of

potential risks to health and wellbeing which are not specific to the service sector and could be considered in relation to a number of foresighting topics such as use of ICT and the financial crisis, while EU-OSHA has recently conducted work on migrant labour and ageing workers.

3.2.5 Impact of Globalisation on Work and OSH

The fifth prioritised topic was the impact of globalisation. This was mentioned by the third largest number of experts. Equal numbers rated it as third and second priority, but none rated it as their top choice. This is because they believed globalisation was an important contextual driver of new potential OSH risks rather than an important topic in its own right. The potential volume of workers that could be exposed to OSH risks from globalisation is arguably more limited than other foresighting topics because it may be confined to those working for multi-national companies or in supply chains with a customer located in another country. Those who did recommend this topic pointed to the very important influence that relationships between organisations have on how OSH risks are identified and managed, and the potential for good or poor practice to be diffused down supply chains. Experts noted particular concerns about poor practice being spread from developing countries outside the EU which may have weaker OSH regulation and poorer practice.

Interviewees noted that EU-OSHA should consider the following specific aspects of globalisation within any foresighting study:

- Sources of OSH risks arising for workers in lower tiers of supply chains. This was noted as a major concern by four experts. One recommended a particular focus on supply chains where firms choose to outsource high risk activities. Concerns about health and safety arising from global supply chain were shared by survey respondents who gave it the highest average point score of 2.71 among all the sub-themes for the topic of globalisation. Fifty-six per cent of respondents gave this topic a score of three or more, and 3% gave it a score of zero.
- Sources of OSH risks arising from uneven OSH regulation, policies and practices across countries within and outside the EU. Two experts noted that this was important because of the difficulties of influencing OSH practice in workplaces which are owned by foreign firms. One gave the example of the collapse of a textile factory located in Bangladesh which made clothes for firms based in Europe. This concern was supported by survey respondents who gave it the second highest an average point score of 2.16, in addition to one respondent who listed the related challenge of applying cross-border regulation in its own right. Thirty-seven per cent of respondents gave this topic a score of three or more, and 9% gave it a score of zero
- OSH risks arising from requirements to work unsocial hours to meet the demands of customers located in countries in different time zones. This links to the OSH risks arising from ICT which enables people to work remotely or outside standard working hours. Some survey respondents shared this concern and gave it an average point score for priority of 1.62.
- OSH risks arising from diseases spread from non-EU to EU countries through worker contact along supply chains. One example of this was the SARS outbreak in 2002/3.
- OSH risks arising from intensified global competition from Asian economies and cost pressures on firms which may lead to pressures of work intensification in the quest for improved productivity accompanied by reduced investment in OSH prevention and mitigation activities. Survey respondents noted a more general concern about the growth of emerging economies with an average point score of 2.03.
- OSH risks arising from business relationships and company networks, which may create acceptance of low standards and poor practice in some sectors. One expert noted transport and construction as sectors which were worth investigating from this perspective.

Within the theme of globalisation, other topics of concern for survey respondents were the general one of implications of working across borders and different cultures with an average point score rating of 2.07.

3.2.6 Additional topics recommended by stakeholders

As an alternative to picking preferred topics from the list emerging from the literature review, experts were invited to suggest their own topics. The topics suggested and an assessment of their potential are set out below:

- Role of managers managing after austerity, how they can be engaged and trained to manage psychosocial risks effectively – this appears to be an extremely important topic based on the strength of feeling among experts and the range of associated issues. However, this topic could potentially be accommodated within the broader theme of HRM trends. In addition, examining the role of managers in reducing risks requires those risks and the hazards causing them to be identified, so this topic requires some expansion for it to be a suitable subject for a foresight study. For example, this could be incorporated within a foresight study on the impact of the financial crisis on OSH and how to manage OSH during and after economic recovery.

- Identifying risks associated with new (bio)chemicals and nanotechnologies and developing early stage detection systems/processes. This is a highly specialist and technical topic, which lends itself less easily to a general foresighting study. Various studies have already been undertaken by EU-OSHA on nanotechnologies (see at https://osha.europa.eu/en/topics/nanomaterials). The challenges of developing early warning mechanisms is a potentially interesting topic but is highly technically specific; it would be suitable for a specialist study of another nature than a foresighting study.

- Impact of stress on brain function caused by work demands/insecurity of work because long-term effects on brain function are unknown and may have differential effects according to whether stress is positive (e.g. engagement) or negative (e.g. burnout). This is a very important topic and merits further exploration. However, the nature of the topic does not lend itself to a foresight methodology; instead an empirical experimental approach using physiological monitoring may be more appropriate.

- Impact of brain enhancement drugs and tools in workplaces. The use of brain enhancement drugs and tools (e.g. computer based products) are starting to spread and become normalised within society but one expert noted that the exact details and effects are unknown. The expert was particularly concerned about blurring of boundaries between acceptable drugs (e.g. caffeine) and unacceptable forms (e.g. illegal drugs). This is a very important topic and merits further exploration. However, the nature of the topic does not lend itself to a foresight methodology; instead an empirical experimental approach using physiological monitoring may be more appropriate. However, the general potential OSH risks arising from use of artificial stimulants could be included as a topic within a broader foresight examining potential health risks to employees from management efforts to increase productivity and OSH risks arising from work intensification, either in relation to demands posed from ICT or broader HRM trends. This topic was partly explored as part of EU-OSHA's foresight of new and emerging risks in green jobs in relation to new green manufacturing techniques and the growing use of collaborative robots that, in the context of a highly competitive society and working environment, may contribute to workers increasingly turning to performance-enhancing drugs and technologies in order to keep up with robots (EU-OSHA, 2013c).

- Impact of working until later in life and how different retirement systems may influence this, and OSH risks and assessment methods for older workers. The topic of OSH risks for older workers has already been the subject of some research by EU-OSHA and is also encompassed in the theme of trends in HRM issues, through the potential increase in workforce diversity by age and other factors. The influence of different retirement systems will be an important driver of labour market engagement and potential exposure to OSH risks among older workers. This report concludes that the topic is more important as a contextual influence of change rather than as a foresight topic in its own right because the focus is at a policy level rather on the potential sources of OSH risks in the workplace.

- Technological and IT developments in the manufacturing sector and how these impact on OSH because this sector appears to be most significantly and rapidly affected by developments in IT

(e.g. 3D printing). Robotics and their role in transport, distribution and the service sector more generally. This topic was partly explored in relation to the introduction of new green manufacturing techniques as part of EU-OSHA's foresight of new and emerging risks associated with new technologies in green jobs (EU-OSHA, 2013c). This is an important potential topic but it could be accommodated in a study with a wider focus. Manufacturing or services could be included as a sector of particular interest within a broader foresight study on the impact of ICT.

- Implications for occupational cancers and diseases from the increased role of chemicals in organisational contexts was the most common topic among the 40% of respondents who suggested other topics for consideration as foresight subjects. Eight out of 24 respondents nominated this with an average score of 7.00 among those suggesting it. This is a relatively specialised topic which requires detailed epidemiological forecasting and assessment, and is therefore less suited to the methodology employed in a foresight study.

- Regulation and enforcement of OSH – this is a potentially very significant topic and could be considered in relation to any of the major themes chosen for foresighting as an underpinning and cross-cutting theme.

- The impact of climate change, particularly natural disasters. While the relative impact of these events can be devastating for those affected, the likelihood of their occurrence and scale of impact is likely to be lower across Europe as a whole than other parts of the world for some of the topics. The range of disasters is potentially very broad and the location of their occurrence may be difficult to identify.

3.3 Conclusions based on combined analysis of literature review, interviews and survey

On balance the findings of the literature review and expert interviews point to the topics of trends in HRM, ICT developments and the impact of the financial crisis as being the three most promising topics for a foresighting study. For ICT this is because of the pervasiveness of its impact across different types of jobs, sectors and workplaces, the rapid pace of development and novelty of ICT applications and level of concern voiced about potential OSH risks arising. For HRM trends, this is because managers in organisations have substantial levels of influence over the level and type of OSH risks that workers are exposed to. Managers make decisions about the working time and contractual arrangements of workers, choose how to respond to competitive pressures and make decisions about policy on ICT and work location. A foresighting study on this topic would also offer the potential to show the significance of OSH within broader, general management activities and help to raise its profile among policymakers and employers outside the traditional and more narrow focus of 'health and safety' issues to include important dimensions of OSH such as well-being, which are less well explored in existing research. Experts emphasised the importance of focusing on hazards which would create psychosocial rather than physical risks, regardless of the precise topic investigated, because they felt this was the major area of hazard growth, partly because of growth of service sector industries. This stance was partly reflected in the literature, although documentary evidence retained more of a flavour of traditional health and safety including accident prevention in primary industrial sectors. It is also important to stress that the literature notes that *combinations* of risks and their compound effects for health e.g. psychosocial strain leading to physical illness are recommended for more detailed investigation (SUVA, 2011).

3.4 Methodological issues in undertaking foresighting

This section discusses some of the methodological issues and concerns in undertaking foresighting studies. It first reviews the strengths and opportunities that foresighting methods present and notes some of the weaknesses and areas that need careful consideration in using foresight methods for research. Secondly, it reports evidence and views from interviewees who had participated in the EU-OSHA study on new and emerging risks in green jobs as well as other foresight studies, with information on foresighting techniques used within existing studies. Last it makes initial recommendations for consideration by EU-OSHA in planning any further foresighting study.

