On 24-25 September 2009, the Partnership for European Research in Occupational Safety and Health (PEROSH) carried out an international expert seminar on future challenges for the working environment.

The seminar was commissioned by the Danish Working Environment Authority as part of its consultation process leading up to a new Danish Working Environment Strategy for 2010-2020.

14 senior experts from the PEROSH member institutes as well as from the European Agency for Safety and Health at Work (Bilbao), the European Foundation for the Improvement of Living and Working Conditions (Dublin), and from l’Institut de recherche Robert-Sauvé en santé et en sécurité du travail (IRSST - Québec) contributed with papers and presentations.

This report contains the written contributions of the participants as well as an executive summary whereas the full material (papers, presentations and videos of the presentations) can be accessed via the PEROSH website www.perosh.eu.
During 2009, the Danish Working Environment Authority has been working on a new Danish Working Environment Strategy for 2010-2020. The National Research Centre for the Working Environment (NRCWE) has provided research-based background knowledge for this process and offered to qualify the “future scanning” by organizing an expert seminar in cooperation with the Partnership for European Research in Occupational Safety and Health (PEROSH).

PEROSH is a cooperation of 13 working environment research institutes across 12 European countries aiming to cooperate and coordinate their research and development efforts for healthier, longer and more productive working lives. Another objective of PEROSH is to counsel and cooperate with the EU and the national authorities of Europe in order to support EU and national policy development and enforcement in the field.

The seminar on future challenges for the working environment took place in Copenhagen 24-25 September 2009. It was financed by the Danish Working Environment Authority and organized by NRCWE.

I would like to thank the 14 senior experts from the PEROSH member institutes as well as from the European Agency for Safety and Health at Work (Bilbao), the European Foundation for the Improvement of Living and Working Conditions (Dublin), and from l’Institut de recherche Robert-Sauvé en santé et en sécurité du travail (IRSST – Québec) who in spite of a very short notice contributed with very inspiring papers and presentations on the current and future working environment challenges.

Papers, presentations and videos of the presentations can be accessed via the PEROSH website www.perosh.eu.

Dr. Palle Ørbaek
Chairman of PEROSH &
Director General of the NRCWE
Copenhagen, November 2009
6 Dansk sammenfatning (Danish Summary)  
By Nele Roskams, PEROSH; Steffen Hyldborg Jensen, NRCWE and Per Jakobsen, NRCWE

14 English Summary  
By Nele Roskams, PEROSH; Steffen Hyldborg Jensen, NRCWE and Per Jakobsen NRCWE

22 Programme for The International Expert Seminar Working Environment Challenges for the future

25 Future Challenges to the Working Environment – Comments of an Accident Insurer  
By Dietmar Reinert, BGIA, Germany

35 Forecast on Future Occupational Safety and Health Challenges in Europe and Italy  
By Sergio Iavicoli, BM Rondinone, G. Buresti and F. Boccuni, ISPESL, Italy

39 Foresight in Germany  
By Karl Kuhn, BAuA, Germany

44 Forecast on Future Challenges in the Work Environment in Québec, Canada  
By Marie Larue, IRSST, Canada

53 The Entry of Self Leadership into the Work Environment Equation  
By Pia Bramming, NRCWE; Anders Raasrup Kristensen, CBS and Michael Pedersen, CBS, Denmark

57 Occupational Safety and Health Research Needs  
By Frédéric Lerais, INRS, France

62 Forecast on Future Working Environment Challenges in Finland  
By Mikko Härmä, Jouni Toikkanen and Harri Vainio, FIOH, Finland

65 Working Environment Challenges for the Future – The Norwegian Perspective  
By Pål Molander and Stein Knardahl, STAMI, Norway

68 Future Working Environment Challenges in the Netherlands  
By Joost Van Genabeek, TNO, Netherlands

83 Future Challenges with Respect to Electromagnetic Component of the Working and Living Environment  
By Jolanta Karpowicz, CIOP-PIB, Poland

84 Horizon Scanning and Futures in the Health and Safety Executive – Selected Topics  
By Peter Ellwood, HSL, United Kingdom
Dansk sammenfatning
(Danish summary)

Af Nele Roskams, Partnership for European Research in Occupational Safety and Health (PEROSH); Steffen Hyldborg Jensen og Per Jakobsen, Det Nationale Forskningscenter for Arbejdsmiljø (NFA)

For at få input til en ny arbejdsmiljøstrategi for perioden 2010 – 2020 og for at opnå indsigt i de fremtidige udfordringer og prioriteringer af arbejdsmiljøindsatsen i Danmark, iværksatte Arbejdstilsynet (AT) en proces med involvering af arbejdsmiljøekspert. En del af processen bestod i afholdelsen af et internationalt ekspertseminar i samarbejde med Partnership for European Research in Occupational Safety and Health (PEROSH).

Formålet med seminaret var at ”prøve at identificere nye og voksende arbejdsmiljøudfordringer samt karakteristika ved det fremtidige arbejdsmarked, som fx. graden af rummelighed eller mangel på samme i forhold til individuel sårbarhed, overvægt, etc.”

Ekspertene blev inviteret til at præsentere deres fremtidsperspektiver for arbejdsmiljøet i et kort skriftligt oplæg og en mundtlig præsentation. De følgende spørgsmål blev inden seminaret sendt til eksperterne til inspiration:
– Hvordan vil arbejdsmiljøet ændre sig i løbet af det næste år? 
– Hvilke udfordringer vil disse ændringer medføre i forhold til den praktiske forebyggelse?
– Hvordan er udviklingen inden for forebyggelse af muskelskeletbesvær?
– Er der opstået nye former for kemiske og biologiske eksponeringer i arbejdsmiljøet (nanopartikler ikke indbefattet)?
– Hvad er den fremtidige rolle for sundhedsfremme på arbejdspladsen?
– Hvor er der huller i vores viden, og hvor er der dermed behov for mere forskning fremover?

Nærværende rapport indeholder eksperternes skriftlige bidrag, mens links til de mundtlige præsentationer og videooptagelser deraf findes på PEROSH’ hjemmeside www.perosh.eu. I videoafspilleren er der desuden links til de enkelte powerpoints. Sammenfatningen indeholder de vigtigste udfordringer og prioriteringer, som de fremgår af de mundtlige og skriftlige ekspertbidrag. Seminaret sluttede med en paneldiskussion, hvor man forsøgte at kortlægge de vigtigste europæiske arbejdsmiljøudfordringer mht. forebyggelse samt de vigtigste forskningssområder inden for arbejdsmiljø i fremtiden.

Nuværende og fremtidige udfordringer i arbejdsmiljøet

De nuværende og fremtidige udfordringer i arbejdsmiljøet er tæt forbundet med samfundsvæksten og kan inddeles i fem hovedområder:
1. Sociale forandringer, fx demografiske (inkl. aldring, køn, migration) og livsstilsfaktorer  
2. Nye teknologier  
3. Globaliseringen  
4. Klima- og miljøproblemer  
5. ”Klassiske” arbejdsmiljørisikofaktorer (biologiske, kemiske, psykosociale, vold, trusler, mv.)
Sociale forandringer på grund af demografi og livsstilsfaktorer

Demografske faktorer, især aldringen af arbejdsstyrken og en stigende migration, har stor indflydelse på beskæftigelsesstrukturen og sammensætningen af arbejdsstyrken.

Aldring af arbejdsstyrken

På grund af en aldrende befolkning i Europa vil arbejdsstyrken hastigt reduceres. Hvis Europa vil opretholde produktiviteten, er det strengt nødvendigt at finde på nye tiltag for at få ældre medarbejdere til at udskyde deres tilbagetrækning fra arbejdsmarkedet. Åldre medarbejdere har større risiko for at udvikle sygdomme. Det er derfor nødvendigt, at der fokuseres på ældre medarbejdernes arbejdssituation ved at udarbejde strategier for, hvordan sundhedstilstanden i arbejdsstyrken kan forbedres og vedligeholdes, og ved at udarbejde fornuftige strategier for karriereforløb blandt arbejdsstyrken som helhed (inkl. livslang læring, jobrotation og rehabiliteringsplaner).

Aldringen i arbejdsstyrken vil medføre, at kroniske sygdomme får en stigende betydning for arbejdsstyrkens arbejdsevne og arbejdskapacitet.

Livsstilstendenser

Ændringer i livsstil blandt nutidens ungdom påvirker arbejdsevnen hos fremtidens arbejdstjørke. Det er derfor vigtigt at gøre unge mennesker bevidste om betydningen af en sund livsstil.

Fysisk inaktivitet kombineret med dårlig kost forøger risikoen for at udvikle dårligt helbred, herunder i særdeleshed risikoen for at udvikle hjertekardsygdomme. Selv om hjertekardsygdomme er folkesundhedsproblemer, har de en stor indflydelse på arbejdspladserne, hvor de forringer arbejdsevnen og kapaciteten blandt medarbejdere, hvilket resulterer i dårligere beskæftigelsesmuligheder. Negative helbredskonsekvenser som følge af fedme vil stige i de kommende år.

Antallet af personer, der udsættes for støj i arbejdstiden, er faldende, hvorimod antallet af høreskader som følge af udsættelse for støj i fritiden højst sandsynligt vil stige i de kommende årtier. Brugen af digitale lydobjekter, fx MP3 afspillerer, fra en meget ung alder har allerede til en vis grad påført de yngre generationer høreskader.

En udvikling hen imod øget selvrealisering har hos nogle grupper medført et behov for at forbedre fysikken og præstationsevnerne vha. medikamenter. Brugen af disse produkter kan udgøre helheds- og sikkerhedsrisici – ikke kun for ”misbrugeren”, men også for kollegaerne.

Migration

Globaliseringen vil medføre en større andel af beskæftigede med indvandrerbaggrund i samfundet og på arbejdspladsen, hvilket vil øge virksomhedsledelsens behov for at styrke bevidstheden om andre kulturer – i forhold til ledelse af medarbejdere generelt og ikke mindst i forhold til at efteruddanne og instruere medarbejderne i arbejdsmiljø- og sikkerhedsmæssige aspekter af jobbet. Når indvandrere skal lære om arbejdsmiljø på arbejdspladsen, bør sprog og kulturelle barrierer tages i betragtning.

Nye teknologier

Eksperterne forudser, at nye teknologier vil dukke op inden for følgende vigtige områder: informations- og kommunikationsteknologi, bioteknologi og genteknologi, robotteknologi, nano-teknologi og energiteknologi.

Informations- og kommunikationsteknologien vil fortsætte med at videreudvikles med høj hastighed inden for alle sektorer. Dette vil indebære flere fleksible arbejdspladser, fx mobile og virtuelle kontorer, telekommunikation samt virtuelt, socialt samvær. Arbejde i virtuelle teams
har stor betydning for arbejdets organisering og kræver en tilpasning af arbejdsmiljøstrategierne.

Trådløse netværk giver store muligheder for global 'networking', men vil samtidig øge befolkningens udsættelse for elektromagnetiske påvirkninger.

Automatisering og brugen af robotter på arbejdspladser vil fortsat stige. Dele af arbejdsstyrken vil blive erstattet af computere og automatiserede systemer. Udviklingen af komplicerede grænseflader (interfaces) mellem menneske og maskine og indlejrede (embedded) computer-systemer vil på den ene side medføre almindelige arbejdsforhold og på den anden side øge behovet for efteruddannelse og oplæring for at fastholde sikkerheden på arbejdspladserne. Ikke alene kan dette medføre en stigning i produktivitet, men det kan også medføre efterspørgsel på arbejdskraft, der ikke er bundet af "normale" arbejdstimer eller de fysiske rammer i et firma for at udføre deres arbejde. Såfremt man ikke er påpasselig med at håndtere denne problematik, kan det bringe balancen mellem arbejds- og privatliv i fare.

Automatisering inden for sikkerhedsteknologi mindsker eksponeringen blandt de ansatte, ved at afstanden mellem de ansatte og produktionsområdet øges med deraf færre menneskelige fejl til følge. Imidlertid kan eventuelle fejl i sikkerhedssystemer ikke udelukkes, hvilket udgør en ny sikkerhedsrisiko for de ansatte, der stoler trygt på disse systemer.

Simuleringer og andre visuelle teknikker vil i stigende grad blive brugt til at forbedre effektiviteten af produktionsapparatet og til at forbedre sikkerheden i forbindelse med produktionen.

Brugen af nanoteknologi og bioteknologi åbner for mange nye muligheder. Mængden af nye former for materialer vil fortsætte med at stige i takt med, at nye anvendelsesmuligheder dukker op. Antallet af medarbejdere, der eksponeres for nye teknologier og materialer, vil fortsat stige. I dag er typerne og omfanget af risici for befolkningen og miljøet stort set ukendt, og det er derfor nødvendigt med en grundig udforskning. Det er vigtigt at udvikle metoder til at måle eksponeringen blandt ansatte.

Gensplejsning vil blive langt mere udbredt og medføre nye risici, nogle endnu ukendte, for den almene befolkning og arbejdsstyrken.

**Globaliseringen**

En globaliseret økonomi vil medføre et stigende pres på virksomhederne for at reducere omkostningerne via bl.a. outsourcing og 'just-in-time' levering af produkterne.

Globaliseringen vil fortsat have stor indflydelse på arbejdsmiljøet og organisationen af arbejdet. Konkurrencen på det globale marked og kravene til omkostningseffektivitet kan medføre en tendens til ringere sikkerhedsstandarder på arbejdspladserne. Ansættelsesvilkårene følger behovene på et globaliseret arbejdsmarked, hvilket kan føre til en udvikling hen mod kortere, mere fleksible kontrakter og usikre ansættelsesforhold, specielt blandt de yngre arbejdsmiljøer. Eksperterne forudser også en arbejdstidsintensivering (høj arbejdstimer) kombineret med stort tidspres, samt en stigning i de faglige og følelsesmæssige krav på jobbet.

De europæiske lande oplever et fald i antallet af medarbejdere i industrien til fordel for servicesektoren, hvilket vil medføre en ændring i arbejdsmiljøudfordringerne. Voksne krav fra kunder og patienter til de ansatte i servicesektoren vil sandsynligvis medføre en stigning i uønsket adfærd, fx vold og aggressioner. Mentale helhedsproblemer (i særlighed depression) er en stigende årsag til sygefravær og invalidεpension.

1) Japansk-inspireret produktions-/lagerstyringsteknik, hvorefter lagertid nedbringes til det minimale
I en tid, hvor udfordringerne inden for arbejdsmiljøet fortsat er vigtige emner, og kvaliteten i arbejdet er under pres, advarer nogle af eksperterne mod nedskæringer i arbejdsmiljøbudgetterne, såvel i den private som i den offentlige sektor.

**Klima- og miljøproblemer**

Klimaet og naturrigdommene er under stigende pres, hvilket stiller krav til en mere bæredygtig produktion og forbrug. Behovet for bæredygtige energiløsninger vil ændre måden, hvorpå vi skaffer vores energi. Selv om vi i de kommende år fortsat vil være ganske afhængige af fossilbrændstof, vil brugen af vedvarende energikilder stige, og energiproduktionen decentraliseres.

En stigende forekomst af klimarelaterede naturkatastrofer er en stor udfordring for nødhjælpsarbejdere. Det stiller også store krav til konstruktionen af nye fabriksanlæg.

Nye former for energibesparelse og genanvendelse vil skabe nye brancher, men vil også medføre nye former for risici. Det er derfor nødvendigt at revidere de nuværende arbejdsmiljøforanstaltninger på arbejdspladsen.

"**Klassiske**" arbejdsmiljøriskofaktorer

De traditionelle arbejdsmiljøriskofaktorer vil stadig forekomme i fremtiden. Hovedområderne er biologiske og kemiske risici, ergonomi, muskelskeletbesvær og psykosociale risikofaktorer. I stedet for at undersøge disse områder hver for sig bør man i stedet fokusere på at forstå medarbejderes samlede eksponering for disse forskellige risikofaktorer. Selv om nogle af risiciene er kendte, vil kombinationen af eksponeringer for såkaldt kendte risici samt forebyggelse af risici fra nye produkter, teknologier og procedurer medføre betydelige arbejdsmiljøudfordringer. På nuværende tidspunkt findes der ingen videnskabelig viden om samspillet mellem de forskellige arbejdsmiljømæssige eksponeringer.


Det er nødvendigt at forske i kombinationen af fysiske eksponeringer samt i samspillet mellem fysiske og psykosociale faktorer og udviklingen af bevægeapparatbesvær.

På grund af væksten i nye produkter og i brugen af disse vil kemiske risikofaktorer fortsat kræve megen opmærksomhed på arbejdspladsen. Eksponeringsmålinger, nye målemetoder og tilstrækkelige beskyttelsesforanstaltninger er afgørende mhp. at forebygge arbejdsrelaterede sygdomme. Allergi og arbejdssrelateret kræft pga. udsættelse for kemiske og biologiske stoffer skal håndteres via langsigtet, primærforebyggelse og med involvering af bred, tværfaglig ekspertise.

Tilgange inden for fremtidsforskning

En såkaldt 'horizon scanning' af fremtidens arbejdsmiljø kan omfatte såvel overvågning af forandringer og effekten af disse af kvantitative data, litteraturkilder og ekspertudtalelser som mere raffinerede og systematiske follow-ups af tendenser og scenarier inden for arbejdsmiljøets udvikling.


I 2007 lancerede den tyske forskningsminister et program for fremtidsforskning³ med det formål at fastholde Tysklands innovationskapacitet og identificere nye nøgleområder inden for forskning og nytænkning. Programmet ser 10 til 15 år ud i fremtiden og tilstræber udveksling af ekspertviden på nationalt og internationalt niveau. Adskillige afprøvede og nye metoder til at se frem i tiden (kvantitative og kvalitative) benyttes i kombination med en systematisk overvågningsproces, som har til formål at understøtte den strategiske planlægning af forskningspolitiske tiltag.

Forskningsbehov

På baggrund af de vigtigste arbejdsmiljøudfordringer, fremkom eksperterne med følgende forskningsbehov og huller i den eksisterende viden:

**Nye forskningstilgange**
- Udvikling af et mere holistisk syn på arbejdets organisering, som omfatter alle virksomhedsprocesser.
- Anvendt forskning, i form af implementerings- og interventionsforskning hvormed man opnår en mere direkte indflydelse på trivsel og arbejdsmiljø. I denne forbindelse er det vigtigt at udvikle værktøjer til at evaluere effekten af interventionsprojekterne.
- En effektiv videnoverførsel, som omfatter stakeholders igennem hele forløbet (fra etablering af forskningsprojektet til implementering af resultater og løsninger).
- Kritisk gennemgang af eksisterende viden om sikkerhed og sundhed i arbejdsmiljøet mhp. at overføre en objektiv og evidensbaseret viden til arbejdspladserne.
- Forskning i forholdet mellem kontekst, arbejde og trivsel ud fra et levnedsløbsperspektiv.

**Tværfaglige forskningsområder**
- Forskning i erhvervsgropper med behov for særligt fokus, fx kroniske syge, invalide, overvægtige, kvinder, immigranter, allergikere samt unge og ældre medarbejdere.
- Kombineret eksponerering for fysiske, psykosociale, kemiske og biologiske risikofaktorer og samspillet mellem dem.
- Bedre koordinering mellem virksomhedernes sikkerheds- og sundhedssystemer og sundhedssektoren.
- Udvikling af en ny model for tidlig intervention, der kan tilbyde ansatte et vist niveau af sundhedsstøtte.
- Modeller for tidlig intervention, Tilbage-Til-Arbejdet-forskning.

²) Ellwood, P., Horizon Scanning and Futures in the Health and Safety Executive – Selected Topics
³) Kuhn, K., Foresight in Germany
**Arbejdsmiljøet i virksomhederne**
- Forskning i vedligeholdelsen af og balancen mellem medarbejdernes produktivitet og trivsel.
- De økonomiske aspekter af sikkerhed og sundhed på arbejdsplassen.
- Forskning i, hvordan man fremmer sikkerhed og sundhed i små og mellemstore virksomheder, samt forskning i hvordan man formidler denne viden til dem.
- Metoder til at implementere og forbedre virksomhederens arbejde med sikkerhed og sundhed på arbejdsplassen i små og mellemstore virksomheder.

**Ulykker**
- Risikofaktorer for arbejdsulykker, kortlægning af de vigtigste risikofaktorer samt effektive metoder til at undgå dem. Der skal udvikles bedre metoder (simulering og modellering) til at forudsige og vurdere ulykker.
- Hvordan man etablerer en sikkerhedskultur på arbejdsplassen.

**Psykosociale problemstillinger**
- Effekten af forandringer i ledelse og omstrukturering på kvaliteten af arbejdsliv og trivsel blandt ansatte.
- Mentale og fællessemasseiske belastninger, specielt depression, som en voksende udfordring i forhold til andre problemer.
- Arbejdsintensivering.
- Forholdet mellem aldring, helbred og arbejde, og hvordan arbejdsforholdene tilpasses behovene blandt alle ansatte i virksomheden.

**Arbejdsfysiologi**
- Effekten af arbejdsmiljøet på kropsfunktioner og sygdomsforløb inden for udbredte sygdomme såsom hjerte-karsygdomme.
- Mere viden om udviklingen af bevægeapparatbesvær og det typiske tidsforløb fra ekspouserings til helbredseffekt.
- Risikofaktorer ved skifteholdsarbejde.

**Kemiske og biologiske risici**
- Metrologi, epidemiologi, vurdering og forebygelse af biologiske risici.
- Bestemmelse af den population, som er udsat for elektromagnetiske felter samt risikovurdering og foranstaltninger mhp. at forhindre skader.
- Effekten af forskellige kemiske produkter og udvikling af nye testmetoder.
- Metoder til måling af eksponering for nanopartikler, risikovurdering og effektive forebyggelsesmetoder.

**Paneldiskussionen**

Paneldiskussionen havde til formål at samle eksperternes vurderinger af de kommende års vigtigste udfordringer mht. forebygelse og forskning. Det var hensigten, at panelet gennem en grundig diskussion kunne nå frem til en prioriteret liste over de vigtigste arbejdsmiljøudfordringer de kommende år. Eksperternes svar på ordstyrerens spørgsmål er opført nedenfor:

**Er der i det kommende årti et behov for en radikal ændring af fokus på arbejdsmiljøproblemerne, eller vil det være tilstrækkeligt med en ”finjustering”?**
3. Det blev diskuteret, hvordan man kommer fra forskning til handling, og om der ikke burde være mere fokus på implementeringsforskning for at undersøge effektiviteten af forebyggende løsninger.

4. I tilknytning til dette var deltagerne enige om, at det var vigtigt for arbejdsmiljøindsatsen, at befolkningen og særligt de politiske beslutningstagere fokuserer på arbejdsmiljøets generelle betydning for samfundet. Et tættere internationalt samarbejde mellem forskerne vil kunne styrke dette fokus.

Bør fokus i fremtiden være rettet mod allerede eksisterende risici eller fremtidige risici?

1. Ifølge panelet er dette ikke et spørgsmål om at vælge mellem de to, da begge spørgsmål er vigtige.

2. På den anden side, er nogle af den overbevisning, at forskning pr. definition bør fokusere på "nye" risici.

3. Der blev argumenteret for nødvendigheden af forbedrede metoder til at opstille fremtids-scenarier, så man proaktivt kan imødegå nye risici. Imidlertid rejser der sig det problem, at i forbindelse med udviklingen af nye teknologier vil virksomheders behov for hemmeligholdelse og fortrolighed hæmme forskeres adgang til at udforske risici knyttet til disse teknologier.


5. Forskere bør være opmærksomme på, at forskellige grupper med forskellige interesser er involveret, hvilket betyder, at det eller de emner, man vælger at fokusere på i fremtiden ikke er neutrale. Ved at involvere stakeholders fra starten af et projektforløb kan man bryde den barriere, der opleves at være mellem forskningsverdenen og det omgivende samfund.

6. Foruden risikoanalyser (nuværende eller fremtidige risici) bør vi fokusere på konkrete handlinger og i særlighed se på implementering af løsninger på arbejdspladsen. Interventionsforskning er et muligt svar på denne udfordring.

Hvilke kriterier er relevante mhp. at definere fremtidige arbejdsmiljøudfordringer og forskningsområder?

1. Hvor vigtig en samfundsmæssig rolle spiller arbejdsmiljøet, samt hvilke arbejdsmiljørisici er samfundet villigt til at acceptere?

2. Hvad er de samfundøkonomiske cost-benefits ved at investere i en specifik arbejdsmiljømæssig udfordring?

3. I hvilket omfang har investeringen en positiv effekt på medarbejderes helbred, og hvor stort et afkast giver investeringen – fx ved at nedbringe arbejdsskadeerstatningerne?

4. Udfylder området et nuværende hul i arbejdsmiljøforskningen?

5. Hvad siger den nyeste viden på andre relaterede områder?

6. Har forskningsområdet en sammenhæng med eksisterende samfundsmæssige prioriteringer?

Hovedkonklusion

Hvad er de fremtidige udfordringer inden for forebyggelse?

På baggrund af præsentationerne og paneldiskussionen er de vigtigste udfordringer mht. forebyggelse i fremtiden sammenfattet i det følgende.

Hovedudfordringerne er:

− Demografiske forandringer som følge af en aldrende arbejdsslange og voksne indvan
− Globaliseringskonsekvenser for arbejdsmiljøet i form af fx intensivering af arbejdet.
- Klimaforandringeres indflydelse på arbejdsmiljøet, fx som følge af det stigende omfang af naturkatastrofer.
- Livsstilsændringer. Usund livsstil blandt nutidens unge vil medføre helbredsproblemer i den fremtidige arbejdsstyrke.
- Arbejdsmiljøaktørerne og virksomhederne bør fokusere mere på en sund livsstil i arbejdsstyrken samt sundhedsfremme på arbejdspladsen.
- Det mentale helbreds indflydelse på arbejdsevnen.
- Voksende krav til arbejdssstyrkens tilpasningsevne i forhold til organisationsændringer.
- Muskel- og skeletbesvær, inklusiv sammenhængene mellem mentalt helbred og muskel- og skeletbesvær.
- Nye ansættelsesformer, fx langdistanceansættelse og hjemmearbejdspladser.
- Fokus på arbejdsmiljø ifm. outsourcing
- Det er nødvendigt at ændre fokus hen imod, hvordan man forbedrer medarbejdernes kapacitet til at kunne håndtere de fysiske og psykosociale risikofaktorer.
- Foruden at fokusere på mulige negative konsekvenser af arbejdsrelaterede risici, bør arbejdsmiljøprofessionelle også koncentrere sig om arbejdets positive effekter på sundhed og mental trivsel.
- Nye teknologier inkl. bioteknologi, IT, automatisering.
- "Klassiske" arbejdsmiljørisici (biologiske, kemiske, psykosociale og fysiske risikofaktorer).
In order to gain input for the New Danish Working Environment Strategy for the period 2010-2020 and to gain insight in the future challenges and priorities for the Danish working environment, the Danish Working Environment Authority decided to organise a consultation process. Part of this process was the organisation of an international expert seminar in collaboration with PEROSH (Partnership for European Research in Occupational Safety and Health).

The purpose of the seminar was to “seek to identify growing, emerging and new working environment challenges as well as characteristics of the future labour market such as its degree of inclusiveness in relation to individual vulnerability, overweight, etc.”

The experts were invited to present their scientific views in a short paper and presentation. The following questions were suggested for consideration by the experts.

- How is the working environment changing during the next decade with respect to each country?
- What challenges with respect to practical prevention do these changes pose?
- How is the development regarding prevention of musculoskeletal disorders?
- Are there any emerging risks with regard to chemical or biological hazards in the working environment (not including nano-materials)?
- What is the future role of workplace health promotion?
- What knowledge gaps – and needs for new research – are foreseen?

The written contributions from the experts are assembled in this report, whereas links to the presentations and videos of the presentations can be accessed via the PEROSH website www.perosh.eu. The executive summary brings together the main challenges and priorities raised in the expert contributions. The seminar concluded with a panel discussion seeking to identify the most important European working environment prevention challenges and the most important future working environment research topics.

Executive summary

Current and future challenges in the work environment
The current and future challenges in the working environment are closely linked to the changes taking place in society and can be clustered in 5 main areas.
1. Social changes such as demographics (including ageing, gender, migration) and lifestyles
2. New technologies
3. Economic changes and the effect of globalisation on our economic system
4. Environmental issues and sustainable development
5. “Classical” OSH risks (Biological, chemical, psychosocial stress, violence and intimidation, …)
Social changes due to demographics and lifestyles

Demographics, such as an ageing workforce and an increase in migrant workers, will have a considerable effect on the employment structure and the composition of the workforce.

An ageing workforce

Due to an ageing population in Europe and abroad the workforce will decrease rapidly. If Europe wishes to maintain its productivity, innovative solutions to make older workers postpone their retirement will be indispensable. Older workers tend to be at greater risk of developing ill health. Greater attention to the working conditions of ageing workers introducing strategies to improve and retain fitness of the workforce and establishing a sound career management strategy adapted to the workforce as a whole (including life-long learning, job rotation and rehabilitation schemes) have to be further developed and attuned to face the challenges.

The ageing of the workforce also increases the relevance of the impact of major chronic diseases on the ability and capacity to work.

Lifestyle trends

The emergence of lifestyle changes in the youth of today will have its effect on the work ability of the workforce of tomorrow. Awareness raising and education from an early age on are essential to prevent further breakdown.

Physical inactivity and poor dietary habits are strong risk factors for the development of ill health, and in particular for the development of cardiovascular diseases. Although these are public health issues, it can have an important effect on the workplace, impairing the abilities and capacities of employees for certain types of jobs, resulting in poorer opportunities for employment. Negative health consequences of obesity are likely to increase during the coming years.

While the exposure to work related noise is on the decline the incidence of noise induced hearing impairment due to leisure related noise will probably rise during the next decades. The use of devices such as MP3 players from an early age has already to some extent damaged the hearing ability of the young generations.

A trend towards increased self realisation has led to a wish to improve the body and enhance human performance through all sorts of therapeutic applications and the use of lifestyle drugs. The use of these products can lead to health and safety risks not only for the users but also for their co-workers.

Migration

Further globalisation will lead to a higher proportion of employees with a migrant background in society and at the workplace increasing the company’s need to enhance their intercultural awareness in management practices, workplace training and health and safety issues. Instructing migrant workers about health and safety issues must take into account language and cultural barriers. Risk perception and social interaction has to take into account different cultural backgrounds and possible language barriers.

New technologies

The experts foresee the emergence of the following significant technologies: information and communication technologies, biotechnology and genetic engineering, robotics, nanotechnologies and emerging energy technologies.

In all sectors, the performance and nature of information and communication technologies will continue to develop at a fast pace. It enables more flexible workplaces such as mobile
and virtual offices, teleworking and social virtualisation. Working in virtual teams has a large impact on the work organisation and calls for adapted OSH strategies.

Wireless networks offer great opportunities for worldwide networking but will increase the exposure of the working population to electromagnetic fields (EMF) from broadcasting and power distribution installations, as well as various electrical and wireless appliances will be likely.

Automation and the use of robotics at the workplace will continue to increase, replacing parts of the labour force by computers and automated systems. This creates possibilities for direct safety oriented man-machine communication. The development of complex human-machine interfaces and “embedded” computer systems will lead to versatile working conditions and subsequent training needs to maintain safety of workplaces. It offers the possibility to increase the productivity, but can also lead to higher demands for workers not limited any longer to “normal” working hours or the company premises to do their job. In case this is not properly dealt with it may jeopardise work-life balance of families.

Automation used in safety technology decreases the workers’ exposure by creating more distance between the worker and the machinery or products and reduces human error. However, potential security flaws in built-in safety systems cannot be ruled out and represent also a new kind of risk to workers relying only on these devices.

Simulations and other visualisation techniques will be used to improve the performance of systems and the safe design of new processes and equipment.

The rise of nanotechnology and biotechnology offers a great deal of new possibilities. The number of new materials will continue to increase as new applications are found. The number of employees exposed to these new technologies and materials will steadily grow. Today the nature and extent of the risks to the public health and the environment remains largely unknown and needs thorough investigation. Measurement devices need to be further developed to assess exposure of employees. Genetic engineering will become more widespread creating new risks – some as yet unknown - to the general public and employees.

**Economic changes and the effect of globalisation on our economic system**

The globalised economy gives rise to international networking and outsourcing, demanding just-in-time delivery and cost cuts.

Globalisation has and will continue to have a profound impact on the quality of the working environment and the work organisation. Competition on the global market may lead to a pressure towards lower occupational safety and health standards. Employment conditions will follow the needs of the globalised labour market, encouraging a decrease in contract duration, in particular for the younger workforce, and an evolution towards more flexible, short term contracts and precarious employment relations. Experts also predict work intensification (high workload combined with high time pressure) and an increase in the professional and emotional demands at work.

European countries report a decrease in the proportion of industrial employment in favour of the tertiary sector. This shift leads to a change in the working environment challenges. Increasing demands from clients and patients towards service sector employees raise the probability of unwanted behaviour such as violence and aggression. Mental disorders (in particular depression) are on the increase in the statistics of sickness leave and disability pensions.

Furthermore, in a time where the challenges to occupational safety and health remain important and the quality of work is under pressure, some of the experts warn against cutting down
on the occupational safety and health budgets, not only in companies but also in the public sector.

Environmental issues

The climate and the natural resources are under increasing pressure which calls for more sustainable production and consumption. The need for sustainable energy solutions will change the way in which we obtain our energy. Although the reliance on fossil fuel will still be considerable in the years to come, renewable energy sources and decentralized energy production will increase.