3.4.1 Review of foresighting methodologies and recommendations

Most foresight projects use a combination of methods. Alongside the more specialised approaches developed within futures research – for example, drivers analysis, Delphi studies and scenario building – generic methods such as qualitative interviewing and literature reviews are commonly used. The most comprehensive resource available on futures methods – providing theoretical background and practical implementation guidance – is the Millennium Project's *Futures Research Methodologies v3.0*. It reviews 39 futures research methods, illustrating the diversity of techniques and tools that are available to Foresight practitioners (Glenn and Gordon, 2009). These methods are of different orders and types. Some – for example, scenarios – are more holistic and can subsume or integrate other techniques – whilst others have a narrower focus. Some of the 39 methods have wider applications in other types of research for example, statistical modelling, and agent modelling, although they have been used in foresight exercises.

A Foresight process is the appropriate and unique mechanism to address the following:

- Deal with uncertainties
- Offer an integrative framework to coalesce and synthesise deep disciplinary or domain level knowledge – often to address a problem that spans individual boundaries
- To improve the capacity of organisations individually and collectively to anticipate future changes – to maximise opportunities and to mitigate risks
- To engage with stakeholders from different organisations and communities on issues of common interest – often to build a shared understanding of future challenges and needs

A review of almost 900 foresight exercises documented within two European-based initiatives outlined the methods commonly used in foresight activities, including literature reviews, trends analysis, scenarios, Delphi, and expert panels (Popper, 2008). These are summarised below. These methods were also most often used in combination and illustrates that the most commonly used methods in Foresight activities are qualitative or semi-quantitative.

These methods serve the main purposes and objectives of foresight exercises via exploring the knowledge base (through literature reviews and scans), engaging expert views (through expert panels and Delphi studies), understanding potential linkages and inter-relationships between domains and systems, the complex co-evolution of phenomena and conditions (scenarios), and forming and expanding networks of key actors from a range of institutions.

3.5 Assessment of individual foresight methods

3.5.1 Literature Review – including trends and drivers

Most foresight exercises include a Literature Review phase, often analysed according to categorisations such as STEEPV (Social, Technological, Economic, Environmental, Political, Values Themes) and guided by the main scope and themes of the exercise. Sources generally include scientific and grey literature, and reviews tend to take account of views of trends and potential changes in the thematic area.

Advantages: literature reviews are considered essential in most exercises to establish a knowledge base of the foresight theme, including assessments of anticipated changes. They help to reveal gaps in knowledge and uncertainties. They also help to develop a broad understanding of the topic area, particularly where multiple themes or 'lenses' are used (STEEPV etc.). Most stakeholders value the 'scientific' nature of literature reviews, which can improve buy-in and the degree of acceptance of foresight products and projects.

Disadvantages: literature reviews can be time-consuming and may require significant resources (time and cost). For example, a foresight literature review might analyse 300-400 published documents. The lead-in time for scientific publications (which can be several years from the date of the original research) can undermine the contemporary value of such products. This often increases the reliance on grey literature.

A reliance on trends analysis can constrain thinking within historical or established patterns of development, which can blind participants to alternative, more disruptive influences.

Overcoming the disadvantages: incorporating disruptive factors or drivers helps to overcome the 'business as usual' perspective that can permeate trend-based thinking and analysis. A selective literature review which applies carefully defined parameters can reduce the likelihood of including material which adds limited value.

3.5.2 Scenarios

The use of scenarios within strategy, organisational development and forward-looking studies has evolved over a number of decades. Scenarios are depictions of possible future states characterised by different framing conditions (economic, technological social etc). Many case studies have been written on the implementation of these methods in a variety of organisational settings, from the pioneering work of Shell in the corporate world to publicly funded bodies (for an illustrative case study, see Rhisiart (2013)). van Notten et al. (2003: 426) construct a scenario typology using three overarching themes: project goal: exploration vs. decision support; process design: intuitive vs. formal; and scenario content: complex vs. simple. Börjeson et al., (2006) identify three types in their review of scenario studies based on the primary functions and questions:

- What will happen? (predictive; forecasts/what if (contingency))
- What can happen? (explorative)
- How can a specific target be reached? (normative)

Bishop et al (2007) offer an assessment of eight different categories of scenario techniques. Table 3.3 sets out some of the advantages and disadvantages of these techniques and also uses the typology – of three scenario types – offered by Börjeson et al., (2006).

Table 3.3: *Advantages and Disadvantages of Selected Scenario Techniques (adapted from Bishop et al., 2007)*

Type (primary focus)	Technique	Advantages	Disadvantages
Predictive	Baseline Development of an 'expected' scenario – based on extrapolation of existing trends into the future (either by judgement or by mathematical techniques)	Easiest for client/audience to accept because generally expected already	No alternative scenarios proposed
	Cross-impact analysis A matrix of columns and rows, in which the goal is to assess the probabilities of events happening. Rather than doing this in isolation, contingent or conditional probabilities with other events in the matrix are used.	Calculates the final probabilities of alternatives or end-states based on rigorous mathematical procedure	Almost impossible to validly estimate the conditional probabilities or impacts of all alternatives against the others
	Modelling Systems models are mainly used for baseline forecasting. Typically they use equations to estimate the changes of the effects on the variables in question between the present and the time horizon.	Creates the best quantitative representation of continuous variables that describe the future state	Difficult to validate the models without complete historical data

Type (primary focus)	Technique	Advantages	Disadvantages
Explorative	Elaboration of fixed scenarios. Participants are given scenarios that are already constructed (e.g. a high-tech future). They are then asked to discuss the implications of this scenario.	Easiest for client/ audience participation because scenario kernels/ logics are done for them. Provides in-depth elaboration of alternative scenarios	Generic scenario kernels might not be relevant to client/audience; therefore less buy-in
	Dimensions of uncertainty The key dimensions of uncertainty are identified and then used as a base for alternative scenarios. An example is the GBN 2x2 matrix, in which (usually) four scenarios are developed around two axes representing key uncertainties.	Best for considering alternative futures as a function of known uncertainties	Less creative because may not consider some novel developments that are not currently considered uncertain
Normative	Backcasting This technique sets out a normative future – usually a preferred vision for the thematic area in question. It then works backwards from the preferred vision to form a map of actions and milestones to get there. This includes the identification of barriers and enablers.	Creative because it decreases the tendency to extrapolate the future based on the past and the present; therefore can provide new insights. Also results in a sequence of events or breakthroughs	Fantastical nature of the mission or end-state might reduce buy-in for client/audience

Dimensions of uncertainty – the GBN intuitive logics approach

The 'dimensions of uncertainty' group of techniques – with its exploratory function to assess a range of possible scenarios that emerge from a common set of uncertainties – is applied widely. Within this group, the GBN 2x2 Intuitive Logics model developed by Pierre Wack – and disseminated through the work of others (Schwartz, 1991; Van der Heijden, 1996) - is the best known and probably the most popular scenario method practised. The scenarios are constructed according to the two most significant and uncertain driving forces, which provide the scenario logics for populating a 2x2 matrix. Further to the general observations in the table above, it has certain advantages and disadvantages.

Advantages: it is relatively straightforward to implement and can be adapted to different workshop lengths. It has 'the right mix of technical sophistication and ease of use for a professional audience' (Bishop et al., 2007: 20).

Disadvantages: although it has been referred to as the 'gold standard of corporate scenario generation' (Millet, 2003: 18), the focus on two dimensions leads to a relatively constrained view of potential future changes.

Futures Literacy – the Hybrid Strategic Scenario Method

A significant contribution to the development of new, theory-informed scenario creation methods has been the Hybrid Strategic Scenario Method (Miller, 2007). It is a participatory, learning-by-doing approach; it depends on the participation of relevant stakeholders in intensive workshop discussions. The 3-stage process works as follows.

- Level 1 surfaces the expectations of participants – how they expect the future to unfold in the thematic area (with underlying norms and assumptions).
- Level 2 takes participants through a 'rigorous imagining' process, where the framing conditions of life in the thematic area are radically different (e.g. in the systems of economic production, social systems, institutions).
- Level 3 focuses on strategic scenarios and strategic choices in the present – based on the rigorous imagining of changed conditions.

Advantages: drawing on advanced theory and knowledge, the method facilitates the development of new strategic choices and decisions in the present – bases on rigorous imagining and strategic scenarios.

Disadvantages: this requires specialised skills and knowledge on the part of the design/facilitation team. In cognitive terms, it is challenging and may not be as accessible to all participants.

Given the diversity of approaches to developing and applying scenarios, it is difficult to provide a simple assessment of advantages and disadvantages of the scenario method as a whole – although the above points identify some of these for specific techniques.

The following points indicate some of the benefits and some of the challenges of running scenario exercises.

Advantages: the benefits are that scenarios are synthetic storylines that portray alternative futures given the differential interplay of key driving forces. They are generally underpinned by solid evidence gathering and analysis and offer a powerful framework to challenge cognitive models and elicit important strategic discussions on potential changes and their implications. Although they necessarily simplify potential future realities, they are unique as a foresight tool in their capacity to convey complex processes of change in an easily understood format.

Disadvantages: The potential disadvantages of scenario-based approaches are first, that scenario processes are generally time-consuming and require relatively significant resourcing. One-day and two-day intensive workshops are often used to work through a scenario method, but this usually requires significant preparation and follow-up work for the delivery team (and sometimes for participants). Second, publishing a scenarios report often takes place before a significant phase of testing or development e.g. of strategies or programmes and engagement e.g. disseminating of results and engaging key stakeholder groups. Organisations working with scenarios tend to neglect to think about post-reporting utilisation and how to enhance impact (for example, for public organisations), ensuring that there is communication and engagement plan or approach internally with staff and externally with relevant stakeholders.

Overcoming the disadvantages: Organisational stakeholders can often misinterpret the nature of scenario exercises, and the types of results that they deliver. For example, for those approaching the scenario exercise expecting prediction-oriented outputs, a lack of forecasts or preferred scenarios can be disappointing and result in lower engagement with foresight outputs. Communicating the nature of scenario processes – what they are and importantly what they are not – and managing expectations are important issues for directing scenario exercises.