The increasing occurrence of natural disasters presents an important challenge to relief workers and to the construction of industrial plants. New types of energy saving and recycling will lead to new business sectors but will also lead to new types of risks. We therefore need to consider revising our health and safety measures.

“Classical” OSH risks

The more traditional OSH risks will not disappear in the years to come. Main areas are biological and chemical risks, ergonomics and musculoskeletal disorders (MSD), and psychosocial risk factors. Instead of studying these areas separately, we must focus on understanding the combined exposure of employees to different risk factors. Although some of the risks are known, combinations of exposure to so called “known” risks together with risks stemming from new products, technologies and procedures will lead to significant OSH challenges. Up till now there is not enough scientific knowledge about the interaction of combined exposures to employees.

MSD still make up for a large proportion of the compensated occupational injuries. It is considered likely that the amount as well as the different types of recognised disorders will not decrease and will even grow in the coming years. Disorders related to repetitive motion of the upper extremities continues to constitute a challenge. There are considerable challenges in the prevention of MSD of young employees (under 25) who are more often exposed to heavy manual labour. Combined physical exposures as well as the nature of the interaction between physical and psychosocial factors and the development of MSD needs to be studied.

Due to the growth of new products but also caused by the increase in the use of products, chemical risks will continue to represent a major centre of attention for workplaces. Assessment of exposure, new measurement methods and adequate protective measures are essential to prevent work-related diseases. Allergies and occupational cancers caused by chemical and biological agents need to be tackled adequately and need a long-term primary prevention focus involving all multidisciplinary expertise available.

The quickly changing “world of work” requires enhanced flexibility and continuous learning. In some countries the amount of mental health disorders has increased considerably during the last decade. The increased cognitive demands and complexity of the workplace due to new technologies, management systems, work processes and the information stream, combined with high work pressure and a growing precariousness on the labour markets has increased emotional and mental strain on workers. There is a need for more awareness on the complex effects of these changes on occupational safety and health and a need for more attention to workability and development of individual mental health and well-being.
**Future scanning concepts**

Horizon scanning related to occupational health and safety can go from the monitoring of change and its effects through examination of available quantitative data, literature sources and expert opinions to rather refined and systematic follow-up of trends and possible scenarios for health and safety.

The Health and Safety Executive (HSE) initiated a horizon scanning system in the UK in 2005 in order to identify and analyse trends and emerging issues that are likely to have an impact on occupational health and safety. The role of the horizon scanning team at the Health and Safety Laboratory is to analyse and assemble information, not only on technological developments but also on social, economic, environmental and political issues from different sources to be included in the HSE strategic planning. Subsequently, a scenario planning project was developed, focusing on the future health and safety issues in 2017 and used in workshops and other planning activities. The Futures Group, which comprises senior HSE specialists in different fields, reflects on the implications of the gathered information and how it should be used by the HSE.

A systematic German foresight process has been introduced by the German Ministry of Research in 2007, in order to maintain the innovative capacity of Germany and to identify new key areas of research and innovation. The foresight process is aimed at gaining an insight in the next 10 to 15 years and strives for personal exchanges between experts at national and international level. A number of tested and new foresight methods (quantitative and qualitative) are used in combination with a specific monitoring process and aim at supporting the strategic planning of research policy measures.

**Knowledge gaps and selected topics for further research**

Linked to the main working environment challenges, the experts mentioned the following research needs and gaps:

**New approaches to research**
- Development of a more holistic view on the organisation of work, including all company processes.
- Applied research, in the form of implementation and intervention research, which has a more direct impact on the well-being and occupational health and safety at the workplace. In this connection it is important to develop tools to evaluate the effect of intervention projects in enterprises.
- Effective knowledge transfer involving the stakeholders during the entire process (from setup of the research process to implementation of results and solutions).
- The need for critical reviewing of the existing knowledge on occupational safety and health in order to implement objective and evidence based knowledge at the workplace.
- Research on the relationships between the contextual framework, work, and well-being in a life course perspective.

**Cross-disciplinary research themes**
- Research on occupational groups that need specific attention such as the chronically ill, disabled, obese workers, women, migrant workers (including focus on inter-cultural health and safety communication), allergic workers, and young as well as ageing workers,
- Combined exposure to physical, psychosocial, chemical and biological risks and the way they interact.

---

4) Ellwood, P., Horizon Scanning and Futures in the Health and Safety Executive – Selected Topics
5) Kuhn, K., Foresight in Germany
– The exchange and coordination between company health care and curative health care with regard to employment-related health issues.
– Development of a new model of early intervention, providing a minimum level of work-related health support to all employees.
– Models for early intervention – return-to-work research.

OSH at the enterprise level
– Research on the maintenance and balance between productivity and well-being of the workforce and the acknowledgement of the employee as a valuable productive asset having a need for self realisation and a capacity of self control.
– The economic aspects of OSH.
– Research on how to approach OSH in small and medium sized enterprises (SMEs) and research on how to transfer knowledge to SMEs (type of information, communication and training needed) is necessary.
– Adequate methods to stimulate and implement OSH management in the small and medium size enterprises.

Accidents
– Risk factors leading to workplace accidents, identification of primary risks, how to effectively prevent them. Simulation and modelling methods to predict and assess accidents should be further developed to understand the nature of the risks and to improve the design of machinery and manufacturing processes.
– How to establish a safety culture at the workplace.

Psycho-social issues
– Psychosocial risks and the effect of changes in management and restructuring on the quality of working life and the well-being of employees.
– Mental and emotional strain and especially depression as a growing challenge relatively to other issues.
– Intensification of work.
– The relation between ageing, health and work and how to adapt working conditions to the needs of all employees in the company.

Work physiology
– The effect of work factors on bodily functions and the pathogenesis of specific disorders such as cardiovascular disease.
– More knowledge on the development of MSD and the typical time period from exposure to health effect.
– The risks of shift work.

Chemical and biological hazards
– Metrology, epidemiology, assessment and prevention of biological risks.
– Identification of the population exposed to electromagnetic and optical fields, risk assessment, and measures to prevent harm.
– The effects of different types of chemical products and the development of alternative testing methods.
– Adequate measurement of the exposure to nanoparticles, risk assessment and effective prevention measures.

The panel discussion
The panel discussion sought to bring together the opinions of the experts on the main prevention challenges and research topics of the coming years. Other than to reach an acknowledged conclusion and to have a formal discussion to determine a list of clear-cut priorities, the
experts were asked to discuss what for them were the points that needed further attention and the necessary conditions to address the working environment challenges from the next decade. Below are presented the opinions of the experts on the questions proposed by the moderator.

Is there in the coming decade a need for a radical shift of focus in work environment issues, or will a fine-tuning be sufficient?
1. The discussion has not led to the idea that there has to be a radical change of focus. A focus of attention is the balance between collective and individualised risk management.
2. Secondly, the question on adequate methodology was raised. The participants called for a more holistic and proactive approach towards OSH issues.
3. The subject was raised how to go from research to specific actions and whether there shouldn’t be more attention towards action and implementation research to test the effectiveness of preventive solutions.
4. Related to this, participants believed that general and specific awareness amongst the general public and more specifically amongst the political decision makers on the topic is necessary to improve the coverage of OSH issues. More collaboration between researchers at the international level could improve the consideration of these topics.

Should future focus on this topic be on the already “materialized risks” or on the “emerging risks”?
1. According to the panel it is not an issue of choosing between the two, both questions remain important.
2. On the other hand, there is also the conviction that research should per definition be focussed on new risks.
3. It was argued that we need better forecasting methods to proactively foresee new risks. A potential problem, however, is that in case of new technologies the need for confidentiality hinders the full understanding of potential new risks.
4. If we could change the focus from either materialised risks to new risks, to an approach of proactive risk management including a multifactorial approach involving multidisciplinary experts, we would be on top of new developments and therefore of new risks. Put in other words, if we include risk management in design management, new risks can effectively be tackled at the source.
5. Researchers should be aware of the fact that different parties with different interests are involved. This means that the subject of what to focus on in the future is not a neutral one.
6. Besides risk analysis (current or future) we should also focus on concrete actions and more in particular look at implementation at the workplace and identify solutions. The idea of intervention research could answer this question.

What criteria are relevant to define future work environment challenges and research topics?
1. A first criterion is the evolution in what society in general deems important and the question of how important occupational safety and health is to us as a society from a humanitarian point of view and what risks are we willing to accept.
2. Secondly, what are the possible cost-benefits of investing in a specific OSH challenge or topic?
3. In how far does the investment have a positive effect on the health of the worker and thus prevents a costly compensation by e.g. the insurance?
4. Another criterion could be if it fills in a current gap in OSH related research.
5. What is the current state of art knowledge in other related domains?
6. Does the research topic have a link with other pre-existing priorities set on the political, economical or social level?
Main conclusion

What are the main future prevention challenges?
On basis of the presentations and the panel discussion the most important future prevention challenges will be summarized in the following:

The main challenges are:
- Demographic changes due to an ageing work force and increased migration
- The impact of mental health on work ability
- Increasing demands on the work force to adapt to organizational change.
- Muscular skeletal disorders (MSD), including the link between mental health and MSD.
- Lifestyle changes. Unhealthy lifestyles of young people today will cause health problems of the future work force.
- New technologies, including biotech, IT, robotics
- Consequences of globalisation on OSH in terms of intensification etc.
- The impact of climate change on OSH, e.g. due to an increased frequency of natural disasters.
- “Classical” OSH risks (biological, chemical, psychosocial, and physical risk factors)
- Occupational safety and health risk of new employment forms such as long distance workers and people working at home.
- Attention to OSH in outsourcing activities.
- The OSH community and the enterprises should give more attention to a healthy life style of the work force and healthy promotion at the work place.
- A shift is needed towards a focus on how to increase the capacity of employees to cope with physical and psychosocial risk factors.
- Apart from a focus on potentially negative outcomes of work related risks, OSH specialists should also concentrate on the positive effects of work and employment on health and mental well-being.
# Programme

The International Expert Seminar  
Working Environment Challenges for the Future

**24 September 2009 (12.00 – 18.00)**

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
</tr>
</thead>
<tbody>
<tr>
<td>12.00 – 13.00</td>
<td>Lunch at the National Research Centre for the Working Environment (NRCWE)</td>
</tr>
</tbody>
</table>
| 13.00 – 13.10 | Introduction and welcome  
Dr. Palle Ørbæk, Chairman of PEROSH                          |
| 13.10 – 13.40 | How is the Working Environment Changing During the Next Decade  
with Respect to Each Country  
Dr. Agnès Parent-Thirion – European Foundation for the Improvement of  
Living and Working Conditions (EU)                          |
| 13.40 – 14.00 | Forecast on New and Emerging Risks Related to Occupational Safety and Health – View of the European Agency  
Dr. Eusebio Rial González – European Agency for Safety and Health at Work (EU) |
| 14.00 – 14.20 | Future Challenges to the Working Environment – Comments of an Accident Insurer  
Dr. Dietmar Reinert – BGIA (Germany)                          |
| 14.20 – 14.40 | Coffee break                                                                               |
| 14.40 – 15.00 | Forecast on Future Occupational Safety and Health Challenges in Europe and Italy  
Dr. Sergio Iavicoli – ISPESL (Italy)                          |
| 15.00 – 15.20 | Foresight in Germany  
Dr. Karl Kuhn – BAuA (Germany)                             |
<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
<th>Speaker(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>15.20</td>
<td>Forecast on Future Challenges in the Work Environment in Québec (Canada)</td>
<td>Dr. Marie Larue – IRSST (Canada)</td>
</tr>
<tr>
<td>15.40</td>
<td>The Entry of Self Leadership into the Work Environment Equation</td>
<td>Dr. Pia Bramming – NRCWE (Denmark)</td>
</tr>
<tr>
<td>16.00</td>
<td>Coffee Break</td>
<td></td>
</tr>
<tr>
<td>16.20</td>
<td>Occupational Safety and Health Research Needs</td>
<td>Dr. Frédéric Lerais – INRS (France)</td>
</tr>
<tr>
<td>16.40</td>
<td>Forecast on future working environment challenges in Finland</td>
<td>Dr. Mikko Härmä – FIOH (Finland)</td>
</tr>
<tr>
<td>17.00</td>
<td>Working Environment Challenges for the Future – The Norwegian perspective</td>
<td>Dr. Pål Molander, Dr. Stein Knardahl – STAMI (Norway)</td>
</tr>
<tr>
<td>17.20</td>
<td>Future working environment challenges in the Netherlands</td>
<td>Dr. Joost Van Genabeek – TNO Work and Employment (Netherlands)</td>
</tr>
<tr>
<td>17.40</td>
<td>Closing of day 1</td>
<td></td>
</tr>
<tr>
<td>20.00</td>
<td>Dinner</td>
<td></td>
</tr>
</tbody>
</table>
25 September 2009 (8.45 – 13.30)

8.45 – 9.00 Coffee and welcome

9.00 – 9.20 Future challenges with respect to the electromagnetic component of the working and living environment
Dr. Jolanta Karpowicz – CIOP-PIB (Poland)

9.20 – 9.40 Horizon Scanning and Futures in the Health and Safety Executive – Selected Topics
Dr. Peter Ellwood – HSL (United Kingdom)

9.40 – 9.50 Coffee break

9.50 – 12.20 Plenum discussion seeking to identify
– The European Top-5 working environment prevention challenges
– The European Top-5 future working environment research topics.
Chairman: Glen Winzor – NRCWE (Denmark)

12.20 – 13.30 Lunch
Future Challenges to the Working Environment –
Comments of a research institute of the German Social Accident Insurance

By Professor, Dr. Dietmar Reinert, BGIA – Institute for Occupational Safety and Health of the German Social Accident Insurance (Germany)

Introduction

The jobrelated trends and challenges of the next 5 to 10 years in Europe cannot be viewed solely from a national point of view. The countries of the European Union are so tightly knit economically and socially that medium- and long-term trends are affected by developments in Europe as a whole (particularly as a result of joint legislation). On the other hand, there are undoubtedly differences between the member states, e.g. in the trend towards a service economy. In the Netherlands for instance virtually 80% of jobs are located in typical service trades while in Germany about 65% work in the services or tertiary sector. This paper highlights five trends and challenges with a genuinely European dimension which have been derived from European future scenarios and forecasts by experts. The main sources are

c. Strategic Research Agenda of the European Technology Platform Industrial Safety - www.industrialsafety-tp.org
e. New and Emerging Risks in OSH – www.newoshera.eu

In this discussion of the five main challenges for the future, reference is made where necessary to the characteristic features of the German economy. This applies most importantly to recommendations for possible occupational safety & health (OSH) research.

While the first part presents the challenges with exemplary facts in order to predict the consequences for the working environment in 10 to 15 years, the second part of the paper, more or less as an analysis of the first part, provides answers to the key questions on the subject.

Future Challenges to the Working Environment

An analysis particularly of the results of the experts forecasts on emerging risks related to OSH (see b) and of the strategic research agenda of the European Technology Platform “Industry Safety” (see c) yields the five OSH-related challenges for the future:

– Trends in personal life-styles
– Demographic changes, including migration
– Trends in new technologies in the near future
Along with these new challenges, we also wish to mention classical hazards where the perception of risks and their prevention is subject to constant change and thus pose challenges for the future as well.

**Trends in personal life-styles**

Anyone investigating of the effect of personal life-styles on future trends is well advised to study the evolving safety and health awareness of children and adolescents. To illustrate this I have taken two examples that will undoubtedly have an effect on the future working environment:

"Poor diet, overweight, smoking and lack of exercise are a current social problem that is affecting more and more young people. This disease-inducing life-style will also have dramatic effects on job prospects, as many activities are strongly restricted by the lack of physical fitness" [1]

This quote from a monthly magazine distributed to German firms indicates one of the problems. In the United Kingdom, for instance, the prevalence of overweight expressed in the body-mass index (BMI) increased from 8 to 20% for children aged 7 to 11 from 1984 to 1998. Similar trends, though not as acute, can be observed in Spain, France, Greece and also Germany [2]. A current survey of over 12,000 women and men aged 16 to 25 shows an increase in overweight of 32% among the 16-year-old men and 50% among the 25-year-old men in Germany [3].

Physical inactivity and poor dietary habits are the cause of these trends and are ultimately responsible for a strong increase in cardiovascular risk factors at an early age. Such persons are no longer eligible for certain jobs, while other jobs soon put these young workers under strain and increase their risk of illness [3]. The situation will have a considerable impact on the European workforce by the year 2020.

Another example is young people’s high consumption of music with MP3 players, going to discotheques, attending pop concerts and playing in bands [4]. Unfortunately there are too few longitudinal studies on trends in hearing loss among adolescents [4]. A study of Norwegian conscripts in 1988 came to the conclusion that the share of recruits with hearing loss of more than 20 dB in the speech range had almost doubled from 1981 to 1987 [5]. Another, German study shows that, 10 years later in a study of 580 school pupils, overall 18% (23% male) had incipient noise-induced hearing loss of more than 20 dB. This figure concurs roughly with the studies from Norway. However, if one concentrates on the pupils who claim to listen frequently to music, the share of noise-induced hearing disorders comes to 31% among the 13- to 15-year-olds and 28% among those aged 16 and 17 [6]. While, at least in Germany, the incidence of work-induced hearing loss is declining, a contrary trend can be observed in leisure-related hearing loss. Since the ability to hear will probably grow in importance in the jobs of the future because of the increase in communication, the incipient hearing loss of adolescents and young adults will probably be of growing significance for working conditions in 2020.

A similar health-impairing aspect of personal life-style is tanning. A new study by the IARC shows a 75% increase in melanoma among those who start regularly using sunbeds at ages under 30 [7].

Safety- and health-promoting behaviour cannot be achieved by persuasion and legislation alone. Life-styles acquired in early childhood can only be changed with huge effort. In terms of the challenges posed by health-hazardous life-styles, increasing efforts must be made in
preschools and schools to educate pupils on health. Safety- and health-promoting behaviour must become as much a part of the syllabus as sports or ethics. In Germany, there is a huge deficit in this area and joint efforts are required in educational research and in the planning of syllabuses to firmly root this subject in the minds of children and adolescents.

**Demographic changes in European society**

Thanks to advances in medicine and the drop in the birth rate, the proportion of old people will continue to grow in our societies. A study by the EU [8] estimates that by the year 2050 half of Europe’s citizens will be 50 years or older. The figure will have already reached 45% by 2025 (see d)). Partly due to this and partly totally independently of this, there will be an increase in employees with a migrant background. There is a marked difference between Germany east and west. Older employees are often at greater risk, particularly given unfavourable physical working conditions. Physical and physiological fitness in terms of sight and hearing, muscle activity, the burden on the cardiovascular system and the speed of recovery after stress deteriorate with increasing age [9]. In Germany, the challenges of demographic change are not being tackled in all companies. Life-long learning, job rotation, the option of the horizontal career, secondary and tertiary prevention, and rehabilitation have not become universally established as means of keeping older employees not only at work but also fit for their specific duties. Demographic change will of course also result in older and older employees having to care for an increasing number of older people. Making these jobs less demanding and safer will be a task of the future.

Migratory movements in the EU have grown strongly in the last 20 years. In Germany, for instance, the number of employees with a migration background almost doubled from 1990 to 2004. Similar trends can be observed in Austria, Italy, Spain, Greece, Denmark and the Czech Republic. The proportion of migrants of the overall population varies from a few per cent (chiefly in the countries of eastern Europe) to 40% in Luxemburg. Demographic change will tend to increase the proportion of employees with a migration background in Europe. Safe and healthy jobs in intercultural teams firms will have to take account of cultural differences. An important factor here will be the leadership of intercultural teams, guidance on intercultural issues, and the development of prevention strategies for schools in the field of migration/intercultural training.

**Technological innovation (see a.)**

The 2005 Eurobarometer survey on biotechnology [10] expects the following technologies to be important for the future:

– Computers and information technology (including mobile phones)
– Solar and wind energy
– Biotechnology
– Genetic engineering
– Space exploration
– Nanotechnology

Of these, I shall take a closer look at the challenges posed by computer technology, information technology and mobile phones on the one hand and by biotechnology, genetic engineering and nanotechnology on the other. In my view, changes due to these technologies will have a powerful effect on the working environment in the next 10 years.

**Computers, information technology and mobile phones**

Numerous studies show that information technology is growing in importance in most sectors and that the working environment in these sectors is changing to a far-reaching extent [11].
For the period after 2020 the information and communication technology report in [12] states: “Information and communications have penetrated every corner of professional and private life. Intelligent, networked devices are used in homes and offices everywhere. ... In the business world, mobile Internet access has become a matter of course, enabling people to access workplace data on the road and from home.” (see page 196 of [12])

It is not only mobile workplaces and worldwide networking that are causing changes in the working environment, but also progress in information technology that is constantly improving the performance of computers. Today, microprocessors can be found in virtually every technical device and this trend will continue. In many cases, communication with such “intelligent systems” will become simpler for the user, but for those that build and set up the machines, greater technological expertise is called for. New technology offers great opportunities, but, applied thoughtlessly and incorrectly, harbours a huge hazard potential. In areas where people work with machines and equipment, access-denying protective devices will tend to be removed wherever possible and a collaborative mode of working with machines and plant will evolve. Direct safety-oriented man-machine communication will grow in importance. It is not only industry that is being penetrated by information technology, but also trade, logistics and building services. Progress in information technology will accelerate globalization and permit a division of labour on the intercontinental scale. Thanks to the improving performance of computer systems, new modelling methods and 3D visualization techniques will become possible. Making use of these technologies to improve the situation at the workplace, particularly where complex technologies are involved, is a research topic for the future. Here it is not only a matter of designing safe systems but also of their functional serviceability and the simulation of harmful situations and their prevention at the workplace. Current examples of this are 3D simulations of maintenance situations at hazardous machines, flight simulators, and simulators to improve the handling characteristics of cars and bicycles [13].

Biotechnology, genetic engineering and nanotechnology

The following developments will probably arise in the next 10 years:

Human genetics and systems biology are increasingly revolutionizing the diagnosis and treatment of disease. There will be further advances and groundbreaking innovations in genomics, gene modification and thus in disease treatment and the development of medicines. Biochips, biosensors and bioinformatics will strongly influence these new developments as multidisciplinary products [12].

Biotechnology will also create new materials for technological applications, e.g. the conversion of wood or vegetable fibres into ceramics, artificial spider silk of extreme strength, lubricants and antifreezes. In special biological reactors, artificial tissue, e.g. artificial skin or liver tissue, can be generated and utilized for medical treatment. The outcome is intelligent tools (so-called adaptive structures) that repair themselves or adapt to ambient conditions. This trend shows that biotechnology and genetic engineering are meshing more and more tightly with computer technology and electronics. Ongoing developments in nanotechnology will contribute to this [12]. This will result in new electronic components (circuitry design based on quantum mechanics), nano C-MOS storage units, progress in gene therapy and molecular prosthetics, the development of implantable biocompatible nanomaterials and in nanomaterials as a transport system for medicines, and biosensors capable of identifying and measuring biological reactions in the nanometre range. Nanotechnology itself will give rise to new materials, such as fillers for polymers that are thus more stable and more resistant to wear and temperature, nanofibres made of so-called carbon nanotubes that are 1000 times more conductive than copper and show 20 times the tensile strength of steel, and nanoparticle coatings that reduce the need for cleaning (lotus effect) and are capable of replacing ecologically suspect anti-corrosion coatings. In the field of lightweight components in vehicle engineering, significant reductions in weight and fuel consumption will be facilitated by nanofoams [12].
The examples show that the above technologies will be integrated in very many different production processes. The reliable measurement of exposure to nano-, bio- and genetically modified particles and their toxicological assessment will be a focus of OSH research in this connection. Past experience has shown that important technological innovations will establish themselves regardless of safety or health concerns.

Globalization

Along with technological innovation, I am of the opinion that globalization will be one of the biggest challenges for the working conditions of the future. The number of firms with international operations has increased dramatically in Germany in particular and in Europe in general in recent years [14]. In view of the worldwide trade between the continents of Europe, North America and Asia, it is obvious that Europe and Asia will occupy a prominent position in this connection [15]. Globalized companies operate worldwide, making use of the networks between their various branches, are in most cases multilingual, work in multicultural teams often at mobile workplaces, have flexible working hours and encourage travel because of their high degree of integration in international trade. These points alone show that globalization will have a profound impact on the working environment of employees in global companies. A consequence of worldwide networking in Germany is the strong increase in reportable illnesses under the German Epidemics Act, which rose from 214,111 in 1995 to 291,736 in 2005 and to 454,787 in 2008 [16, 17].

Globalization also encourages competition. The low wages in Asia intensify the squeeze on costs not only in the globalized companies, but also in local companies in Europe. This squeeze on costs promotes the outsourcing of certain activities to companies that often have low safety and health standards, while encouraging temporary work and precarious employment relationships. It also results in high work intensity and, in those areas where cost-effectiveness measures fail, in an unstable labour market.

In my view, the following topics are possible as research focuses: Mobile IT workplaces, OSH in outsourced companies, improvement of psycho-social factors in connection with stressful workplaces (see e) and the treatment of traditional OSH topics in multicultural firms and particularly in small and medium-size enterprises (SMEs).

Increase in natural disasters (see c.)

Statistics of reinsurance companies show that natural disasters have tripled on average since 1950 [18]. Highly conspicuous among them are hurricanes, floods and climate-related events. Although Europe is not as seriously affected by major natural disasters as the other continents, the damage and loss caused by floods and serious storms are growing even here. Industrial plants are of course also affected by such events. Most of these plants are not designed to withstand a natural disaster. Harm is caused not only to the environment, but also of course and above all to the employees of these plants. Emergency plans and such scenarios will have to be prepared in Europe as well. Natural disasters inevitably have a pronounced impact on those vocational groups that are expected to provide relief in such disasters. All the classical hazards are joined here by mental stress, irregular and unpredictable working hours, dealings with aggressive and violent people, and contact with wild animals or unsupervised livestock. Natural disaster relief is often accompanied by poor management as well as a lack of coordination.

There is a shortage of research in this connection in the development of technologies capable of withstanding natural disasters and in the investigation of novel hazards which may arise as a result. Improving the OSH conditions of relief personnel in this connection is also a topic of future OSH research [19].
Working days lost due to illness

If one looks at the current sick leave statistics in German firms, the subjects mentioned above tend to be of secondary importance. At 24.2%, musculoskeletal and joint diseases came out on top in 2007 [20]. Injuries and poisoning caused 12.8% of days lost due to illness, closely followed by respiratory diseases at 12.4%. Much less frequent are psychological and behavioural disorders (8.2%), cardiovascular diseases (6.9%) and diseases of the digestive tract (6.5%). This list shows that the efforts of OSH in the coming 10 years must not neglect classical prevention activities.

Changing or enhanced risk awareness in the service economy will bring new aspects of old, classical hazards to the fore. Examples of this are the consequences of combined exposure to, for example, vibration and awkward postures, and musculoskeletal stressing and mental risk factors or ototoxic substances.

Also important are a more detailed analysis of classical risks such as impact-like vibrations, the sick building syndrome, possible risks from toners for printer and photocopiers, and the hazards of passive smoking.

Familiar diseases may become more frequent at the same time. These include allergies, induced for instance by epoxy resins or isocyanates and acrylates, occupational diseases due to arthrosis of the knee or hip, and disorders due to repetitive motion.

Existing expertise is not always put into practice. This applies particularly to SMEs where there is still ergonomically inadequate equipment and insufficient awareness of the issues associated with biological and chemical risks.

The growing pressure on costs will call for stronger justification of OSH expenditure. Laws alone cannot be expected to bring about any improvement. Persuasion resulting from an understanding of the issues will be the method of choice of the future. The establishment of a prevention culture in firms, a systematic and visible prevention system, and a swift response to possible risks caused by changes in the working environment will become increasingly important in this context¹. These challenges already give an indication where research efforts need to be deepened or extended.

Consequences of this analysis for future working conditions

In the following six sections, the above analysis of future trends and challenges will be summarized, focusing on six core issues.

How will the working environment in Germany change over the next decade?

Over the next 10 years, the working environment will be strongly marked by the effects of globalization. This means not only the growing tendency for globally operating companies to merge, but also the fact that the growing pressure on costs due to growing competition with low-wage countries will transform jobs in manufacturing industry, of which there is still a relatively large proportion in Germany.

Along with globalization, I believe that innovation in information technology, biotechnology, genetic engineering and nanotechnology will be the driving forces for future change. While information technology is affecting virtually all sectors of industry, genetic engineering will

¹) These topics will be given greater prominence in Germany in the Joint German OSH Strategy (see f.).
precipitate change in the working environment in the health service and bio/nanotechnology in manufacturing industry and the services sector.

Third in importance will be the changing nature of classical risks in the near future. Key issues in this connection will be combined exposures, the detailed analysis of classical risks as a result of enhance risk awareness, the growth in allergies and special musculoskeletal disorders, the deficits in the implementation of OSH in SMEs and the challenges to effective prevention posed by the growing pressure on costs.

Demographic trends combined with growing migration will affect the workforce of the future in virtually all European countries. The situation will be marked by a shortage of highly skilled staff and by intercultural teams, and this will prompt companies to make greater efforts.

Personal life-styles that are damaging to health, which are already being observed in children and adolescents today, will have a more pronounced impact on the workforce of the future. Prominent factors here are dietary and exercise habits and leisure patterns.

Finally, I should like to mention natural disasters, of which Europe will not be spared. These will give rise to technological risks that have so far been given too little attention in safety analyses.

**What challenges are faced by practical prevention?**

The growing squeeze on costs due to globalization will encourage outsourcing in production, temporary and precarious employment relationships and higher work intensity. The sources of psychological pressure will grow considerably in the coming years. Implementing safety and health protection in outsourced companies and reaching employees in unstable employment relationships will be another major challenge of the next decade. Since international cooperation will accelerate the spread of epidemics and pandemics, there will be growing importance attached to effective strategies to combat such risks.

Technological innovation will yield increasingly complex man-machine interfaces. Upholding the safety of personnel throughout the life-cycle of a machine or plant is one of the major challenges in connection with these new, highly complex working conditions. Mobile workplaces will become more prevalent and it will be the IT-supported mobile workplaces that will call for new OSH strategies. Virtual reality offers entirely new scope for the development and validation of OSH strategies. The production of biological materials, nanomaterials, nanoelectronics and nanobiotechnology will have a far greater impact on OSH in 2020 than today. It will be important to accompany the introduction of these technologies at an early stage with suitable prevention activities.

Although the consequences of demographic change are largely known, industry, in Germany at any rate, has not yet adequately converted this knowledge into strategies. Keeping older employees fit for their duties will become an important focus for the next 10 years. Migration and growing globalization will call for intercultural teams that will be characteristic of companies with worldwide operations. Establishing OSH in these teams will be a major challenge in practical prevention work.

Behaviour patterns acquired in childhood and youth are difficult to change at a later date. Healthy personal life-styles therefore have to be explained and trained in preschools and schools. Health should be a subject on the syllabus of all German schools.

Natural disasters today represent a major challenge for relief workers as well as for the development of safe industrial plants. In this connection, the growing number of natural disasters in Europe poses new challenges to safety and health protection.
What is the situation regarding the prevention of musculoskeletal disorders?

In Germany there are already several recognized occupational diseases associated with musculoskeletal disorders (MSDs). This list will be extended considerably in the coming years. Disorders attributable to repetitive motion and musculoskeletal disorders of the lower extremities will become more prominent than hitherto. Exposure assessment and preventive activities in relation to MSDs will be among our institution’s future central tasks.

Changes in office workplaces as a result of information technology are encouraging physical immobility, thus inducing both MSDs and other diseases. The prevention of such MSDs will involve finding new ways of modifying the life-styles of affected employees.

The combination of the stressing of the musculoskeletal system with exposure to such factors as vibration or stress is set to play a growing role in connection with MSDs. Suitable assessments of exposure scenarios will have to be developed.

The design of modern complex machines and plant that operate hand-in-hand with their users has to be geared more to human needs. Ergonomic findings, which have already been available for several years, are of great significance in this context. Faulty installation and operation of more complex machines will have far greater consequences than in the past.

Are there any emerging risks with regard to chemical or biological hazards in the working environment?

There is an increase in allergies in connection with chemical and biological agents and these will have to be combated more consistently. The prevention of pandemics will become more important in the future.

The future will see strong growth in the importance of biotechnology and genetic engineering. This will be accompanied by an increasing need to take action in terms of assessing exposure and developing suitable protective measures.

In connection with nanotechnology, personal measurement systems will have to be developed for exposure assessment. Greater efforts will also have to be made in toxicology with regard to carbon nanotubes.

In Germany, passive smoking, the sick building syndrome and the inadequate assessment and prevention of biological and chemical risks in SMEs will be prominent topics in the coming years.

In connection with the REACH regulation, future risk-based limit values for carcinogenic agents will pose possible challenges as they may result in dramatically reduced limit values for metals, for example. It will then be necessary to develop new measuring methods for monitoring such low concentrations.

What is the future role of workplace health promotion?

Because of the potentially critical state of health of young employees in 2020 due to the health-impairing personal life-styles of children and adolescents today, in-plant health promotion will have an even greater role to play in future. Only long-term programmes will be capable of ameliorating the bad habits acquired in early childhood.
The growing pressure on costs calls for programmes capable of demonstrating their effectiveness with a reduction in the number of working days lost due to illness. In this connection, future measures will have to be validated with greater care.