Wright et al. (2013) point to the utility and effectiveness of scenario methods, particularly where they are enhanced with other methods such as Delphi and strategy evaluation. They also conclude from this evidence that there is no single method of scenario development that is superior to others.

3.5.3 Delphi

Delphi studies are used to capture judgements on possible future developments. Originally developed in the 1960s, Delphi studies have been used to explore the possible trajectories of a wide range of topics, from technologies to health. It is a structured, iterative method for collecting the views of experts on an anonymous basis. Run over two or more rounds, judgements (both numerical values and textual responses) are analysed and fed back to participants – each iteration synthesising the results of the previous round and seeking explanations for preferences and stated views.

The questions included within a Delphi are generally of three types (Gordon, 2009)

- Forecasts on the occurrence of future developments: when an event is expected or the future value of a parameter. For example, a date when a technology becomes diffused in industries;
- Desirability of some future state: what should happen (and why). For example, 'Should there be a dedicated entrepreneurship programme?'
- The means for achieving or avoiding a future state: mechanisms, actions, policies etc. For example, 'How can learning and collaboration amongst entrepreneurs be supported?'

The anonymity of respondents is considered important in encouraging independence of thought in the response of experts.

Advantages: Delphi studies generally encourages opinion change that leads to greater accuracy in forecasts compared to other, unstructured group interactions (Rowe and Wright, 1999) although the effectiveness of the method relies on the implementation process (number of iterations, type of feedback) (Rowe et al., 1991; Bolger et al, 2011).

Anonymity encourages the avoidance of groupthink so that key issues can be interrogated as independently as possible without participants facing perceived seniority/scientific rank issues. It provides capacity to develop questions and areas based on different feedback rounds, allowing particular responses and areas of interest to be probed further. It is a relatively effective way of gathering inputs from dispersed geographical communities – particularly through web-based Delphi systems. It can develop consensus or signal disagreement about the key questions under consideration.

Disadvantages: Consensus or convergence in opinion over multiple rounds does not guarantee greater accuracy in forecasting (Rowe et al, 2005; Bolger et al. 2011).

Amongst the most frequently cited issues are problems in identifying and recruiting and ensuring heterogeneity in panel membership (ensuring appropriate depth of individual topics but also sufficient coverage of areas that can be multi-disciplinary). Over multiple rounds, there tends to be a fall off of participants.

Delphis can be relatively time consuming. A Delphi involving three rounds can take three to four months (and more). Convening an expert panel can provide more rapid, direct outcomes.

There is a tendency for Delphi participants that hold a minority opinion to change their opinion to that of the majority opinion over the course of the process, particularly where their confidence levels are lower (Bolger et al,, 2011). This suggests that (majority) group pressures and thinking can occur even in anonymous settings.

Overcoming some of the disadvantages: some of the disadvantages have been addressed by adapting and learning – through decades of experience of implementation. Asking participants to self-rate their level of expertise (on a continuum of options) and the levels of confidence that they have in their answers have become relatively standardised with Delphi studies.

One of the innovations of recent years in this method is the development of Real-Time Delphi, which is conducted in one open round. Whilst it has similar challenges in some ways to conventional Delphi studies, Real-Time Delphi can be run more quickly whilst retaining the same type of value and benefits (Gnatzy et al., 2011).

3.5.4 Expert Panels

Expert Panels are convened to elicit the expertise of a limited group of individuals over a time frame (typically) of 3-18 months. It has been a relatively common method within foresight activities in the EU and the following draws on the description provided by the EU's FOR-LEARN foresight guide initiative (http://forlearn.jrc.ec.europa.eu/guide/0_home/index.htm). Expert panels are used in foresight exercises that have a substantial technological or scientific orientation. The function and composition of the Expert Panels reflects the need to engage high-level expertise and bring in solid scientific evidence to the process. Panels generally are composed of 12-20 individual experts and the remit and scope can vary but they are generally tasked with analysing the future of a given area, e.g. a technology, an application area, or an economic sector.

The implementation of the approach depends on the scope and resources provided but the panel may function as a hub to draw in a larger number of experts or scientific communities. It may do this through reviewing evidence (sometimes with the help of a technical secretariat) and producing position papers or similar outputs. Expert Panels gather and synthesise evidence, leading to new insights. Expert Panels are often used to identify priorities and recommendations for investment or policy action in the topic area. Reaching consensus may not be required for all Expert Panels but they are expected to set a clear focus or direction for action. The *modus operandi* of Expert Panels can vary – from regular face-to-face meetings of the group to virtual, online collaboration.

Advantages: Expert Panels are a way of convening experts from different fields that may not ordinarily work together. This blending of different expertise or perspectives can yield rich, synthetic perspectives on the topic area.

Through the experience and networks of individual panellists, they provide a mechanism for engagement with a broader range of scientific communities and areas of practice.

Disadvantages: some of the disadvantages are typical of group-based process, such as the influence of a dominating personality (which skews the process/outcomes towards his or her view); perceptions of seniority and respect (superior vs. subordinates) can stifle open, critical discussion and progress; a lack of familiarity with foresight may lead participants to adopt a more conventional mode of operating, which may not lead to a longer-term, holistic view of the topics under discussion.

Views of foresight participants

Overall, seven experts were familiar with the EU-OHSA foresighting study into new and emerging risks from green jobs and ten were able to comment on foresighting methods more generally. Their main views are presented under the headings below.

Clarity of purpose

Two experts pointed to the need to develop tightly focussed objectives for any research exercise, to consider its intended audience and impact. This should outline why the work is being done, what its benefit will be and what it can and cannot do to avoid confusion. Some difficulty was noted in using foresight findings effectively to stimulate policy makers to take action. The first recommendation therefore is for EU-OSHA to be absolutely clear about the purpose of any foresight exercise, to know who it is intended to influence and why. The Agency should therefore ask what it is trying to achieve through the proposed piece of research, how the research is intended to help contribute to achieving its strategic objective and to be sure that foresighting is the most appropriate tool for this purpose. This also needs to include a clear vision for what will be done with the outputs of the foresighting exercise, how they will be used to influence subsequent research or policy development activity and the development of measures to assess the success of the foresight study before the start of the project. One expert suggested that this could be used as an evaluation tool and revisited over a two to five year period to see how developments match predictions and to refine/modify future projections.

Experts noted that scenarios are a good way of opening up discussion away from a fixed agenda and can be helpful when used in an exploratory fashion so that a wide range of ideas can develop. One commented that they could be powerful in helping people to break free from thinking about OSH in the current societal and economic context and could help people to envisage implications resulting from future change to the context of work. Another found that bringing people together from a variety of backgrounds was helpful in a safe space where they could speak freely.

The major weakness noted by interviewees was in how foresight studies handle uncertainty. Interviewees noted that the way in which the findings were presented in terms of scenarios or qualitative descriptions couched in the language of 'possibilities' may not necessarily be convincing to policy makers. Likewise, some expert interviewees expressed disappointment that the 'predictions' of foresight studies do not generally materialise, while foresighting literature argues that 'prediction' is not the purpose of foresighting, but rather it is intended to help people think critically about potential future outcomes. This underscores the need to be clear about the purpose of foresighting work and to ensure that its target audiences understand what it can and cannot do. One expert expressed disappointment that their experience of foresighting studies was that they did not produce 'new' ideas, including the EU-OSHA green jobs study (EU-OSHA, 2011). Another recommended that people from unconventional creative backgrounds such as artists and scenario writers should be involved because

these people are good at thinking innovatively and coming up with new ideas. For a study of the type and subject area that EU-OSHA is considering, it is somewhat unlikely that entirely new topics will be identified that will have an effect on the nature of work with the exception of innovations that have not yet been foreseen, for example, in the field of ICT. However, it is entirely possible that new and unforeseen *risks* for OSH may emerge as a result of existing or emergent trends growing and expanding. It is also likely that some of the existing and growing trends affecting the nature of work may have bigger impacts on a greater scale than new, small or niche phenomena that may be more limited in their effects. For this reason, a recommendation made in the literature is that baseline environmental scanning of literature should take on a regular, repeated basis, rather than as a one-off exercise, as this makes it easier to monitor and spot trends (Miles, 2007).

Tailoring of mixed methods

The second key principle was to tailor the methods of foresighting for the precise objectives of the study. One expert recommended a blend of qualitative and quantitative methods because this usually caters to the diverse expectations and preferences of foresight customers and policy makers. However, it is important to quantify elements of foresighting in the most useful way possible: for example, counting bibliographic citations of particular issues, trends or drivers of change may only indicate level of current interest, prevalence of existing trends or ease of researching them rather than indicate the likely future increase or decrease and possible impact. When using multiple tools and phases for research it is important to be absolutely clear about how the different stages will relate to each other and complement each other, whether these need to take place in sequence or can be scheduled in parallel and at what stages to involve different groups of research participants. One expert recommended that DELPHI approaches should be considered in combination with a baseline literature scan and more innovative scenario development methodology. Here a literature review provides a starting position of trends, then scenarios can be used to project existing trends forward and also develop an understanding of new or unforeseen influences and DELPHI can be used to help develop the scenarios or to test out their credibility. DELPHI approaches typically involve bringing a group of experts together either face-to-face or using virtual ICT environments to prioritise a range of possible outcomes or developments identified from literature or scenario modelling. These exercises are sometimes repeated until a consensus emerges and additional information is sometimes provided to experts between the rounds of discussion. Some methods may use discussion between experts and some simply use an online questionnaire approach, potentially with forced choice alternatives. Another expert also supported the advantages of DELPHI, suggesting that this would bring structure to the foresighting process, could potentially provide access to a wider range of carefully selected experts, and that the questions posed could be more detailed. Literature also recommends this approach as producing high quality and detailed results but notes that it is a time-consuming and labour-intensive task requiring selective targeting of participants, very careful question phrasing and detailed feedback to those taking part (Miles, 2007).