Mental health and wellbeing will gain in importance for safety and health at work. Strategies to improve high-exposure workplaces will have to be increasingly implemented in the context of in-plant health management.

In Germany, cooperation between health and accident insurers will have to be intensified further in order to achieve a holistic approach to health promotion.

Where are there gaps in our knowledge and where is there a need for new research?

Educationalists will have to bring classical health programmes to the classroom in preschools and schools. The implementation of the strategies of life-long learning, job rotation, horizontal careers, secondary and tertiary prevention and job-related rehabilitation will have to be significantly improved if the ageing working population is to remain fit for its duties.

The development of intercultural training in schools and companies is a field of educational research that will grow in importance. The implementation of OSH measures in firms run by foreign management will have to be systematically improved.

A redoubling of research efforts will be necessary to create healthy mobile workplaces in the information technology sector. Another research focus concerns collaborative machines and plant. Thanks to virtual reality, it will be possible to simulate future production processes and design them to meet human needs. Studies on the human-centred design of machines and plant will grow in importance, the more complex these machines become.

Risk assessment for the products of biotechnology, genetic engineering and nanotechnology will have to be developed and refined. The efficacy of existing prevention measures will have to be checked.

OSH in outsourced companies is in many cases still insufficient. New research projects and programmes must yield substantial improvements in this area. To improve mental wellbeing and health when working under pressure, evidence-based intervention strategies will have to be developed and improved.

Findings from high-risk sectors (nuclear energy, aviation) will have to be adapted to the various manufacturing technologies, and technologies and processes capable of tolerating natural disasters will have to be developed.

Existing strategies of prevention culture will have to be modified so that they are effective in SMEs as well. There is a need for research particularly into exposure measurement and the assessment of multifactorial risks. This is where this complex subject will have to be approached step by step, starting with the most critical combinations.

Final remarks

A review of the last 10 years and their importance for safety and health protection shows that many trends have indeed been foreseen. Nevertheless, developments in some areas have proceeded contrary to expectation and new topics have emerged that did not appear to be so important at the time. Against this background, a forecast for the next 10 years cannot
present a complete picture. However, the constant preoccupation with new developments in the working environment will enable us to respond promptly and appropriately to new findings. Rather than merely reacting after the event, as in the past, safety and health protection is now more proactive.

**Literature**

1. Gesundheitszeitung 05/2009
3. Leyk D., Rüther Th., et. al: Deutsches Ärzteblatt, Jahrgang 105, Heft 46, 14.11.2008
10. EC: Special Eurobarometer 244b. Final report on Eurobarometer 64.3. Europeans and Biotechnology in 2005: Patterns and Trends
15. UN-Statistik, Globus Grafiken 2006
18. Münchener Rückversicherungs-Gesellschaft, GeoRisikoForschung, NatCatService, 2009
Introduction

Twenty years after the EU Directive 89/391/EEC on the introduction of measures to encourage improvements in the safety and health of workers at work came into force, the European regulatory system seems to be stabilized by now. The EU Directive also provided the enabling framework for a number of other individual Directives which were subsequently acknowledged by Member States, concerning with specific aspects of health and safety. The following stage (still in progress in some countries) was the correct implementation of the existing regulations on a national basis.

In the meanwhile the general context has changed and seems to be in constant development. Globalization and free capitals and investments circulation have led simultaneously to liberalization and growth of the labour market. At the same time, innovations and new technologies are going through a period of rapid and steady growth, whose consequence is the wide availability of new tools and technologies, which have generated not only new chances and challenges but also different emerging risks for workers.

On the one hand such a picture is generating new competences and experts in Occupational Safety and Health (OSH) sector, on the other hand some critical points arise:

- The effective appliance of the existing regulation with particular reference to some specific territorial areas and production sectors.
- The effectiveness of an appropriate system of control.
- The risk for OSH professionals in playing the main role of "rule followers" to the detriment of their principal activity as "problem solvers". Besides, Hale AR et al. (1986) had foreseen such a risk even before the UE directive was adopted.
- The need to adapt the legislative context to the changing world of work and to the technological development.
- The difficulties of extending the implementation of these regulations also to the Small and Medium Enterprises (SMEs).
- At the same time it seems that Occupational Health as a discipline is going through a crisis, as pointed out from the following indicators:
  - University departments are fewer and smaller than 20 years ago, and there is a prospect of further shrinkage, as reported particularly in the UK. Various factors have contributed to this trend. Perhaps the most important is a dearth of younger occupational physicians with the interest, ability and motivation to pursue an academic career.
  - The reduction of OSH funds and the attention turned to the occupational problems in social science, raise some questions regarding the existence of dedicated structures and National institutes; the case of the closure of NIWL in Sweden is worth mentioning in this view.
  - The priorities identified for the development of research in OSH sector in Italy and collected in the study carried out from ISPESL in 2007, have remained almost unchanged if compared...
with the previous ISPESL study (2000) and with similar studies carried out from BOHRF in England, NIOSH in the USA, as well as in Holland, Japan and from WHO Collaborating Centres and within the NEW OSH ERA project.

- Occupational physicians turn their attention to the prevention of health risks and occupational diseases; this doesn’t allow to fully understand all the opportunities offered by diagnostics, which remains an important part on occupational physicians’ curricula.
- This situation has clear effects on scientific production and on the weakening of the critical mass.

Working environment challenges

Given this general picture, working environment challenges of the future can be summarized in the development of the following key questions.

1. Workforce: changes and gaps

The global macro-trends of work life, such as globalization of economies, changes in demographic structure, introduction of new technologies, 24-h economy, increased speed and pace of communication, growing time pressure and psychological stress, and high productivity demands affect drastically the conditions of work in Europe.

The short-term work contracts, mobility of workforce, growing role of the service sector, changes in work organisation and company structures all result in breakdown and fragmentation of previously stable continuity typical for the industrial society in the last century. As the big global scale multinationals grow ever larger and ask for international OH activities, simultaneously the number of local small enterprises and self-employed (SEs) increases rapidly and needs effective solutions at local level. The active outsourcing of company internal service activities concerns also occupational health services and leads to further separation of occupational health from its client constituents.

What really seems to be missing is a real approach to the impact of company restructuring on occupational health, to the evaluation of working life overall wellbeing also in a gender view, to the ageing influence in the working environment in terms of work-ability preservation of workers affected by chronic-degenerative diseases.

2. Innovation

If it’s true that scientific revolutions can be viewed unfavourably and meet with resistance, simultaneously they have an effect in changing the order of priorities: some aspects lacking in importance can be reassessed thanks to a new way of conceiving sciences, in contrast some scientific sectors can entirely become outdated. The changed technological background offers interesting opportunities to occupational medicine that cannot be ignored considering their great advantages for workers’ health and for the population in general. Some examples of the opportunities offered by the technological development in the last years can be identified in the fields of sensors for environmental monitoring, non-invasive diagnostic techniques, genetics and molecular biology.

The new technology developments also bring new hazards and risks to be managed, new substances and materials, new energies, such as radio-frequency waves, indoor air problems, new types of physical stress, new microbial and other biological hazards, new accident risks. Some of the new hazards have been unexpected, such as the danger of new microbial or chemical contamination of workplaces, which were not foreseen before their emergency.
The rapid growth and spreading of mobile communication technologies and nanotechnologies that occurred in the last years are two examples of both important development opportunities and potential risks related to the introduction of new technologies.

3. Work life balance

If in the past health policies were thought to be responsible only for the grant and financing of medical assistance (medical treatments can prolong survival and improve the prognosis of serious diseases), at present the social determinants of health, that is the social and economic conditions that mostly cause diseases and force people to ask for medical treatment, have also become important:
- **Social gradient**: life expectancy is shorter and most diseases affect the lowest levels of the social ladder in each society.
- **Stress**: stress conditions, which make people feel worried, anxious and unable to react, are detrimental to health and increase the risk of catching illnesses at the workplace. On the contrary people who work in a more relaxed and restrained environment show a better state of health. Furthermore work-related stress has a growing impact on workers’ life: some examples are provided from figures about the use of drugs made by some workers’ groups, eating disorders and divorces.
- **Unemployment**: job security increases health, well-being and workers’ satisfaction. Higher rates of unemployment cause more illness and premature death.
- **Urbanization**: the concentration of workplaces in the major metropolitan areas increases the commuting time that people spend travelling to or from work, with a strong influence on “in itinere” accidents.

These conditions make it necessary to develop initiatives which promote occupational health as well as models for risk management (with particular reference to the work-related stress).

4. Economic dimension

Economic models related to the prevention of injuries and work-related diseases are still general and not quantified. The question of identifying the indicators to be taken into account to estimate the costs of such a prevention arises. For example:

a. **Absenteeism**: the phenomenon of workers’ and employees’ absenteeism, that is the unscheduled habitual absence from work during the normal working hours, affects both public and private sector and inflicts heavy costs which can take a financial toll on companies and enterprises. As motivation factors may also cause absenteeism, the reduction of this phenomenon cannot be reached through unilateral company actions, which could make the situation even worse. The problem needs to be tackled through cooperation with workers’ representatives in order to act directly on its primary causes.

b. **Presenteeism**: the opposite of absenteeism it occurs when employees come to work in spite of illness, which can also have negative repercussions such as:
   - Hidden long-term costs;
   - Social problems for the enterprise.
   - An employee who works despite illness may only operate at a fraction of his normal capacity despite requiring the same expenditure in wage, social contribution and taxes.
   - Workers may be more prone to mistakes.
   - Workers may transmit the illness to fellow employees.

All efforts could be focused to develop an effective and modern occupational health research and service in order to reduce the morbidity of working population and to produce economic benefits amounting to a few per cents of GDP.
Conclusion

Beginning with these four aspects it would be suitable to direct all efforts towards a global cultural change to be realized through an accurate analysis of the reasons for OSH sector crisis, without drawing the wrong conclusion that the traditional model of approach introduced by Ramazzini in the 18th century should be considered outdated or not more suitable to current conditions.

Indeed, in the 21st century Ramazzini’s works are still highly relevant in both developing and industrialized world. In fact, the globalization of the world economies has increased the relevance of the Ramazzinian paradigm. When the companies and governments in search of competitiveness and control of costs tend to down-prioritize the occupational health and safety programmes they simultaneously accept greater loss of health through increasing risks – and in fact – weaken their real competitiveness. Simultaneously, the situation of workers working under most adverse working conditions weakens and their negotiation power – if it ever has existed disappears. But also in the most industrialized part of the world, where the knowledge-based immaterial production is growing, Ramazzini’s teaching is still relevant especially in the management of new challenges of labour market, such as psychosocial hazards and problems related to new types of work organization and, for example, unphysiological working hours. New physical and chemical risks, such as nanotechnologies and nanomaterials, also need new approaches for risk management. The health, work ability and social conditions of aging workers and growing numbers of migrants need a very comprehensive Ramazzinian approach.

Therefore, what is necessary is an opening to confrontation with society and other biomedical disciplines, by renewing all efforts aimed at promoting a “culture of OSH”. The starting point of this global and transnational action will be the experience of EU countries which remains the most important resource for the OSH sector both in terms of legislation and OSH professionals critical mass.

References

– Harrison J and Sharp C 2004. Training in Occupational Medicine: are we as good as we think we are? Occupational Medicine, 2004; 54:437-438
Germany has a long tradition in foresight studies.

The BMBF (Ministry for research) launched a Foresight Process in September 2007 in order to safeguard Germany’s long-term innovative capacity as a centre for research and education. In this frame a international comparative study about existing foresight studies was carried out and is on the web. (http://www.bmbf.de/pub/technologieprognosen_im_vergleich.pdf) Some States like Baden-Württemberg have carried out foresight studies for specific sectors (Media, Hospitals, health system and technology).

**Background**

Globalization and the trend towards a knowledge and service-based society call for new ideas to promote Germany as a world centre for research and production. The far-sighted design and organization of strategic decision-making processes in research and development is crucial to Germany’s competitiveness and innovative ability. It is important to identify emerging future developments at an early stage, to interpret them accurately and anticipate them in current research policy.

The Federal Ministry of Education and Research therefore launched its Foresight Process in September 2007 with the following objectives:

– Identifying new key areas in research and technology
– Naming (and determining) areas for cross-cutting activities in the field of research and innovation
– Analysing fields of technology and innovation with regard to their potential for strategic partnerships
– Determining priority fields of action for research and development

Technology foresight has a long tradition at the BMBF. The BMBF’s current Foresight Process is intended to cast an eye on the next 10 to 15 years - and beyond. It aims to facilitate direct personal exchanges between experts at national and international level, based on a combination of new and tried-and-tested Foresight-Methods together with an accompanying monitoring process. This cooperation will significantly extend the information base for decision-makers in
the German research community and support the strategic planning of research policy measures.

Method

The Foresight Process includes different approaches and methods which can be combined to meet individual objectives. An integrated approach has been chosen in order to use the Foresight Process as a strategic instrument and to achieve the four objectives defined by the BMBF. The combination of methods applied includes classical foresight methods with additional innovative elements as well as monitoring activities.

Quantitative approaches such as data mining and bibliometric analyses will be combined with qualitative studies within the framework of structured searches. The qualitative studies include, for example, inventor scouting, policy analysis, Internet and literature searches, recent elements in workshops (e.g. journeys through time) and an intensive expert discourse. The process will be accompanied by an international Monitoring Panel with specialist competence networks in order to prepare approved information in a systematic and continuous manner and integrate this information in the process.

First Results of the 1st wave:
A large number of the topic areas already identified after the first workshop in 2007 and in the subsequent search phase have been proven to be sustainable. Many aspects of Ageing Research, HumanLifeSpace, Human-Technology Boundaries, Models and Simulations, Production-Consumption2.0 and Time Research that were compiled in the course of the BMBF Foresight Process were also regarded by the majority of the online survey respondents as relevant and as undergoing intensive research in the long term. Further work to provide more detail is required here and a further overarching synopsis and interpretation must be made. From an OSH point of view the following points could have a future potential:

Ageing research:
- Better understanding of ageing
- Can the individual ageing process be influenced
- Can besides of prolonging of the life span the health span be prolonged
- Because of this how working processes will be changing
- Can the mechanism of learning be identified and how can this be used for learning of elderly
HumanLifeSpace:
- How will be the infrastructure of LifeSpaces changed by technology, traffic, services, living and working, safety and security

Human-Technology Boundaries:
- Role of human being within more and more technological wrappers
- Mechanical persons
- Symbiotic of man-machine
- Man-machine-cultures

ProductionConsumption2.0:
- Interactive value creation
- Governance of the systemic change of ProductionConsumption2.0

Time Research:
- Time is not well understood and a critical factor in complex processes
- Chronobiology as future issue – i.e. for medicalisation (missile drugs, target drugs, depots etc)
- Synchronisation and parallelisation

The results of the German foresight study will be delivered end of next year.
In the most foresight studies the individual has often only a residual meaning. But taking into account the results other foresight studies there can be seen some future challenges with OSH potentials:

Understanding the complexity of stress and strain and health:

The nature of work stressors and their consequences will be changed within the future trend; Problem: How stressors are measured. First, there needs to be less focus on the somewhat blunt way in which “stress” is measured, and more on measuring and understanding the emotions associated with different stressor conditions. This shift of emphasis will enable specific causal pathways to become clearer, and will enhance understanding of the impact of work stressors. In turn, this approach has the potential to lead to intervention strategies that are more focused. Secondly, it will be important to measure both the objective nature of work stressors and also the meanings individuals give to these conditions: it is on the basis of these meanings and the way the individual appraises the situation that coping strategies are initiated.

Research in the future will continue to explore problem-focused and emotion-focused coping, particularly in terms of their potential: to improve the quality of working life; to enable individuals to develop a sense of self-worth; to mobilise confidence; and to promote health and wellbeing. Research will also continue to investigate how different coping strategies are used, how they combine, the patterns they take in relation to different stressors and emotions, and what criteria individuals use to evaluate coping effectiveness.

Learning in changing environment
The six core features that contribute to the development of an individual’s mental capital and mental wellbeing are: sensory processing; cognition; social cognition; executive function; emotional/motivational processing; and self-concept. All learning difficulties have an impact on self-concept, although individual differences in self-concept (e.g. persistence) will also moderate or amplify the effects of impairments in the other core features. There is a need for future clarification how this core features influence each other and with which strategies/approaches work ability and employability can be safe guarded over a life span.
Work overload

Work overload, for example, will continue to be described in quantitative terms (e.g. too much work to do with too few resources, too many interruptions, working long hours). But it will also have a qualitative dimension, which focuses on the “cognitive” aspects of the job. Here stress is expected to arise as a result of a more continuous learning requirement, which may involve new skills for new aspects of the job, arising from more sophisticated software and technological innovations. Competing through people management operates as a double-edged sword. Jobs can be motivating and satisfying when challenging and meaningful, and when they give employees the opportunities to use their skills, to influence how they work and control the pace of work. Designing jobs that optimise these characteristics not only allows employees to flourish, but also to experience “flow” – where an employee is fully using their skills successfully to deal with a challenge.