Some experts drew attention to the time-consuming nature of detailed foresighting studies involving multi-phased approaches; one referred to the United Kingdom Government's foresight programme on Mental Capital and Wellbeing which involved detailed secondary evidence and commissioned reviews, an extensive consultation with stakeholders and a thorough policy recommendations process, which lasted two years.

Choice and role of participants – experts and lay practitioners

All experts who expressed views on foresighting commented on the importance of participants having an appropriate role. None commented on the precise numbers that should be involved, as this will be determined by considerations such as the scope of the topic area. It was clear from their discussions that having more rather than fewer participants was advisable to ensure an adequate knowledge base, although the cost implications were acknowledged. One expert commented that for scoping activities which tend to be narrowly focussed, the participants could be restricted to a small initial group of experts. Larger scale projects or those which require a multi-disciplinary perspective or bring together several different subject areas (such as OSH and dimensions of work) require a greater number and diversity of participants. One expert stressed that stakeholders who will have an active role in taking action or implementing recommendations made as a result of the foresight exercise must be included as participants to build their commitment to the results, although this can be a particular challenge in securing their participation if they are not close to the topic or it requires a significant time commitment.

Two experts believed that more lay people should be involved in foresight studies of the type envisaged to widen the applicability and potential pool of ideas. One argued that more experts are required. In practice, it is difficult for lay participants to have a suitable depth and breadth of knowledge of work trends, OSH and the specific topic under investigation to be able to make detailed contributions. This individual believed that to undertake a good foresighting exercise it was important to involve a wide range of expert participants. Involving experts who have detailed knowledge of work and employment issues or the specialist topic selected, with a smaller number of OSH experts may be helpful to cover the range of issues that a foresighting subject may throw up. Another expert argued for greater input from industry representatives, through later consultation about emerging findings to test out the implications for particular sectors or occupations. One expert recommended that participation in any foresight study should be opened up to EU-OSHA's focal contact points. Interviewees who were enthusiastic about participation tended to enjoy the networking and learning elements of foresight studies in particular.

Literature on foresighting stresses the importance of using experts, particularly for the purpose of interpreting local contexts when undertaking SWOT analysis (Miles, 2007) and in ensuring they speak from an independent expert perspective rather than from an interest group to which they belong.

Face-to-face versus virtual contact

One expert pointed out the importance of having at least one face to face meeting using small group discussions as a way of engaging contributors and helping them to work together. In addition, for those participants who reported networking as one of the attractions in taking part in a foresight study, this may be an important 'hook' to secure their contribution.

The importance of sufficient time to prepare and reflect

One expert reported that he had previously had insufficient time to prepare and consider his responses to the questions posed to him during foresighting exercises including the EU-OSHA green jobs study. Our experience of conducting the expert interviews is that even those with detailed understanding of labour market change and possible futures of work ideally require a considerable amount of preparation time and opportunities to reflect on stimulus materials in order to form their views *before* they are prepared to discuss and brainstorm topics. However, a number did not have time to read the detailed briefing sent in advance of the interviews, suggesting that experts may need some face-to-face briefing time to ensure that they engage fully with baseline materials for foresighting. Research experts also typically prefer to respond to well-evidenced themes and topics and therefore need careful preparation to participate fully. One expert noted the need for very skilled facilitators to prepare people to contribute effectively in foresighting workshops, which is echoed in the literature (Miles, 2007) and to ensure that people do not perceive time allocated for reflection or personal study as unproductive, because it is an essential element in preparing people to work effectively using futures methods.

Choice of appropriate communication methods

Choice of communication methods to include non-text based methods of depicting the outcomes of foresight studies may help to engage a wider or broader audience including lay people and practitioners. One expert felt that these should be designed in as part of the foresighting processes. Fictional futures, vignettes and visualisations in this case of future workplaces and their sources of risk may be helpful in capturing attention. However, if the purpose of the study is to influence policy makers, a short and well-drafted brief or communiqué adequately backed with evidence, may have greater impact.

Ensuring independence and impact

Lastly one expert commented on the breadth and depth of EU-OSHA's expertise and understanding in its field and how respected its research is. The expert felt that EU-OSHA may sometimes dilute or censor its research findings under pressure from its stakeholders and cautioned against doing this with foresight studies. The justification they gave was that the purpose of foresighting should be to provoke people and make them uncomfortable by presenting them with scenarios they may not like or with implications they may find difficult to handle.

3.5.5 Guidance on methods in future EU OSHA Foresight work

The following guidance suggests which foresight methods EU OSHA could use in its future activities. Although each foresight exercise needs to be designed around its specific scope, aims and resources, the following, general framework is informed by contemporary discussions in foresight methods and practices. The main phases and methods are set out below – against the main functions that they have. This assumes that the main scope and aims have been clarified and confirmed.

Phase 1: Analysis of Literature, Trends and Drivers

Questions guiding this phase:

- What is currently understood about this theme?
- What are the main assumptions on the future of this theme?
- What are the potential future disruptions? What are the key drivers?
- What are the main uncertainties?

Methods and steps involved:

Literature Review of scientific and grey literature on the topic area. The focus should be on relevant literature published in the last 3 years to maintain a current/recent perspective. It should include a bibliometric analysis to assess citations in scientific databases which enables an assessment of the weight and impact of the different items.

Review of scenarios literature: to check whether the theme has been addressed in other foresight exercises and identify what value can be added through the proposed project.

Interviews: interviews should be conducted with international experts in areas relevant to the topic. It is usually sufficient to interview 10-20 experts depending on the breadth of the topic and the range of sub-themes included, providing they are chosen carefully. A DELPHI element could be included within this phase or within the scenario development phase.

Analysis of trends and drivers: the project should analyse 15-20 key trends shaping the context of the topic. This information should be collected in a standard format and cite the evidence for the trends. This enables the project to identify the key driving forces – causal factors that are actively involved in shaping changes in the topic area. The key driving forces should be validated through cross-impact analysis to ascertain which factors are closely related to one another and eliminate unrelated factors, and uncertainty-impact analysis to ascertain the level of uncertainty. This process should lead to a reduced number of the key driving factors (6-12).

Development of possible projections for each driver: the research should map out potential projections for each driver, outlining key differences in possible outcomes.

Phase 2 Scenario development

Questions for this phase:

- What are the possible and plausible pictures of the future for this topic?
- What are the assumptions that underpin these alternative pictures?

Methods

Development of raw scenarios: the raw scenarios should be developed through bundling of consistent driver projections. A consistency analysis approach should be used to validate the co-existence of different driver projections into outline or raw scenarios. It is suggested that one scenario is trend-based (business as usual) and the other 2-4 scenarios should incorporate disruptive or radical changes.

Development of scenario narratives: the raw scenarios are elaborated with the rich content and evidence from literature review.

Scenario implications and action needs: a participatory workshop with invited participants can be organised to explore the implications of the scenarios for different themes related to the topic areas. The structure discussions should focus on action needs, impacts, priorities and strategic policy implications. The workshop typically lasts half a day, though more time may be required if participants are likely to need preparation and reflection time between sessions. A group of 15-30 participants is typically adequate to undertake this. Careful selection of participants to gain a mix of OSH experts, labour market/HR experts and sectoral/occupational experts is helpful. From a stakeholder perspective, it may be desirable to expand numbers to ensure acceptance and commitment to the project outcomes among key interest groups. This needs to be balanced against ensuring participants are selected with sufficient knowledge of the subject area to be able to contribute fully to the exercise.

Phase 3 Communication and Engagement

Question for this phase:

▪ How does the foresight activity engage effectively with relevant stakeholders and audiences?

The success of foresight activities depends to a large extent on effective communication and engagement with key groups and audiences. A suite of tools should be used throughout the project. Conventional (textbased) reporting methods remain important in foresight activities – particularly for policy audiences. These are supplemented by engaging visual and other creative tools.

Methods:
▪ Text-based reporting (such as a final report)
▪ Scenario visualisations: professional, graphic designed visuals are a powerful yet cost-effective way of conveying the main storylines of the scenarios
▪ A 10-page brochure to be used for broad communication and engagement with different stakeholder communities and target audiences
▪ Vignettes: scenario vignettes are types of creative fictional prototypes (Rhisiart, 2013) that provide ways of depicting potential changes and radically different conditions that might frame particular scenarios. These can take different forms such as dialogues between different fictional characters about the future.

4   Conclusions

On the basis of the literature evidence and expert consultation, the report from this scoping study recommends giving further consideration to the topics of ICT, trends in HRM and the impact of financial crisis to identify their implications for OSH in any foresight study. The reasons for selecting the first topic relate to the breadth of ICT, the novelty of potential applications and risks from new innovations and the relative lack of existing research examining detailed implications of ICT. For HRM, the breadth and centrality of this topic to people's experience of work and its capacity to incorporate elements of other possible foresight topics and range of OSH risks make it an important alternative subject for foresighting. The uncertainty of the European work context has also intensified, and any foresight exercise will need to reflect this in the topic(s) focus, and provides the rationale for considering the topic of financial crisis and OSH management during and after recovery from the financial crisis. This topic dominates much of the literature from EC institutions and agencies and is a subject of much policy concern because of its potential impact on vulnerable groups of workers, how OSH is perceived in social and political terms, and the resources allocated to OSH at national (e.g. inspection, OSH research), and enterprise level.

Additional topics proposed by experts have been considered within the overall scope of the study. A number of these could be incorporated within existing themes. Others may not be suitable for a foresighting study but may be considered for other EU-OSHA research priorities, so, for example, EU-OSHA may consider commissioning expert reviews on some of these topics.