Content and context issues surrounding the job require employees to attend to the psychological contract and to the management of the exchange relationship relating to expectations and promises between employee and employer. When employees feel that their psychological contract has been broken, then this sense of injustice and unfairness inevitably leads to perceptions about the job and management that have consequences for stress and wellbeing. This will be a challenge for workplace health promotion and mental health promotion.

Chemical Substances

BAuA is integrated as the German Member State representative in the ECHA (European Chemicals Agency) activities in the frame of the REACH regulation.

One important aspect of REACH is the authorisation of substances. A group of NGOs have extracted those chemicals from the European inventory of classified substances (Annex I of directive 67/548/EEC) that are categorised as carcinogenic, mutagenic or toxic to the reproduction (Category 1 or 2) into a separate list without any consideration of the actual risk caused by the substances for employees, consumers and the environment. This so-called SIN-List (Substitute It Now) includes 267 chemicals in its Version 1.0. The NGOs intended to speed up the transition into a toxic free world by publishing this list as well as to push the legislative process and provide a tool that businesses and other actors can use to substitute hazardous chemicals with safer alternatives - ahead of legislation. Contrary to the NGOs' opinion, BAuA favours a risk triggered prioritisation rather than the solely hazard related approach of the NGOs.

The prioritisation process is continuous:

In a first step, dossiers for 16 substances have been submitted to the ECHA as identified Substances of Very High Concern (SVHC) of which 15 substances have been added to the candidate list. Actually, another package of 15 substances has been published on the ECHA website for public consultation. Until October 15th interested parties are welcome to comment on these 15 substances. The comments will be taken into account when the ECHA Member State Committee decides whether the substances will be added to the Candidate List from which substances are selected for authorisation. The new suggested substances have been, just like the 15 substances already on the Candidate List, proposed by EU/EEA Member States and by the European Commission.

The contribution of our institute to the second package is two dossiers concerning refractory ceramic fibers.

My suggestion is that all interested parties should use the opportunity to give input into these activities at appropriate stages.

Developing a new model for early intervention

The literature review of the Peninsula Medical School found that early intervention occupational health services can play a key role in assessing how and when employees can return to appropriate work. However, these occupational health services cover a wide range of support,
from simple sickness absence management tools through to high-quality, multidisciplinary teams supporting people to either stay in or return to work.

In considering a range of service models, the literature review highlighted the importance of three key principles for effective early intervention.

– Holistic care in line with the ‘biopsychosocial’ model. This simultaneously considers the biological (the disease or condition), the psychological (the impact and perceived impact on mental health and well-being) and the social (wider determinants that can have a negative impact on health and well-being including work, home or family situation) and the links between all three factors.

– Multidisciplinary teams able to deliver a range of services tailored to the needs of the individual patient. Effective interventions have included exercise, cognitive behavioural therapy, organisational elements (workplace review or adjustment), educational elements (such as on back care) and more holistic support to address broader determinants of poor health such as housing or financial concerns.

– Case managers or support workers who can help the individual navigate the system and facilitate communication between the individual, their employer, their GP and other clinicians.

Several studies have shown that a comprehensive early intervention service based on these principles can result in good clinical outcomes, as well as a significant reduction in time spent off work. A new model of early intervention should support GPs with new options for referral. It should provide a minimum level of work-related health support to all employees, especially important for those in organisations without any form of occupational health provision. A suggested approach to achieving this would be through the creation of a Fit for Work service.

To find an appropriate way to include SME’s in comprehensive intervention is still a future challenge.
Forecast on Future Challenges in the Work Environment in Québec, Canada

By President and CEO Marie Larue, Institut de recherché Robert-Sauvé en santé et en sécurité du travail, Canada

Introduction

In order to foresee and better describe the possible trends of the work environment that will likely affect health and safety conditions over the coming years in Québec (Canada), four different perspectives are considered: the work environment, the societal changes both within Québec and globally, as well as the knowledge gap, research needs, knowledge transfer practices and, finally, result evaluation.

Employment data and statistics on occupational injuries are analyzed in an effort to assess how the work environment is going to change and what challenges are related to the prevention activities. Comments are then made on the role of the workplace in terms of health promotion, and on the type of research that is needed to address key issues regarding occupational health and safety.

Overview of the situation in Québec – Economically Active and Inactive Population aged 15 and over

Table 1 presents data on the employment status, sex, type of work, and class of workers of Québec population aged 15 and over. The distribution of the active population is similar for both men and women.

Table 1. Population aged 15 and over by employment status, sex, type of work and class of workers, Québec, 2007.

<table>
<thead>
<tr>
<th>Population aged 15 and over</th>
<th>6 314 500</th>
</tr>
</thead>
<tbody>
<tr>
<td>Economically Active Population</td>
<td>4 150 100 (65,7%)</td>
</tr>
<tr>
<td>Men</td>
<td>2 191 100 (52,8%)</td>
</tr>
<tr>
<td>Women</td>
<td>1 959 000 (47,2%)</td>
</tr>
<tr>
<td>Employment</td>
<td>3 851 700 (92,8%)</td>
</tr>
<tr>
<td>Full-time (30 hrs and +/week)</td>
<td>3 136 800 (81,4%)</td>
</tr>
<tr>
<td>Men</td>
<td>1 778 600 (56,7%)</td>
</tr>
<tr>
<td>Women</td>
<td>1 358 100 (43,3%)</td>
</tr>
<tr>
<td>Part-time (&lt; 30 hrs/week)</td>
<td>714 900 (18,6%)</td>
</tr>
<tr>
<td>Men</td>
<td>238 700 (33,4%)</td>
</tr>
<tr>
<td>Women</td>
<td>476 200 (66,6%)</td>
</tr>
</tbody>
</table>
The structure of economically active population by age is similar for men and women; however, the proportion of the active individual in the group 55+ is slightly higher among men, as shown in Table 2.

Table 2. Economically Active Population by Age Group and Sex, Quebec, 2007.

<table>
<thead>
<tr>
<th>Age Group</th>
<th>Female</th>
<th>Male</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>k</td>
<td>%</td>
<td>k</td>
</tr>
<tr>
<td>15 - 24</td>
<td>309,4</td>
<td>15,8%</td>
<td>326,2</td>
</tr>
<tr>
<td>25 - 44</td>
<td>886,8</td>
<td>45,3%</td>
<td>994,6</td>
</tr>
<tr>
<td>45 - 54</td>
<td>507,8</td>
<td>25,9%</td>
<td>544,1</td>
</tr>
<tr>
<td>55 +</td>
<td>255,0</td>
<td>13,0%</td>
<td>326,2</td>
</tr>
<tr>
<td>Total</td>
<td>1 959,0</td>
<td>100,0%</td>
<td>2 191,1</td>
</tr>
</tbody>
</table>


The work environment

Over the past years, it has been observed that an increasing percentage of the workforce in Québec now works in the tertiary or services-producing sector of the economy (Figure 1).

More than 75 % of the Quebec’s labour force worked in this sector during the last five-year period. This proportion is expected to average around this value in the future.
As the economy continues to change, the labour force needs to adapt, and thus training becomes very important both from economic, and health and safety perspectives. Research has shown that no matter the age of a worker, good on-the-job training correlates positively with a reduction in occupational injuries. This is particularly true for the younger worker age group (15-24 years).

It is also known that an increasing number of young people combine studies and part-time work. Young workers are considered to be at higher risk than older workers not only because initial on-the-job training is very often deficient, but also because the accident risk is increased by the number of new jobs taken, the lack of experience, the absence of knowledge transfer between older and younger workers and, finally, the absence of job stability (Notes II, III, IV, V, VI, VII, VIII, IX).

Aging of the workforce is another factor that has to be taken into account. Between 1985 and 2010, the Québec workforce is expected to have increased by 33.5% compared to Canada (45.2%) and the United States (32.2%). For the years to come, it is estimated that the active population will stop growing and remain more or less constant.

This does not mean that society will not face challenges because the workforce profile has changed and is bound to keep changing. From 2005 to 2020, it is estimated that the proportion of workers over 55 years of age will have grown from 12.8% to 19.2% of the working population (Figure 2). Even though Québec’s population is presently not "as old" as in some other industrialized countries, its aging rate is expected to increase more rapidly than elsewhere (Figure 3).
Figure 2. Proportion of individuals aged 55 and over among the economically active population, 1985 – 2020.

Figure 3. Proportion of individuals aged 65 and over, total population, 1985 - 2035.

The work environment will then have to adapt to the workforce’s changing characteristics and its ability to cope with constraints associated with physical load, pressure, and the need to maintain a good work/life balance. It is generally agreed that older workers have a lower accident rate, but tend to be on injury leave for longer periods of time to recuperate, while also retaining more sequelae than younger coworkers (Table 3).
Table 3. Time-lost Work-related Injuries by Age Group, Quebec, 2000-2002.

<table>
<thead>
<tr>
<th>Age Group</th>
<th>Standardised Injury Rate per 100 FTE*</th>
<th>Standardised Average Time Loss (Calendar Days)*</th>
<th>Median Time Loss (Calendar Days)</th>
<th>% of injuries with PPMI**</th>
<th>Average PPMI** Rate (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>15 - 24</td>
<td>4.6</td>
<td>36.0</td>
<td>11.4</td>
<td>7.0</td>
<td>5.6</td>
</tr>
<tr>
<td>25 - 44</td>
<td>4.5</td>
<td>70.6</td>
<td>14.0</td>
<td>11.9</td>
<td>5.2</td>
</tr>
<tr>
<td>45 +</td>
<td>3.2</td>
<td>92.1</td>
<td>14.0</td>
<td>20.2</td>
<td>7.0</td>
</tr>
</tbody>
</table>

* Rates are standardised according to job-type structure, Quebec, 2001
FTE = Full-time equivalent
** PPMI = Permanent physical or mental impairment

Sources:
1. Time-lost work-related injuries: CSST administrative data.

Another factor that needs to be taken into account is the fact that the workforce is now composed of migrant workers and first generation immigrants in a higher proportion than in the past. This increases the need for on-the-job training that takes into account the different cultural backgrounds in terms of prevention of injuries, the meaning of work and attitude towards risks, hazards and danger, and towards the return-to-work after an occupational injury has occurred.

Other factors to be considered include the increased pace at which changes are implemented in the workplace, work intensification and the rise in psychological injuries.

In Québec from 1990 to 2007, a significant decline in the number of compensated injuries has been observed, as shown in Figure 4. During that same period, the number of occupational psychological injuries has more than doubled (Figure 4). New challenges thus include the prevention of psychological injuries and the promotion of well-being in the workplace.

Figure 4. Accepted Time-Lost Work-Related Injuries, Total (1982-2007XII) and Psychological Injuries (1990-2006XIII), Québec.
Challenges in prevention

Québec is facing five main challenges with regard to the prevention of workplace injuries. These include the need for:

I. Integrating a global health and safety prevention strategy, in a more systemic manner than currently applied case-by-case or risk-by-risk approaches.

II. Improving the performance of workplace injuries prevention strategies considering that uncertainties exist as to their cause or the proper solution to be applied for risk reduction or elimination (musculoskeletal disorders or psychological injuries falling into that category).

III. For psychological injuries, recent research at IRSST has indicated that the “meaning of work” positively contributes to the workers’ overall health and negatively correlates with their stress level. This being known, the next challenge that needs to be addressed is how to better support the workplace in taking into account the factors that likely influence the “meaning of work”.

IV. Increasing the efforts devoted to primary prevention of occupational cancer: identify, eliminate or effectively reduce worker’s exposure to cancer-causing agents. It is not sufficient to do early detection, treat, and compensate the workers. Efforts are needed to develop a long-term primary prevention strategy, involving both the medical doctors and occupational hygienists.

V. Monitoring the changes occurring in the workplace or the working conditions in society in general on a periodic basis and adapting the strategy accordingly.

VI. Addressing the special needs of SMEs in terms of prevention strategy.

Prevention of musculoskeletal disorders

Several challenges are foreseen regarding the prevention of MSDs, which still represent close to 40% of compensated occupational injuries in Québec. There is a need to consider the changes on how work is performed.

Work intensification is a key factor that needs to be reconciled with the significant presence of an aging labour force, more fragile to the more physically or psychologically demanding work. On the other hand, the considerable proportion of new workers under 25 years of age poses new challenges as they are known to be particularly exposed to MSDs, mainly male young manual workers. Thus manpower training imposes new requirements. An interesting avenue is to formalize the knowledge of expert workers and develop strategies for transferring this knowledge to the younger workers. This implies having the means of understanding the know-how of experienced workers and of creating, in workplaces, opportunities for transmitting this knowledge. The entire field of competency transfer is therefore a major issue in MSD prevention.

It is known that in the occurrence of MSDs, there are interactions between physical risk factors and psychosocial factors, thus posing the need to better understand the nature of these interactions.

Another important issue is to develop avenues of prevention adapted to small and medium-sized enterprises (SMEs). There needs to be a reflection so that the action scenarios that will lead to sustainable prevention cultures in companies can be clearly identified. It will be important to have a better correlation between prevention activities and production activities; to achieve this, continuous improvement programs represent a good avenue to consider. Research will also have to be carried out to better integrate ergonomics and health and safety practices into production activities.
There must also be reflection and action in order to determine how standards and legislation can help control MSDs.

Despite years of research, the physical constraints of workplaces still remain. It is important to develop ambulatory methods in order to better evaluate physical exposures directly in the field. From a monitoring perspective, longitudinal studies are important. A major issue in large investigations on working conditions is to develop valid questions that will allow an evaluation of physical exposures. In the field of physical constraints, sustained but low intensity exposures will have to be better understood, such as those which result from static work, which often involve women and office workers.

In short, there are major challenges to be dealt with in three research orientations relevant to MSDs: the etiology of MSDs, the interventions in workplaces, and the monitoring of these disorders.

**Emerging chemical and biological risks**

In terms of chemical or biological hazards, it is considered in Québec that no relevant new risk other than nanotechnology may exist. It is foreseen an increasing demand for the recognition of cancer or other new health problems as being related to mixed exposures to chemical contaminants present in the workplace or even to mixed exposures occurring both in the workplace and in the environment.

**The future role of the workplace in health promotion**

Health promotion in the workplace must be part of a global societal strategy to ensure safe and healthy work practices.

To be successful, such an approach must be accompanied by strong preventive measures; otherwise, any action taken will seem meaningless to the worker and to the population.

Promoting good nutritional habits will rapidly seem futile should a worker be exposed to a cancer-causing agent in the workplace or in the environment. In the North American context, societal marketing must use very strong communication strategies in order to have any influence on work or health habits.

**The knowledge gap, research and knowledge transfer**

Currently, the added value of many research projects and research institutes is often measured in terms of the applicability and usefulness of the research results provided. The end users tend not to consider the necessity of fundamental research. In this context, the challenge for any given research institute is therefore to balance its resources between "materialized risk" (e.g., occupational injuries and diseases) and emerging risks in perhaps an 80%-20% proportion. But any research result that is not transmitted in a user-friendly format may remain ignored or unused, lowering the perceived added value of research to the workplace and to society in general.

In Québec, a knowledge transfer cycle scheme has been designed and implemented which foresees the involvement and participation of the individual or organization making the request (client) throughout the research process: from the statement of the request through the execution of the research, the result dissemination, and the appropriation strategies by the community (Figure 5).
There is now a need to evaluate the results of the implementation of such a scheme for the stakeholders. This evaluation is becoming increasingly important because the relevance of research has to be demonstrated to the stakeholders and governing bodies as well as to the society. The impact of the research on the improvement of OHS conditions must be demonstrated.

Figure 5. The research and knowledge translation cycle (T3).

Conclusion

The major challenges facing the work environment in Québec are consistent with the structural, social and technological changes which have been observed in recent years within most major industrialized countries. These include aging of the workforce, the important increase in occupational mental health disorders, and the need to take into account the demographic changes that have occurred within the workforce and the difficulties associated with the integration of a prevention culture within small and medium-sized enterprises. Research will need to adapt to these new realities and ensure that knowledge transfer schemes are developed and applied to promote the appropriation and application of the research results in the workplace.

References

Sources
1998-2008: Institut de la statistique du Québec. Nombre de personnes ayant un emploi par

Date de production: 21 juillet 2009.


ibid. 10


The Entry of Self-Leadership into Work Environment Research

By Senior Researcher, PhD Pia Bramming, NRCWE; M.A. Anders Raastrup Kristensen and Assistant Professor, PhD Michael Pedersen, Copenhagen Business School, Denmark

This paper is conceptual within the field of organisation and leadership, examining the relations and meanings of organisation and leadership from a theoretical, philosophically inspired perspective. To a certain degree the paper is speculative and hence more essayistic than traditional academic papers. We have chosen this style of presentation in light of the task we were given: seek to identify five of the most important working environment challenges expected to emerge or grow within the next 5 to 10 years.

Abstract

Well-being and dissatisfaction at work is often ascribed to the quality of management. However, today management is not only a task for managers, but is also expected and demanded of employees in the form of self leadership. The self lead employee controls and manages his or her own work performance, is responsible for his or her own productivity, given specific demands on productivity. This means that both new and existing forms of management, organization and technology are enacted differently and that we witness new complex expressions of well-being and productivity. The consequences for work environment and more specifically for the well-being of employees are unclear and ambiguous.

Transforming Economy and Self-leadership

The last decade we have witnessed an increasing interest in an emergent or perhaps even impetuous economy known under different aliases: knowledge economy, experience economy, new economy, globalised economy, network society, post fordistic production etc. In this paper we will take point of departure in these changes seen not only as changes in the economy, but as a general shift in the sociality and mechanics of production today characterised by being of a subjective, diffuse intellectual and immaterial nature (Vercellone, 2007). The transformation of economy covers a preponderance of living knowledge over knowledge incorporated in fixed capital and corporate organisations (Vercellone, 2007:32). Contemporary researchers in social sciences point at subjectivity as the paramount condition for production in modern capitalism (Boltanski & Chiapello, 2007; Hardt & Negri, 2003; Lazzarato, 2004; Vercellone, 2007).

What has been termed the ‘traditional conditions of work’ (Allvin & Aronsson, 2003) started to transform in the 70’ies and 80’ies. Allvin and Aronsson (2003) states that ‘the formerly absolute regulations of time and space for work are relaxing’ and a personal involvement and consciousness of responsibility becomes prerequisites for entering a work relationship. Allvin and Aronsson argues, that ‘work environment’ as an independent variable ceases to exist which simultaneously means that the interest in work environment issues dwindles in the Scandinavian countries since the 1990´s due to the propagation of the concepts of work environment followed by a dilution of work environment concepts (Allvin & Aronsson, 2003).
In this paper we will argue how this transformed economy transforms the conditions of work, employee and management. These transformations in turn create a new constellation where productivity, well-being and self-leadership are internally related and mutually constitutive. Problematics of work-life and work environment is in this conceptualization attacked at the level of conditions rather than effects of actions. Organisation and management, structures and management technologies condition the spaces and intensities of organizational work life and hence of the possibilities for well-being. We will argue that the main work environmental challenge in this light lies in understanding how the conditions in a new economy create an indiscernible alliance between the self project of the employee, well-being and productivity.

The Self-leadership Challenge

Self-leadership is a managerial concept and technology associating new economy demands with worker subjectivity, which challenges the conceptualisation of productivity and well-being in organisations in relation to work environment.

Self-leadership combines commitment to the organization with an idea of the employee as a psychological being with needs for self realisation and a capacity to self control (Manz & Sims, 1989). These needs and capacities are important in a new economy where value is increasingly immaterial and produced from the employee-subjects ability to communicate, start over, changes, create, feel and think productively (Hardt & Negri, 2003). Knowledge and creativity is sought for in especially what we know as more ‘creative jobs’, but increasingly in all kinds of different jobs. The employee as a general figure is perceived as a subject actively using his or her subjective taste (evaluation, sense, ability to start over) in cooperative networks and as a productive good benefiting the organization for which the employee works (Hardt & Negri, 2003). During the fordistic area in contrast, thoughts, language, fantasy, passion, empathy were perceived as external factors to the productive processes of the organisation. In the new economy the division of work at the fordistic assembly line is dissolved, challenging management to create space for and to effectuate thoughts, empathy etc. and integrate them in the production (Quigley & Tymon, 2006).

The Management System Challenge

The trend toward affectivity, subjectivity and immateriality creates an entirely new situation for the management system, and the ways in which work environment issues are raised, to whom they become important and how they become important. Work environment in a new economy can not (only) be dealt with in terms of physical or psychological health hazards in the work place (Allvin & Arronsson, 2003). The problematic at hand is to be observed in the transformation of the relations between employee, leader and organisation.

Modern management technologies seek to ensure employee commitment through a consented exploitation of employee subjectivity. In the words of Bains et al: “People that are happy and have the freedom to be themselves are more productive and give more of themselves.” (Bains et al, 2007:241). This statement however must be said to be ‘old news’. Since the ‘discovery’ of the ‘Hawthorne effect’ (Mayo, 1945) it has been common management knowledge that employee well-being is affected by commitment and that commitment has some sort of effect on productivity. Hence it has been a central concern for management and to figure out how commitment can be promoted in organizations. The relation of commitment to productivity has been laded with different meaning over time.

In the history of management theories we can observe a transformation of strategies of commitment from Whytes ‘Organization Man’ from 1956 (Whyte, 2002/1956), over corporate culturalism (Peters & Waterman, 1982, Willmott, 1993), normative control (Kunda, 1992) to neo-normative control (Fleming & Sturdy, 2003). Over time the question sought solved
through the application of strategies of commitment has changed from how motivation, self-management and empowerment could be ensured to the question of how modern management technologies regulate and penetrate subjectivity. Fleming and Sturdy (2007) understands this transformation as a new form of control (neo-normative), where the normative element is a concern not with a homogenisation of employee subjectivity, but rather a more subtle demand on the employee to ‘be him- or herself’ including all the personal peculiarities an employee may posses. “In addition to task empowerment, recruits should be ‘existentially empowered’ in that they should not share the organization’s value, and should even oppose them [...] in short, employees are encouraged and even legislated to be themselves rather than normatively conform to an externally engineered, homogeneous and organizationally based identity.” (Fleming & Sturdy, 2007, 2-3). The key to organizational success is seen to be found by ‘liberation’ of the diversity already inherent in employees. To be directly in opposition to the doings and goals of the organization is in this way seen to potentially improve performance, because self-indulgence and real enjoyment is seen to be more productive than just doing the expected. In this way self-leadership as a concept has increased its scope. Self-leadership is not about task empowerment or self-determination as opposed to an adjustment of self to a shared set of values. It is about existential empowerment: to be and lead yourself in a productive way. The organization becomes a scene upon which the employee can be him or herself by adjusting to the parts of the organization which fits with the interests of the employee and be in opposition to other interests. Passion is turned toward the task and the development of self it demands: finding meaning in and create intensity from the task itself. Kunda (1992:21) emphasize that the normative demands of an organizational culture always will be met with opposition because employees: “never (are) passive objects of control [...] ‘they are active participants [...] that may accept, deny, react, reshape, rethink, acquiesce, rebel, conform, and define and redefine the demands and their responses. In other words they create themselves within the constrains imposed on them’” (Kunda, 1992: 21). It is, Fleming and Sturdy suggests, exactly this kind of active re-forming, cynicism and resistance which is expected of the employee, assuming that this ‘authentic self’ converges with the organizational world.

The Challenge for Work Environment

The changes in the economy creates new conditions and forms for work, organisation and productivity (Ellis & Taylor, 2006, Rainnie et al., 2008) where the organization has to deliver the highest possible output at minimum cost and also handle change, ambivalence and immateriality in the pursuit of innovation. The main point in the argument above in relation to work environment is that the emphasis on employee humanity in the new economy is an emphasis on the conditions for being human. It is in other words not an emphasis on the individual employee but on a pre-individual condition becoming important for work environment studies because well-being and productivity enters a relation: Healthy employees are not an issue from a purely humanitarian point of view. Health is important because of organizational productivity and societal competitiveness. Management of self-leading employees is a management of the potential productivity of the employee, just as the prevention of obesity, smoking, alcohol politics etc. is an organisation of the potential risks of non-productivity.

We see the main challenge for work environment research to be investigating the conditions for productivity and well-being in light of the changes in the economy emphasising the humanity of employees as the most valuable productive force. Self-leadership is a concept which captures this folding of well-being and productivity.

Reference List

Occupational Safety and Health Research Needs
An INRS Contribution to the seminar on working environment challenges for the future (24-25 September 2009)

By Dr. Frédéric Lerais, Dr. Martine Reynier and Scientific Director, Dr. Didier Baptiste, Institut national de la recherche scientifique (INRS), France¹

This memo is a stage memo for feeding the expert seminar on working environment challenges for the future on the research priorities for risk prevention in occupational safety and health. It is based to a large extent on the strategic approach adopted by the Board of Directors of INRS (2009-2012); this strategic approach is based on 7 focal points and 22 priority topics (cf. Box 1).¹

The memo recalls a few salient features of the situation in terms of occupational accidents and diseases in France (i) while using figures and listing the societal changes that might have effects on the working environment. It then describes a few major research priorities (ii).

Situation in terms of occupational accidents and diseases

A few figures

– In 2008, 704,000 recognised occupational accidents with days lost were recorded in France, including 44,000 serious accidents and 570 deaths, these figures being down on the preceding year. The frequency of occurrence of occupational accidents per 1,000 employees has been decreasing steadily since 1998, going from nearly 45 per thousand to 38 per thousand.¹ The ensuing number of working days lost has been tending to increase. Falls from heights, slips and trips, and accidents occurring during manual handling are still the main cause of occupational accidents in France.

– Occupational diseases are constantly increasing. Musculoskeletal disorders (MSDs) represent over 70% of the occupational diseases recognised by the French Social Security System, and their proportion as a percentage of all occupational diseases is on the increase. This increase does not appear to be due simply to the growth in recognition of these disorders.¹¹ Every year, MSDs contribute to excluding employees from the working world. It would appear that MSDs thus cause 7.5 million working days to be lost every year (cf. ¹¹).

– The fraction attributable to occupational exposure in cancers as a whole lies in the range 4.0% to 8.5%, i.e. an incidence lying in the range 11,000 to 23,000 new cases per year (out of the 280,000 new cases of cancer in 2000). According to the French SUMER survey (an occupational physician survey), 13.5% of the working population, i.e. over 2 million employees were exposed to at least one carcinogenic agent at their workplaces during a reference week.¹²

– We are witnessing a development of psychosocial disorders related to excessive stress, to harassment or bullying and to violence at work; those disorders can lead to various serious pathologies, including suicides. The social cost of stress and of violence at work, be it in terms of antidepressants or of days lost to sick leave, is assessed at in the range 0.8 billion

¹) Corresponding author: Frédéric Lerais, INRS, 30 rue Olivier Noyer, 75680 Paris cedex 14, France; e-mail: frederic.lerais@inrs.fr; Phone: 33 1 40 44 31 52.
euros to 1.7 billion euros, i.e. in the range 10% to 20% of the Occupational Accidents and Diseases (AT/MP) branch of the French Social Security System.\textsuperscript{VI}

- The situation has not improved uniformly across all categories of employees or across all sectors. In spite of clear progress, building and construction remains a sector that is particularly exposed, where the frequency of occurrence of accidents is particularly high. Certain categories are still particularly hard hit by occupational safety and health problems. This applies to employees in very small businesses and in small-to-medium-sized businesses, to newly hired employees, to temporary staff and to employees of subcontractors. Of the fatal accidents, nearly 11% concern subcontracting companies.\textsuperscript{VII}

Key technical and societal changes

The occupational risks of tomorrow depend to a large extent on the technological and societal changes happening today. These changes are liable to have more or less direct effects on the working environment:\textsuperscript{VIII}

- Demographic change and population ageing will leave a lasting mark on the structure of employment and on the job market: there will be more elderly workers and more migrant workers.

- The productive system is continuing to be transformed to a large extent under the effects of a growing service economy, of the rise in outsourcing (subcontracting), of extension of just-in-time organisation, and of globalisation of the productive processes. We are witnessing a decrease in the proportion of industrial employment in total employment, and an increase in the tertiary proportion, partially related to the effects of outsourcing: from 1978 to 2008, the proportion of intermediary service consumption by firms (that consumption being to a large extent constituted by the wage bill for the employees of subcontractors) was multiplied by 2.5.\textsuperscript{IX}

- The quest for productivity gains is continuing, partly to keep firms competitive or for offsetting population ageing. This is resulting in a marked intensification of work, and acceleration in innovations in terms of products and processes. These technological changes are liable to bring both solutions and also problems for risk prevention.

- In recent decades, as shown by the survey entitled \textit{Changements Organisationnels et Informatisation} (COI) or “Organisational Changes and Computerisation,” the working environment has changed a lot in terms both of content and of organisation.\textsuperscript{x} This is due to the development of new technologies, in particular computerisation and automation, and of new styles of management. These changes are characterised mainly by strengthening control over results, hunting down dead time, and seeking optimum operation with as few staff as possible, and with high growth in outsourcing.

- New forms of work are developing under the effect of the labour market becoming more flexible (temporary work, fixed-term employment contracts, distance work, etc.), and of contract duration being shortened, in particular for the youngest;

- Climate change and environmental issues\textsuperscript{e} could play a part both directly, with temperature change and the biological risks that might be associated with such change, and also indirectly, e.g. with the adaptation of tools to save energy (e.g. ventilation systems), or indeed with new emerging risk sectors (waste management).

- Society becoming more demanding on health and safety issues, at work and elsewhere, is translating into a growing judicialization of contemporary societies and into a high demand for regulation.

- As regards the most recent trends, we should emphasise that the impact of the current recession is difficult to define at this stage, but it would seem that the restructuring in progress, far from abating the relative tension in terms of psychosocial risks for employees, is liable to make it worse due to the uncertainties such restructuring causes in terms of unemployment. The recession might also translate into work intensification in the firms that survive. The subject merits particular watchfulness.
Research needs

At this stage, the idea is not to determine the consequences of all of these transformations on the emergence of risks and on prevention of occupational risks. That would be an exercise that would exceed the scope of this memo. Here, it is a question, more simply, of taking a look at some major trends and of asking questions about needs in terms of research.

– The “conventional” accident risks still need research work as regards both how the accidents arise and also how to prevent them. The issues in this research field consist in: (1) developing analytical approaches using scenarios, making it possible to better identify primary risks; (2) establishing comparisons between the analysis and assessment tools and methods that are implemented in the fields of occupational accidents, and of industrial or environment risks, and in the field of “private” risks; (3) determining the relations between work situations and the concepts of risk perception and acceptability, and also changes in these concepts; (4) identifying any changing behaviour when faced with the risks; (5) establishing balance-keeping and balance-loss models, balance disturbance appearing today as the main cause of same-level falls.

– The theme of psychosocial risks (PSRs) is emerging as a priority field. Various studies have shown that work organisation is also liable to generate effects that are harmful to health, and in particular psychosocial risks. In this field, it is a question of (1) characterising the relations between the changes in the work activities and the determinants: the studies consist in particular in analysing the consequences of installing new technologies, new organisation, and new modes of management,...; (2) understanding the phenomena related to work activities that can lead to well-being or to degradation in physical and mental health; and (3) improving knowledge on work-related psychosocial risks and their effects on physical and mental health.

– MSDs and low back pain, it should be remembered, numerically form one of the largest categories of occupational diseases. The continued growth of MSDs that are related to work organisation raises questions. Improvements in knowledge are still necessary, among which mention might be made of: (1) understanding the mechanisms of MSDs, combining knowledge of inflammation, biomechanics, biochemistry, and physiology of movement; (2) interactions between the emergence of MSDs and low back pain, and of PSRs. Studies still need to be conducted to identify and specify the respective roles of the biomechanical and psychosocial risk factors, and to estimate their interactions; and (3) Estimation of consequences of MSDs and of low back pain on life and career paths, and on ageing; all of which constitute major concerns.

– In view of the necessary lengthening of careers, the relationships between ageing, health, and work take on a particularly acute nature. The issues that arise initially are: (1) how to adapt work to accommodate an ageing population? and (2) what impacts do working conditions have on ageing? In order to prevent premature ageing at work, it is necessary to characterize a few major families of indicators of how physically demanding particular types of work are.

– Work organisations are often described as being the causes of new pathologies (MSDs, PSRs, etc.), but they also constitute an essential resource on which the work activity can and should draw. Research should therefore open up (1) to “the organisation work,” i.e. to all of the schemes and processes that participate in organising work (other people’s and one’s own work); (2) to the way in which risk prevention should be organised in regularly changing contexts; and (3) to the way in which risk prevention should be integrated into the bodies and networks that, from outside the firm, develop guidelines and requirements that apply to it.

– With the growth of products marketed, the risks related to chemicals still constitute a key focus for research into risk prevention, in particular in the following fields: (1) Developing knowledge on the carcinogenic, reprotoxic, neurotoxic, ototoxic, and immunotoxic effects; (2) Developing alternative methods for testing toxicology of products, (3) Developing biometrolology methods for occupational exposure; (4) Collecting field data on exposure to chemicals (air monitoring and biomonitoring); (5) Developing techniques that make it possible firstly to reduce emissions at source, and secondly to take risks into account as of the
design stage of work equipment and facilities. As regards carcinogenic agents, substitution approaches should be fostered and facilitated; and (6) Knowing the effects of co-exposure.