The study has made a number of recommendations for guiding the structure and the content of a proposed foresight study. It should consist of 3 phases:

- An analysis of literature, trends and drivers, covering a review of material published in the last 3 years, around 10-20 expert interviews and identifying 15-20 key trends and driving forces of continuity and change. A DELPHI element could be included at this stage or within the scenario development stage.
- Development of 2-4 scenarios including one of limited change and others of radical change, with accompanying narratives, implications and requirements for action through a participatory workshop of 15-20 or more experts with adequate coverage of OSH, labour market/HR and sectoral/occupational experts
- Communication and engagement to ensure the project has the desired impact, using text-based reporting, scenario visualisations, a 10 page brochure for communicating findings to a broader audience if appropriate and vignettes involving dialogues about the future between fictional characters.

A number of recommendations have emerged to ensure any foresighting exercise undertaken is of a high quality. These include creating tightly focussed objectives relating to the strategic purpose any foresighting project is supposed to support for the commissioning organisation, sensitive presentation of foresight findings to avoid raising expectations about predictive accuracy, management of expectations about the level of novelty that foresight projects generate, choice of foresighting techniques requires tailoring of mixed methods for each study, a mixture of independent experts to derive future perspectives and lay practitioners to explore application and implications for specific sectors and occupations, face-to-face contact to help participants' understand each others' perspectives, adequate time to prepare and reflect during foresighting exercises, serious consideration for a DELPHI element to the study, choice of appropriate communication methods including non-text based representations of scenarios and outcomes, and being prepared to include controversial findings.

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6 Annex A List of expert individuals interviewed

Name	Organisation	Country
Francisco Jesús Álvarez Hidalgo	European Commission	European Union
Bart De Norre	Eurostat	European Union
Agnès Parent-Thirion	European Foundation for Improvement of Living and Working Conditions	European Union
Jan Kahr Frederiksen	Confederation of Professionals Trade Union	Denmark
Martin Röhrich	Independent Consultant	Czech Republic
Daniel Podgórski	Central Institute for Labour Protection	Poland.
Jill Rubery	Manchester Business School	United Kingdom
Peter Ellwood	Health and Safety Laboratory	United Kingdom
Thomas Coutrot	Ministry of Employment	France
Kerstin Cuhls	Fraunhofer Institute for Systems and Innovation Research	Germany
J R Popma	University of Amsterdam	Netherlands
Mark Beatson	Chartered Institute of Personnel and Development	United Kingdom.
Cary Cooper	University of Lancaster	United Kingdom.
Stephen Bevan	The Work Foundation	United Kingdom
Gérard Lasfargues	ANSES	France
Paulien Bongers	TNO Work and Employment	Netherlands
Dietmar Reinert	Institute for Occupational Safety and Health of the German Social Accident Insurance	Germany
Chris Warhurst	Institute for Employment Research	United Kingdom.
Martin Rhisiart	University of South Wales	United Kingdom

7 Annex B Interview guide and briefing materials

7.1 Interview guide EU-OSHA Foresighting Study: Draft discussion guide

The European Agency for Safety and Health at Work (EU-OSHA) has commissioned the Institute for Employment Studies to carry out a scoping exercise examining issues affecting **the** future of occupational safety and health (OSH). This is designed to make recommendations about the new and emerging OSH challenges which would be most relevant to explore in their next foresight study.

These interviews are designed to gain perspectives on the possible topics to be covered. This means first looking at the issues which are likely to have the biggest impact on the nature and structure of work over the next ten or twenty years and then considering how they might affect OSH. The study is focused on the European Union, so it would be useful if you could answer the questions with this context in mind.

The data collected will be treated confidentially and kept anonymous. This means that your name will not be attributed to any comments used in reporting and the details of your views will not be circulated outside the research team.

NB Check and note whether interviewee agrees for his/her name, organisation and country to be published in list of interviewees in the report.

Trends affecting the future of work

We'd like to begin the discussion by understanding your views on the broad nature of changes affecting the future of work.

- Can you look at the list of factors below and tell me what you think are the biggest influences on the way the nature of work is developing in Europe and how these will change over the next 10 year or so?
- NOTE TO INTERVIEWER: unlikely that interviewees will be able to talk about all topics in depth and they may only be able to talk about 2-3 in detail
- **economic** trends?
- political trends?
- cultural or social trends?
- environmental trends?
- demographic trends?
- technological trends?
- labour market trends?
- health-related trends?

Now, we'd like to ask you to think about what work will look like in the future.

- What difference will there be in the nature of work in the EU in ten or twenty years' time?

Probes: NOTE TO INTERVIEWER – use these as necessary – the question on sectoral growth/decline and job growth can be helpful to get interviewees to start talking.

- How will the composition, age and structure of the workforce have changed?
- Which sectors will have grown and which declined, and what sort of jobs will be most numerous?
- How will types of employment/contracts and working conditions have changed?
- How will the way workers are managed have change?
- How will industrial relations have changed?
- Where might new technologies have the greatest impact on work and workplaces and what are they?

Impact on OSH in the future

- How do you think the trends you have identified will affect workers' exposure to workplace hazards (organisational, psychosocial, chemical, biological or physical hazards) and their health and safety in future?

Probes:

- Will they bring new risks, or will any current risks increase or decrease?
- What kind of trends in OSH systems, services, labour inspection policy and practices might impact on OSH?
- Are there political trends in the importance of OSH and how it is perceived?
- Will there be any impact on resources available for OSH or how OSH services are delivered?
- Are there trends in the way OSH is managed at company level that could impact on OSH?
- How will new technologies affect OSH issues?

Views on suitable topics identified for foresighting

Before this interview we sent you a list of topic areas identified in our initial literature scan as being of significance for the changing nature of work in the future and the health and safety issues that might be associated. *NOTE to interviewer: list is reproduced below for ease of reference – remind interviewee if they have forgotten*

- Which two topics would you recommend that we consider for a more a detailed foresight study?
- What, if any, significant issues were missing from this list?
- Within each topic area, what issues or themes do you think would be worth examining in more detail in a foresight?

NOTE TO INTERVIEWER: use detailed list of themes under each heading to probe as necessary – use background document sent to interviewees to guide you through this.

7.1.1 Topic list

- Impact of financial crisis on work and OSH – through resources available for OSH, changes to provision of OSH services, contracts, work intensification and job insecurity
- Service sector growth and OSH implications of emotional labour; also new types of services with new types of workplaces and working conditions (e.g. Amazon)
- Impact of ICT on worker health and safety – e.g. information overload, increased job intensity, permanent connection to work, longer exposure times to ergonomic risks over working life
- Implications of changes to work location for health and safety e.g. via urbanisation, mobile working, telework, working time
- Globalisation – in terms of the management of health and safety across geopolitical borders and through value chains/supply chains
- Trends in HRM practices affecting worker well-being e.g. new management styles, delayered organisational structures and tight deadlines/monitoring of work

Lastly, we'd now like to ask a little bit about your involvement in scenario building and foresighting approaches to research about the future of work and OSH.

- Are you familiar with EU-OSHA's foresight study into new and emerging risks in green jobs or any other foresight studies concerning the future of work?

If **no**, thank and end the interview.

If **yes**, ask the following:

- How useful have you found EU-OSHA's green jobs and/or other foresighting studies? Why?

- What methodological aspects of these studies do you think are particularly helpful and should be considered carefully in developing EU-OSHA's next foresight study? What aspects do you find are weaker or more problematic and how do you think these can be overcome or reduced?

THANK AND CLOSE.

7.2 Briefing materials

Following discussion with EU-OSHA, a detailed briefing document was issued to participants to give them the opportunity to reflect on and identify key sub-themes for potential inclusion in a foresight study. It is reproduced below.

7.2.1 Background information for EU-OSHA foresight feasibility study on issues affecting future of work and occupational health and safety

Dear Participant

Thank you for agreeing to be interviewed for this study. The list below is intended to provide you with some background information about the kinds of topics we would like to discuss. Please do reflect in advance on these topics if you have the opportunity. If you have any questions, please do contact us.

- Changes in the nature of work: sectoral growth/decline, types of jobs growing/declining, hours and conditions of work, how workers are managed, nature of industrial relations, use of new technologies.
- Impact of these trends on workplace hazards, health and safety, how occupational health is managed at workplace level and through national policy, systems and regulation.

We would then like to gather your views on the merits of different possible topics for a foresighting exercise and the possible themes for focus within each topic. The list of possible topics is given below and more detail is provided in the Appendix to this document. It is not necessary to have studied all the sub-themes in detail before the interview.

7.2.2 Possible topics for a foresighting exercise

- Impact of financial crisis on work and OSH – through resources available for OSH, changes to provision of OSH services, contracts, work intensification and job insecurity.
- Service sector growth and OSH implications of emotional labour; also new types of services with new types of workplaces and working conditions (e.g. Amazon warehouses).
- Impact of ICT on worker health and safety – e.g. information overload, increased job intensity, permanent connection to work, longer exposure times to ergonomic risks over working life.
- Implications of changes to work location for health and safety e.g. via urbanisation, mobile working, telework, working time.
- Globalisation – in terms of the management of health and safety across geopolitical borders and through value chains/supply chains.
- Trends in HRM practices affecting worker well-being e.g. new management styles, delayered organisational structures and tight deadlines/monitoring of work.

Topics we would NOT primarily focus on for foresighting

Please note that this list **excludes** some of the major developments with implications for worker health/safety and OSH because EU-OSHA has already undertaken some major studies on certain themes and wishes to focus its next foresight on a new area. Therefore we are not proposing to recommend a foresighting study on population ageing, migration, stress at work, workplace violence and harassment, health of women at work, new technologies in green jobs, but if there are new angles

or areas of interest in relation to these topics which you feel we should consider, we would be pleased to hear about them.

The focus of our discussion will be on European countries.

7.2.3 Detailed themes within each possible foresighting topic

Impact of financial crisis on work and OSH

▪ Growth of part-time, intensified insecure jobs, how are Human Resource practices applied to extract effort?, subcontracting (is good OSH practice limited to a company's own workers)?, more precarious jobs especially fixed term contracting (which can undermine OSH surveillance systems).

▪ Intensified competition and cost pressures on companies and public OSH services creates pressures to target resources/investment and less resources for OSH; social and political attitudes to OSH (e.g. decreasing importance, de-regulation?)

▪ Lack of long-term investment decisions (e.g. in prevention of OSH conditions), increased work intensity resulting from greater emphasis on productivity may lead to less effective OSH management systems.

▪ Self-employment, outsourcing and growth of SME employment with fewer resources for and less knowledge of OSH, good OSH practice are less common in small private sector services which are most likely to grow (and also where poor quality jobs are most likely to be found).

▪ Growth of unpaid work, work with uncertain contractual status e.g. internships, it is not clear how far OSH policy is applied, and workers may find it harder to get/receive help concerning OSH, more individualisation of workplace relationships may lead to those who need most help not receiving it.

▪ Information demands and tight deadlines.

▪ Changes in contracts – fewer permanent and more self-employed workers, increase in part time jobs, especially involuntary, have been increasing even if the share of temporary contracts has fallen in the EU due to recession.

▪ Increase in precarious/flexible contracts including zero hours contracts – such workers are more likely to be found in jobs with poorer OSH conditions, to suffer occupational injury and work-related diseases, fixed term contracts have lower overall job quality and workers may take these jobs involuntarily, overall increase in stress arising from job insecurity.

▪ Complexity of settings, stakeholders, and management practices to meet pace of organisational restructuring arising from recession means that workplaces are more dynamic and changeable so threatening continuity and stability of OSH services.

▪ The rise in undeclared work especially domestic services.

▪ Stress, harassment and violence at work are likely to become more significant in a financial recession as employment becomes more precarious, and workloads and working hours increase.

▪ Disruption of work-life balance through increased workload, time pressures to complete it and long irregular working hours, but note that working time is polarised – 11% of workers are working fewer and 18% working more hours as a result of recession so different forms of stress may develop i.e. too much work versus too little income.

▪ Employee participation improves OSH management but this is less likely in smaller firms due to cost pressures, less likely for workers with precarious jobs and the self-employed and has a long-term payback period which SMEs cannot afford, there may be less employee representation in growing sectors such as private service sector industries.

- More turnover and lack of trust between employers/employees, higher turnover could lead to increased accidents due to loss of corporate memory and cost cutting due to globalisation cuts investment in OSH.

- Job insecurity as a result of high unemployment rates and precarious employment patterns lead to increased psychosocial risks and stress.

- Downsizing after recession leads to psychosocial risks especially if repeated in successive rounds.

- Role stress arising from ambiguity, role conflict and workload, loss of trust in employer – explore broken psychological contract and impact on health creating anxiety even without definite change.

- Impact on health from lower income due to pay freezes or forced early retirement and in-work poverty affecting nearly a quarter of EU population due to job loss etc, restructuring most common in financial services, manufacturing, health, transport, and public administration and defence.

- 2) Information technology impact on work

- Steady increase in shares of people using computers at work over past 20 years may continue to increase.

- Technology stress – defined as anxiety from IT failures, inability to learn, monitoring pressures, people may be required to do more work more quickly, and the potential to be constantly connected to work through mobile ICT devices, forced response to new information required immediately, resulting in habitual multi-tasking.

- ICT enables a 24/7 economy leading to a blurred work-life balance and potential working time stress, issues of ICT and extended working time (how pervasive will these trends be?).

- ICT implications of globalisation and impact on stress, e.g. via subcontracting and maintaining OSH quality through supply chains.

- Managing information intensity at work – explosion of information and information overload but fragmentation of knowledge, mechanisms for interacting across distances at work.

- Intense work ethic/culture of far-East countries, miniaturising of IT and General Purpose Technologies and complete diffusion of mobile communications across developing countries, interconnectedness means pervasion of trends – how can policy manage to influence across and through these?

- IT serves both to personalise the experience of work and to isolate individuals at work, exacerbated by the rise of the service sector? This may be linked to a lack of worker autonomy.

- Risks of MSDs from use of ICT including personal computers and other mobile devices; e.g via increase in fixed body postures and physical inactivity at work.

- IT may also increase risk of accidents due to blind faith in IT systems.

- Medication to improve performance to cope with long working hours from IT may lead to risk of ill health.

- Working from home through ICTs can bring about well-being but also negatives of mental workload and permanent accessibility.

- What could be the role of MOOCs (Massive Open Online Courses) in embedding/diffusing knowledge and good practice in OSH?

- Potential to individualise learning to own personal health needs or those of immediate colleagues/workforce?

- Impact of ICT on workflow – unknown and very few studies in general on ICT.

- Application of ICT in monitoring health and wellbeing through monitoring/surveillance, ICT devices embedded in clothing, but also invasion of privacy and 'Big Brother' effects.

- Implications of automation and greater use of robotics, automation could reduce employment in some occupations and protect others from harm.
- Potential of ICT to support vulnerable workers and make workplace adaptations.

Globalisation

- Implication of BRICS countries growth for work quality in EU due to reduced trade barriers, squeezed profit margins in exports, globalisation had negative effect on safe/fair labour relations.
- Maintaining OSH quality via subcontracting through supply chains.
- Increased trade but more competitive and increased transport costs, 'unfair' competition, reduced diversity in providers so monopoly power, transnational companies and increasing Foreign Direct Investment, shifting from the triangle of USA-Europe-Japan to a large network of nations grounded on regional partnerships and centred on the Indian and Pacific Ocean.
- Interconnectedness means pervasion of trends – how can policy manage to influence across and through these? Intensified competition and cost pressures on companies creates pressures to target resources/investment including that for OSH .
- Working time requirements lead to unsocial hours either due to demand for face to face contact across time zones or requirement to be online/available.
- Globalisation has fuelled migration through economic integration of companies and countries – some in high skilled and some low skilled work but migrant workers have higher OSH risks.
- Challenges for OSH and feasibility of being able to do inspections in non-national companies.

Location of work

- Challenges arising from location of work (growth of cities versus rural communities posing different challenges in terms of work-related risks and capacity/capability to manage OSH), green cities, new transport routes.
- Telework, how to ensure effective OSH management in public spaces eg airports, hotels, coffee shops, bars, shared/rented office space for self-employed, home working, working when travelling for work, new office design.
- Organisational cultures and attitudes will affect how work locations are managed and degree of discretion/monitoring offered to/imposed on workers.
- What about implications for food, exercise and work (access to healthy eating choices, ability to exercise – how can OSH be delivered effectively to meet all these needs? What will the role be of individualised ill health prevention activities?

Trends in Human Resource Management practices affecting worker well-being

- New work organisation methods affecting speed/pace of deadlines.
- Leaner flatter management structures affect how work managed, organised and interface with OSH, link to lack of autonomy.
- Psychosocial hazards from job content, workload and work pace, work intensity, work schedule, control, environment and equipment, organisational culture and function, interpersonal relationships at work, role in organisation, career development, home-work interface.
- Poor communications between managers and staff a persisting problem due to poor management capability.
- Information demands and tight deadlines.
- Possible screening of workers for health and safety conscious values and behaviours.

Service sector growth and OSH implications of emotional labour

- Emotional labour leading to burnout and stress – dealing with difficult customers is a major management concern, health, social work, education and public administration are the top sectors of concern for dealing with customers, patients or clients.

- Service sector growth regarded as leading to exposure to violence/emotional stress.
- OSH and particular MSD interventions and guidance are lacking for some high-risk groups in service sector: provision of care in people's homes, residential homes and hospitals home deliveries, catering, cleaning and homeworking.
- Moving from a manufacturing economy to a service- and knowledge- based economy may create a polarised workforce between high-skilled jobs (ICT, marketing) and low-skilled, low-wage jobs with non-standard working conditions and unsociable working hours.
- For the retail sector the main new risks are antisocial behaviour, from verbal abuse to physical violence and robbery by third parties, in addition to the difficulties of reconciling work and life due to irregular working schedules, there are mixed implications for emergence of risks since job quality is highest in information and communications, finance/insurance.
- Job quality is overall lowest in activities of households (and is often undeclared work); and accommodation and food service sectors.
- New types of workplaces e.g. warehouses for distribution of goods in the service sector (e.g. Amazon) – but with more atypical working time and conditions than for similar operations in manufacturing?

8 Appendix C Literature search strategy

Where each database allowed, the search was constrained to post 2007; English language; peer-reviewed; journals, ('scholarly journals' in ABI/Inform), research papers, reports and working papers; and adult populations. Where the Advanced Search function allowed search to be restricted to Abstract and/or keywords the search was narrowed to these fields. Two platforms did not offer this option; in these the search was constrained to Title only. The following databases were searched:

Table 8.1: Databases searched

Database/platform	Field searched
Google Scholar	Search tool for scholarly literature inc. theses, books, abstracts and articles.
INGENTA	IngentaConnect gives access to over 28,000 academic and trade journals across a wide range of subject areas.
PsychINFO	Index covering psychology and psychological aspects of related disciplines, inc. education, psychiatry, medicine.
Zetoc	The British Library's Electronic TOC Service and indexes 20,000 journals and 16,000 conference proceedings.
CISDOC	Occupational Health and Safety Database of publications from ILO
ABI/INFORM	Database of Business Research- combines business journals and sources of online business with international and scholarly content.
ASSIA	Applied Social Sciences Index and Abstracts - provides references and summaries of articles from 650 journals covering: social services; social work; sociology; education; health.
Emerald	Emerald includes access to academic articles on human resource management.
IBSS	International Bibliography of the Social Sciences – indexes material on economics, sociology, politics and anthropology.
JSTOR	An archive of electronic journals which currently provides access to more than 200 scholarly titles in over 20 disciplines in the Arts and Sciences.
Web of Science	This service provides access to the Web of Science databases: Arts & Humanities Citation Index; Social Science Citation Index; Science Citation Index.

The search terms used are shown in Table 8.2

In addition, other relevant material will include EC, 2013: Evaluation of the European Strategy On Safety and Health At Work 2007-2012 (EC, Luxembourg).

IES has also full access to the full standard range of academic journals in online and print formats through a link with the University of Brighton. The search was limited to indexes to the most useful/relevant databases (Table 8.2).

Table 8.2: Recommended databases for search

Name of database	Description
Google Scholar	Search tool for scholarly literature inc. theses, books, abstracts and articles.
INGENTA	IngentaConnect gives access to over 28,000 academic and trade journals across a wide range of subject areas.
PsychINFO	Index covering psychology and psychological aspects of related disciplines, inc. education, psychiatry, medicine.
Zetoc	The British Library's Electronic TOC Service and indexes 20,000 journals and 16,000 conference proceedings.
CISDOC	Occupational Health and Safety Database of publications from ILO
ABI/INFORM	Database of Business Research- combines business journals and sources of online business with international and scholarly content.
ASSIA	Applied Social Sciences Index and Abstracts - provides references and summaries of articles from 650 journals covering: social services; social work; sociology; education; health.
Emerald	Emerald includes access to academic articles on human resource management.
IBSS	International Bibliography of the Social Sciences – indexes material on economics, sociology, politics and anthropology.
JSTOR	An archive of electronic journals which currently provides access to more than 200 scholarly titles in over 20 disciplines in the Arts and Sciences.
Web of Science	This service provides access to the Web of Science databases: Arts & Humanities Citation Index; Social Science Citation Index; Science Citation Index.

Source: IES, 2013

In conducting reviews there are diminishing returns in using a large number of databases since items repeat across sources and eliminating duplicates can take up valuable research time. A highly focused review of academic and published articles/research, alongside a focused review of grey sources will yield results of equal interest.

Determining the most appropriate search terms is vital. Keywords can be used singly or in combination, using Boolean operators and truncation. As part of inception work we will agree with EU-OSHA the search terms to be used. These are likely to include combinations of future or scenario or foresight plus occupational health/safety/work/employ*/risk/hazard. As the review is time-bound, it was limited to articles published since 2007, in order to ensure that the possible topics giving rise to potential OSH risks remain relevant. An initial trawl of the databases using key words yields results ranging from 30 to several thousand, of which a considerably smaller proportion appear likely to be relevant, as many studies are either highly technical or deal only with countries outside Europe, so some time will be required to sift initial lists.

9 Appendix D EU OSHA Foresighting: Pro forma

9.1.1 Document classification

- Author(s):
- Date:
- Full reference:
- Geographic scope:
- Weblink to report:

a.   Methodology

Overview of methods used *(tick all that apply)*

Quantitative research	☐	Policy document	☐	Evidence/literature review *(please note whether review of other reviews etc.)*	☐
Qualitative research	☐	Opinion piece	☐	Other – please specify	☐

Assessment of research quality

Brief description of methods used including (where relevant) sample size, sampling strategy, response rate, reasons for non-participation, any weaknesses in the data, evidence of bias etc.

Validity of the research – are measurements accurate? Is any data missing or are there gaps? Does the analysis support the conclusions drawn? Should the findings be given a high (very robust), medium or low (not very robust) weight?

Assessment of foresighting approach

Brief description of foresighting methods used – what are their strengths and weaknesses?

b.   Summary of findings relevant to research themes

Please include page numbers for data and quotes

Summary of purpose and scope of the study and its main applicability to the project

Summary of evidence on trends in **sectoral expansion or decline** (government priorities, areas which are likely to see natural growth or reduction, trends in education and training)

Summary of evidence on trends in **working population** (migration, ageing, female workforce, skill levels, birth rates and working families, and implications for work and workers)

Summary of evidence on trends in **working arrangements** (self-employment and other employment patterns (e.g. on-call, zero-hour contracts, multiple jobs, etc.) flexible working, organisation size, work organisation including mobile/telework, management styles (e.g. lean management), working hours, productivity, consequences for workers)

Summary of evidence on trends in the p**hysical environment** (effects of climate change on work and workplaces, trends in energy/resource use and impact on work/workplaces)

Summary of evidence on trends in **workplace mental health and wellbeing** (stress at work, work-related burnout, violence at work, workplace bullying, employee development and engagement)

Summary of any other relevant information or reviewer notes:

Final note: a) comments on likely scale of relevance across EU member states:

b) whether any topic(s) are already addressed in EU OSHA reports; Reviewer initials: Date:

10 Appendix E Long list of potential foresight issues from literature

10.1 Implications of financial crisis for work and OSH in recovery

High levels of control and lower levels of job strain generally spreading (EF 2012 HWB) but changes in contracts – fewer permanent and more self-employed (SUVA, 2009) (EFP, 2012) – self-employed organising own work due to automation, part time jobs, especially involuntary, have been increasing even if the share of temporary contracts has fallen in the EU due to recession (EC, 2013), working time polarised – 11% working fewer and 18% working more hours as a result of recession (EWCS, 2012), increase in precarious/flex contracts – *such workers more likely to suffer occupational injury (ILO, 2013)* and workers in these jobs involuntarily, settings, stakeholders, complexity of interventions) means that workplaces are more dynamic and changeable (EUOSHA 2013), fixed term contracts have lower job quality overall (EF 2012), EP (2013) rise in undeclared work esp domestic services, increase in subcontracting, outsourcing, precariousness, work intensification and employment insecurity (EP 2013), change in nature of growing firms: : ee participation improves OSH management (ESENER, 2010) but less likely in smaller firms due to cost pressures (EUOSHA 2013) and long term payback period which SMEs cannot afford (EUOSHA 2013), less ee representation in growing sectors of concern because associated with more effective OSH

OSH implications

- Growth of part-time, intensified insecure jobs, how are HR practices applied to extract effort?, subcontracting (H&S limited to co's own workers)?, more precarious jobs (which can undermine OSH surveillance systems EU OSHA 2013); growth of unpaid work, work with uncertain contractual status eg internships (EF 2012), particularly common for employees on fixed-term contracts to have inadequate working conditions by comparison with permanent employees (EP 2013), increase in precarious/flex contracts – such workers more likely to suffer occupational injury (ILO, 2013)

- Intensified competition and cost pressures on companies creates pressures to target resources/investment, less resources for OSH (EC, 2013; ILO 2011:PEROSH 2009), risk averseness and lack of long-term investment decisions (e.g. in long-term prevention of OSH conditions?) (EC, 2009), increased work intensity resulting from greater emphasis on productivity may lead to less effective OSH management systems (ILO, 2011), self-employment outsourcing and SMEs (ESENER, 2010) (with fewer resources for and less knowledge of OSH), self-employed firms engaged in outsourcing, OSH less common in small private sector services which are growing firms (where poor quality jobs most likely to be found EF 2012)

- Not clear how far OSH policy is applied in growing nos of small firms and for self-employed, workers find it harder to get/receive help concerning OSH (EUOSHA 2013), more individualisation of workplace relationships and those who need most help do not get it (ETUI, 2010),

- Disruption of work-life balance (EC 2013), FC also mentioned in EFP 2012 on future of learning, workload (time pressures, ESENER, 2010) and long irregular working hours (ESENER, 2010), *but NB working time polarised – 11% working fewer and 18% working more hours as a result of recession (EWCS, 2012)* – so different forms of stress – too much work v too little income

- <u>Changes in the nature of existing firms</u> ILO (2013) downsizing after recession leads to psychosocial risks especially in repeated rounds, role ambiguity and role stress (ambiguity, conflict and wokload), loss of trust – explore broken PC literature and impact on health, anxiety even without definite change (ILO 2013), impact on health from lower income due to pay freezes or forced early retirement (ILO, 2013) and in work poverty (EC 2013) affecting nearly a quarter of EU population due to job loss etc, restructuring most common in financial services, manufacturing, health, transport, and public administration and defence (EWCS 2012)

- Violence and harassment at work (also ESENER, 2010, EUOSHA 2005), stress, harassment and violence at work are likely to become more significant in a financial recession as employment becomes more precarious, and workloads and working hours increase (ILO, 2011)

- More turnover and lack of trust between ers/ees (SUVA), higher turnover could lead to increased accidents due to loss of corporate memory and cost cutting due to globalisation cuts investment in OSH (SUVA 2029)

Information technology impact on work

- Some of this is about the rise of new ICT technologies, some is about expansion of existing technologies and some is about change in nature of supply chains requiring use of ICT
- Steady increase in shares of people using computers at work over past 20 years (EWCS, 2012) and increased information intensity/information rich environments – Big Data potential
- ICT implications of globalisation and impact on stress, eg via subcontracting (maintaining OSH quality through supply chains (EC 2013)
- managing information intensity at work – explosion of info but fragmentation of knowledge, interactive distance mechanisms for work, intense work ethic/culture of far East countries, miniaturising of IT and GPT and complete diffusion of mobile comms across developing cos (EC, 2013), interconnectedness means pervasion of trends – how can policy manage to influence across and through these (EC, 2009)?
- IT serves to personalise experience of work (and isolate?) (EC, 2009), exacerbated by rise of service sector? Link to lack of autonomy (ESENER, 2010),
- risks of handheld non keyboard IT devices (EUOSHA, 2005),
- IT may also increase risk of accidents due to blind faith in IT systems (SUVA 2029)
- medication to improve performance to cope with long working hours from iT may lead to risk of ill health SUVA
- weight of SMEs in the economy is increasing due to new technologies diluting economies of scale (and OSH is harder to implement in these companies as noted in previous section) (EUOSHA 2013),
- unfamiliar IT and inexperienced workers in new green industries may lead to accidents (EUOSHA, 2013);
- use of computers leading to increase in fixed body postures and physical inactivity at work and musculoskeletal disorders (MSDs) (EUOSHA, 2013);
- working from home through ICTs can bring about well-being but also negatives of mental workload and permanent accessibility (EUOSHA 2013)
- Impact of ICT on workflow (EUOSHA, 2013) – unknown and v few studies in general on ICT (Prof Windel, EUOSHA seminar 2012)
- Implications of automation and greater use of robotics (EU OSHA, 2013), automation could reduce employment in some occupations and protect others from harm (PEROSH, 2009)

Some potential opportunities

- Potential of ICT to support vulnerable workers and make workplace adaptations (EU OSHA, 2013), also to monitor and track impacts of OSH interventions better through real time reporting
- Application of ICT in monitoring health and wellbeing through monitoring/surveillance, ICT devices embedded in clothing (EU OSHA, 2013)
- Potential to individualise learning to own personal health needs or those of immediate colleagues/workforce?
- Implications of bio regenerative technologies for work and workers?
- what could be the role of MOOCs (Massive Open Online Courses) in embedding/diffusing knowledge and good practice in OSH?

OSH issues

- Techno stress – anxiety from IT failures, inability to learn, monitoring pressures(Dewe and Kompier, 2008)
- ICT enables 24/7 economy – working time stress (EOSHA, 2013), as well as physical posture/fatigue issues

Globalisation

- Relocation of points of production/services to cheaper countries with lower pay/labour standards may level down quality of working conditions, (are cos making deliberate choices to do this?) managing OSH through globalised supply chains (how does regulation work)
- Implication of BRICS growth for work quality in EU due to reduced trade barriers, squeezed profit margins in exports (Dewe and Kompier, 2008), globalisation had negative effect on safe/fair labour relations (EP, 2013)
- Increased trade but more competitive and increased transport costs, 'unfair' competition, reduced diversity in providers so monopoly power, transnational companies and increasing FDI, shifting from the triangle of USA-Europe-Japan to a large network of nations grounded on regional partnerships and centred on the Indian and Pacific Ocean (EC, 2009),
- Interconnectedness means pervasion of trends – how can policy manage to influence across and through these? Intensified competition and cost pressures on companies creates pressures to target resources/investment (ESENER, 2010)
- settings, stakeholders, complexity of interventions) means that workplaces are more dynamic and changeable (EUOSHA 2013);
- Increasing interconnectedness following the impact of globalisation has led to 14,000 cases of large companies restructuring, whether this be reorganisation, closures, mergers, acquisitions, downsizing, outsourcing or relocation (EUOSHA 2013); with potentially similar consequences noted in section 1
- Globalisation has fuelled migration through economic integration of companies and countries – some in high skilled and some low skilled work (EUOSHA, 2013) but are more likely to have OSH risks

OSH implications

- challenges for OSH and feasibility of being able to do inspections in non-national companies? (EP, 2013)
- maintaining OSH quality via subcontracting through supply chains (EC 2013),
- working time issues of unsocial hours either from face to face contact needed or requirement to be online/available
- increased diversity of workforces make OSH harder to manage through greater need for customisation
- Privatisation of health and safety in sense of personal medical/health security in parts of world which are unstable and where high physical risk? Could spread to other areas of OSH? (EC, 2009)

Location of work

- Challenges arising from location of work (growth of cities v rural communities posing different challenges in terms of work related risks and capacity/capability to manage OSH), green cities, new transport routes (EC, 2013) – drivers could be urbanisation, shortage of space for commercial properties?
- Telework, how to ensure effective OSH management in public spaces eg coffee shops, bars, shared/rented office spare for self-employed, home working, new office design (intelligent housing) (EF Germany, 2005),
- Issues of ICT and extended working time etc (how pervasive will these trends be?)
- Organisational cultures and attitudes will affect how work locations are managed and degree of discretion/monitoring offered to/imposed on workers,
- What about implications for food, exercise and work (how consume, how exercise etc?) – how can OSH be delivered effectively to meet all these needs? What will the role be of individualised ill health prevention activities?

Trends in HRM practices affecting worker well-being

- new work organisation methods affecting speed/pace of deadlines (EC 2013)

- leaner flatter management structures affect how work managed, organised and interface with OSH (ESENER, 2010), link to lack of autonomy (ESENER, 2010),
- poor communications (ESENER, 2010),
- information demands and tight deadlines (EUOSHA 2005)
- possible screening of workers for health and safety conscious values and behaviours (Walter 2007) but what about ethical implications?

Drivers and challenges

- Ageing population (SUVA) expected to lead to people having to work longer and pose challenges for HR to manage – higher risk of burnout and stress, ageing population – wide range of issues (EUOSHA, 2013)
- The status and management of OSH within enterprises - level of resources, changing attitudes and trends – take from interviews, cross reference to challenges for SMEs discussed earlier, who will pay and how much for interventions to keep older workers working or not? Difficulty in managing stress – orgs don't take seriously and know how to manage
- Younger workers may be less fit for work due to sedentary lifestyles and lack of exercise so higher rates of early cardiovascular and other diseases, also impaired hearing from noise exposure through headphones (PEROSH, 2009) – adjustments/limitations to kind of work they can do
- Rise of chronic but treatable diseases will require long-term strategies for self-management (role for OSH?) (EC, 2009)

Why the consequences might be important

- heavy lifting, long working hours, low job control predict early workforce exit (EUOSHA 2013) – how can these be addressed by HR
- Psychosocial hazards from job content, workload and work pace, work schedule, control, environment and equipment, organisational culture and function, interpersonal relationships at work, role in organisation, career development, home-work interface (ESENER, 2010),

Service sector growth

- Service sector growth (see ESENER 2010 also and SUVA, 2009 – knowledge economy
- Home deliveries, catering, cleaning and homeworking (EUOSHA, 2005),
- From manufacturing economy to a service- and knowledge- based economy, polarised workforce between high-skilled jobs (ICT, marketing) and low-skilled, low-wage jobs (non-standard working conditions and unsociable working hours) (EU OSHA, 2013), R&D jobs etc (APT interview), creative entertainment media companies (CC)

OSH implications

- (EUOSHA, 2013); retail sector the main new risks are antisocial behaviour, from verbal abuse to physical violence and robbery by third parties, in addition to the difficulties of reconciling work and life due to irregular working schedules (EUOSHA, 2013), mixed implications for emergence of risks since job quality highest in info and comms, finance/insurance, job quality, overall, lowest in activities of households (often undeclared work, EP 2012); and accommodation and food service sectors (EF 2012)
- Emotional labour leading to burnout and stress – dealing with difficult customers top mgt concern (ESENER, 2010), customers and patients or clients (EUOSHA 2005), health, social work, education and public admin top sectors of concern (ESENER, 2010) but globalisation more effects in mf/private services? Service sector growth regarded as leading to exposure to violence/emotional stress (PEROSH, 2009)
- OSH and particular MSD interventions and guidance lacking for some high-risk groups in service sector: provision of care in people's homes, residential homes and hospitals

Other drivers

- Need to discriminate and guide people in interpreting information eg on OSH – threat of terrorism minor compared to accidents at work? (EC, 2009),
- Women exiting the workplace mid-career – implications for workplace flexibility etc but increased female participation may offset ageing (ETFP 2012) (what about women with caring pressures for parents and as grandparents?), women have lower earnings (EF 2012)
- Climate change – lead to heat stress in Med countries, driving migration from refugees
- What is the effect of combinations of potential risks on workers – need to understand multiple effects (PEROSH, 2009)

Topics already covered by EU OSHA

Psychological impacts, psychosocial risks, biological risks, stress at work, musculoskeletal disorders, workplace violence and harassment, health of women at work, new technologies in green jobs, ageing workforce, migrant workers.

11 Appendix F

Table 11.1: **Distribution of stakeholder survey respondents by country**

Country in which respondent is based	Freq	%
Austria	5	8
Belgium	2	3
Bulgaria	2	3
Croatia	1	2
Cyprus	1	2
Czech Republic	2	3
Denmark	2	3
Estonia	0	0
Finland	3	5
France	0	0
Germany	6	10
Greece	0	0
Hungary	0	0
Iceland	1	2
Ireland	2	3
Italy	1	2
Latvia	1	2
Lithuania	1	2
Liechtenstein	0	0
Luxembourg	1	2
Malta	0	0
Netherlands	1	2
Norway	1	2
Poland	1	2
Portugal	1	2
Romania	1	2
Slovakia	0	0
Slovenia	2	3
Spain	2	3
Sweden	2	3
United Kingdom	4	7
Did not answer	17	28

The European Agency for Safety and Health at Work (EU-OSHA) contributes to making Europe a safer, healthier and more productive place to work. The Agency researches, develops, and distributes reliable, balanced, and impartial safety and health information and organises pan-European awareness raising campaigns. Set up by the European Union in 1996 and based in Bilbao, Spain, the Agency brings together representatives from the European Commission, Member State governments, employers' and workers' organisations, as well as leading experts in each of the EU Member States and beyond.

European Agency for Safety and Health at Work

Santiago de Compostela 12, 5th floor - 48003 Bilbao · Spain
Tel. +34 944 358 400 ·
Fax +34 944 358 401
information@osha.europa.eu

http://osha.europa.eu

Publications Office