- The risks related to industrially produced nanoparticles are already keeping several laboratories in France busy. This field of research requires a multi-disciplinary response that is reinforced and co-ordinated with the work in progress internationally around three objectives: (1) assess the effects on health; (2) assess exposure; and (3) prevent risks. In this context, INRS has put in place a priority programme. A laboratory will be available in 2010. This laboratory will be specifically dedicated to in vivo toxicological studies on the inhalation of nanoparticle aerosols.

- The study of biological risks is insufficiently developed. Generally speaking, there is a lack of knowledge, in particular on immuno-allergic and toxin risks at work. There is also a need for metrology, epidemiology, and assessment and prevention of biological risks. In terms of sectors, the waste sector requires particular monitoring. The biotechnologies sector is also a high-growth sector that has not yet received much study.

- As regards electromagnetic fields, new populations are becoming exposed due to the popularisation of professional and domestic applications using the properties of radio waves and of electric fields. It is necessary to identify the populations exposed to electromagnetic (and optical) fields, to identify the collective or individual prevention means, and to develop primary prevention assessment methods.

- Multi-exposure has been raising questions for a long time now. Combinations of chemical, physical, and psychological exposures are frequent, and knowledge on how they interact in humans is insufficient (co-exposure to chemicals, MSDs & PSRs, noise & solvents, etc.).

- Reinforcing the simulation and modelling methods should make it possible to predict occupational accidents, to hone-down the protection methods, and to assist in designing prevention schemes start from the conception of machinery. Virtual dummies would avoid, as far as possible, testing on humans, and, similarly, the development of modelling of physical and chemical mechanisms (e.g. transcutaneous diffusion) would make it possible to develop knowledge in this field. Virtual reality and modelling methods should enrich risk prevention techniques and conception of machinery (for ventilation systems, for personal protective equipment, etc.).

- Economic, health, and social assessments of risk prevention initiatives (micro/meso/macro) are as yet very insufficiently developed due to lack of statistics and of surveys. Beyond that, it is necessary to develop the culture of assessment and acquisition of methods appropriate for assessing risk prevention actions.

Bibliography

1. INRS (2008): “Cadrage stratégique” in Faits et Chiffres
7. HERY M. (DIR.) (2009): La sous-traitance interne, INRS-EDP.
WHO (2009): *Protecting health from climate change: Global research priorities*


EUROPEAN AGENCY FOR SAFETY AND HEALTH AT WORK (2005): *Priorities for occupational safety and health research in EU-25.*

**Boxe 1. The 22 priority topics of the INRS strategic approach**

1. Accidentology, Perception of Risk, and Acceptability
2. Personal Care Assistance
3. Occupational Allergies
4. Biotechnologies
5. Noise, Vibration, Electromagnetic Fields, Optics
6. Building and Civil Engineering
7. Occupational Cancer
8. Design of Work Equipment, of Workplaces and of Work Situations
9. Waste and Recycling
10. Nanotechnologies and Nanoparticles
11. New Addictions and Work
12. Organisation, Health, Safety, and Well-Being at Work
13. Ionising Radiation
14. Biological Risks
15. Chemical Risks
16. Mechanical Risks
17. Psychosocial Risks (stress, internal and external violence)
18. Reproductive Risks
19. Occupational Road Accident Risk
20. Tertiary Sector
21. Musculoskeletal Disorders (MSDs) and Low Back Pain
22. Ageing, Work, and Health
Forecast on Future Working Environment Challenges in Finland

By Dr. Mikko Härmä, Jouni Toikkanen and Director General, Dr. Harri Vainio, Finnish Institute of Occupational Health (FIOH), Finland

Key drivers of change in the Finnish Society

The call for new innovations in all policies, including the development of working life, has been active in Finland. In 2008, Matti Vanhanen’s II Cabinet launched Finland’s national innovation strategy. The strategy aims at broad-based and multifaceted innovation policy and strengthening its implementation.

Finland’s Cabinet identified four major key drivers of change in the Finnish society:

– **Globalisation.** Industrial manufacturing is flexibly placed in locations offering the most favourable operating conditions. Knowledge and competence are undergoing similar development. Operators in developing countries are striving to challenge those who are presently enjoying success throughout the world.

– **Sustainable development.** Increasing awareness of climate change and the related threats has created pressure to adopt ecologically sustainable production and consumption. The scarcity of energy and raw materials, and their soaring prices, are adding to this pressure.

– **New technologies.** Technological development continues at an accelerating pace. For instance, the fields of information and communication technology and bio- and nanotechnology are producing information and results on a continuous basis, creating huge potential for new applications and the renewal of former operations.

– **Ageing of the population.** Finland is one of the first countries to face reducing workforce volumes. The rapidly changing population structure is forcing Finland to devise rapid solutions in order to enhance productivity and efficiency, while creating the preconditions for new innovations.

In addition to the four key drivers, The Finnish Innovation Fund (SITRA) has later added two other major key drivers of change to the list. They are

– **Increasing migration,** being related to globalisation, and

– **Structural trends in economical and industrial life.** It is obvious that there will be structural changes in industrial activities and branches of employment. It is, however, unclear yet which branches of work will stay in Finland.

Changes in Finnish working life and working conditions

According to the qualitative characteristics of work assessed by the 4th European Survey on Working Conditions (2005), Finland was above EU15 average for instance in the frequency of telework, work with computers, using internet/email at work, and doing teamwork. Finns reported the highest frequency of having a female immediate boss (39%). Finland had the highest frequency of workers feeling they are well informed about health and safety risks (96.5%). Above EU average prevalence was also reported for fit between working hours and social/
family commitments as well as for satisfaction with working conditions. On the negative side Finns reported one of the highest frequencies for violence, bullying and harassment at work as well as for working at a very high speed and working to tight deadlines. On the other hand, according to the EU Commission’s 2008 Employment in Europe report, Finland was grouped among the best performers both within the socio-economic security/working conditions and the gender balance/education dimensions.

Certain worrying features characteristic for the contemporary Finnish working life become visible in international statistical comparisons. One of them is the relatively large amount of work-age people in disability pension. Of the main reasons of disability pension among people with a work career, the share has decreased for circulatory diseases, stayed stable for musculoskeletal diseases and clearly increased for mental disorders. In absolute terms the number of people on disability pension due to mental disorders increased from 59 000 in 1996 to 82 000 in 2007. The increase is almost exclusively attributable to depressive disorders for which the new disability pensions almost doubled in 1996-2007. The number of sick-leave days per employed person increased by 22% in 2000-2007, with a 38% increase in sick-leave days due to mental disorders. It is difficult to see any marked increase in the prevalence of mental disorders overall in the Finnish population, and thus the above mentioned developments seem to be related to changes in worklife practices and to the mental burdens that are imposed upon the employees.

Based on the key drivers of the Finnish society, The Finnish Innovation Fund predicted in 2009 the following major trends in future Finnish working life:
- open and network economy
- insecurity and insecure working places
- higher work demands and longer working hours
- increased competition at work and for working places

Prepared for the FIOH International evaluation in 2009, a special report of FIOH (Kasvio et al. 2009) highlights the effect of immigration and its challenge to the managerial practices and workplace cultures. The insecurity in working life may also activate dissatisfaction with the precariousness of the labour market and induce polarisation in workers’ attitudes with existing jobs. Although 80% of Finnish employees feel currently that their physical and mental work ability is fairly or very good, the Finnish working force has rather pessimistic visions about long-terms trends in working life. Finally, there is also a risk of a possible vicious circle due to depression and weaker public finances.

In conclusion, the Finnish working life and working conditions are changing mostly similarly than the working conditions of the other Scandinavian and European countries. During the next 10 years, the following major trends in OSH risks are the most probable in Finland:

System:
- a need for new OSH strategies due to changing OSH management systems, network economy and changes in safety cultures at work. Integration of OSH to general management and productivity.
- a need for higher protection of increasing high-risk groups: older workers, low status workers and the foreign workforce

Mental:
- new forms of employment contracts and job insecurity
- complexity of new technologies, work processes and human-machine interfaces leading to information overload, increased mental and emotional strain
- work intensification (high workload and time pressure) and higher professional and emotional demands at work (including violence and bullying)
- poor work-life balance: disintegration of work from time and place, atypical working hours
Physical:
- pertinent high exposure to MSD risk factors at work
- moulds in indoor workplaces
- new potential risks due to the use of new bio- and nanotechnology
- new potential risks due to global epidemics

FIOH challenges

FIOH strategy 2006-2010 is based on the ‘ambidextrous’ innovation model, aiming at effectiveness through the interactive use of client-based R&D linked with the dissemination of information and the offering of client services and training. In addition, social innovations were sought by thematic areas, aiming at novel contributions in relation to the major societal OSH-related needs. FIOH’s current strengths are related to its apparent high competence and scientific performance, multidisciplinarity, good connections to its stakeholders and social partners, innovative R&D, and good national and international networks.

At the moment, Finland is caught by the economic depression together with the global economy. Depression is likely to have profound influences on the quality of working life, resulting in increased uncertainties and heightened risks in both psychosocial and physical hazards at work. At the same time, the government of Finland has set goals for the decrease of personnel in all public sectors, including the governmental research institutes and FIOH.

The future challenges of FIOH are related more than earlier to its resource management and fluidity, its ability to obtain appropriate distribution and competence of sufficient R&D&I personnel for its new 2011-2015 strategy. During that strategy period FIOH will face the public sector depression with decreasing staffing but increasing challenges for the support of OSH and well-being at work.

References

Working Environment Challenges for the Future – The Norwegian perspective

By Research Director, Dr. Stein Knardahl and Research Director General, Dr. Pål Molander, National Institute of Occupational Health, Norway

Work environment changes during the next decade

We do not foresee radical changes in work environments during the next decade. We expect current developments driven by information-communication technology to continue.

There may be an increase in exploitation of resources in the arctic and subarctic region with more people exposed to work in a cold climate. Challenges related to increased population of migrant workers are likely to continue.

Challenges with respect to practical prevention

The challenges for prevention remain the same as today. For many “classical” exposure factors there is a paucity of knowledge of pathogenic potential. With improved knowledge, challenges for prevention may change.

A high number of individuals on disability pension pose a challenge to maintaining sustainable health care and welfare systems. This challenge necessitates acquiring better knowledge of biological, psychological, and social factors that determine early exit from work.

There seems to be an increasing number of migrant workers both in the EU and globally. This may result in additional strain on the workers due to for instance language barriers. Furthermore, cultural differences may pose challenges to risk perception and in social interactions, as well as in relation to the social dialogue that is well settled in the Nordic countries.

Development regarding prevention of musculoskeletal disorders

Musculoskeletal disorders make a large contribution to health care costs, sickness absence, and exit from work in Norway. There seems to be little change in prevalence and incidence. There seems to be a focus on ergonomy in many businesses, but knowledge of scientific evidence is lacking.

Since we do not know the pathogenic mechanisms of most musculoskeletal pain disorders, we do not know the time scale of exposure-health effect relationships. Therefore, one does not know the relevant time period from exposure to health effect and this poses a problem for designing epidemiologic studies. The US term “cumulative trauma disorder” is misleading, since cumulative effects have not been observed.

Most preventive interventions seem to be initiated on a trial-and-error basis, and systematic evaluations are rarely performed. A systematic critical review performed for the Labour
Inspectorates in Norway revealed that few interventions have resulted in positive effects when tested by scientific methods. Hence, there is a need for better research on risk factors, mechanisms, and effects of preventive measures in this field.

**Emerging risks with regard to chemical or biological hazards**

Norway is among the countries in Europe that has preserved much research efforts with regard to chemical and biological hazards, and this field still has great attention from political environments, social partners, other stakeholders, and media. There are large R&D efforts to develop new materials throughout the world. Obviously, it is a challenge to verify pathogenic potential in the plethora of new chemical substances.

The oil and gas industry in Norway pay much attention to chemical hazards. Novel technology for "removing" CO2 from oil and gas producing facilities has raised questions of new personal exposure scenarios for workers. Demolitions of older platforms containing unspecified coatings etc. pose an emerging risk. In general, increased focus on recirculation, waste management, demolition etc. will probably bring about exposures that call for monitoring and scientific activities.

There are great concerns in Europe with regard to accumulation of persistent pollutants in the environment and in the food chain. Little attention has been directed towards occupational exposures for such compounds. Some studies from our institute have found substantially higher exposure levels for such components among workers compared to the general public living close to polluting sites. It is challenging to clarify health relevance of such relatively "higher" exposures among workers as compared to the general population, when environment pollution authorities express great concerns based on a precautionary principle. This focus will probably call for research activities in occupational settings, where the potential for conducting epidemiologic studies are higher than among the general public due to better exposure control, higher exposure levels and most probably more pronounced health effects outcomes if present.

When genetically engineered therapy becomes validated medical treatment methods, more people will probably be exposed to viruses and DNA/RNA-fragments used in this therapy. This raises questions of pathogenic potential and practical procedures to protect health-care workers.

**Future role of workplace health promotion**

Workplace health promotion (WHP) may be defined as the efforts undertaken to maintain the health of the employees, i.e. health and safety measures. However, WHP may also be defined as general health promotion measures using the workplace as the arena (e.g. smoking cessation campaigns at the workplace).

We consider primary prevention our first priority in promoting health. Interventions directed at the individual (e.g. exercise) may prove effective, but should not substitute primary prevention. However, in a society with physically inactive individuals, physical strength may come to be considered part of an individual’s competence for a job.

**Knowledge gaps**

There is a need for systematic critical reviews of most fields of occupational health. Those systematic reviews that have been undertaken show that there are knowledge gaps in health
effects of many present exposures at work. There is inadequate knowledge of pathogenic mechanisms for most risk factors.

Systematic reviews have revealed that very few epidemiological studies have been able to include objective measurements exposure that follow the worker over time and take variations into account. Very few studies have been able to assess interacting factors or confounders adequately. In most fields there are few prospective longitudinal studies.

Therefore, there is a need for studies of health effects of chemical and physical exposures based on adequate objective exposure measurements to the individual by continuous (or representative) measurement over time in such a way that variation (and peaks) are recorded. For psychological and social factors assessment of specific work factors with repeated measurements to measure representative data and variation is needed.

Several studies have shown that psychological factors (e.g. high level of demand combined with low level of control/autonomy) are risk factors of cardiovascular disease (CVD). The pathogenesis of psychological pathogenesis of CVD is largely unknown, although there are several neuroendocrine systems that are putative candidates. There is need for knowledge of how work factors control body functions and pathogenesis of disease. This knowledge will provide markers of dose and of precursors of disease. Furthermore, psychological problems seem to contribute to consequences for work ability of most disorders and diseases. There is a need for knowledge of interactions between psychology and biology.

The pathogenesis of most work-related musculoskeletal disorders is unknown. Since we do not know the pathogenic mechanisms of most subjective disorders, we do not know the time scale of exposure-health effect relationships. Therefore, one does not know the relevant time period from exposure to health effect and this poses a big problem for designing epidemiologic studies. This poses a major problem for practical prevention: should prevention avoid peak exposure levels or sustained moderate-level exposures. There is a need for knowledge of pathogenesis to direct the work for effective prevention.
Future Working Environment Challenges in the Netherlands

By Dr. Joost Van Genabeek, TNO Work and Employment, the Netherlands

Introduction

This paper examines the challenges facing working conditions in the Netherlands over the coming decade (2010-2020). I will investigate the following trends that have an influence on work in general and on working conditions in particular:

– new technologies;
– the dominance of the service sector;
– upgrading of the labour market.

These are trends that are currently emerging whose development over the next ten years it is therefore already possible to envisage. I also considered including climate change as an issue because of the major impact that rising sea levels are likely to have on the low-lying Netherlands. However, since the effect of rising sea levels will only fully emerge in the long term, I decided to exclude this issue.

In writing this paper, I referred extensively to the various studies published on the future of work in recent years (Huizinga and Smid 2004, Wevers et al 2005, Fouarge et al 2006, Research Centre for Education and the Labour Market [ROA] 2007, Genabeek et al 2007 II, Genabeek et al 2009). Unfortunately, these investigations fail to fully account for several recent events that have had a significant impact on society. For example, most of them make no reference to the credit crunch and its repercussions on the real economy and labour market. I have therefore found it necessary to make substantial adjustments to forecasts and expectations from earlier investigations.

This paper is structured as follows. I start by examining the three trends mentioned above and the implications these are likely to have for working conditions. I then discuss the future of occupational safety and health in the Netherlands. I examine the general health of the Dutch working population, focusing specifically on health issues that have no causal connection with employment. I then investigate the changes expected to occur in employment-related health issues. In my brief conclusion, I outline several gaps in knowledge and areas identified as requiring further research. I conclude my paper with an overview of relevant national strategies and policy priorities in the Netherlands.

New technologies

Specification of the trend

In the Netherlands there is broad consensus on the far-reaching influence that technological developments will have in the coming years both in terms of the content of work and the conditions in which it is carried out. Developments in ICT and telecommunications, automa-
tion and robotics, biotechnology and nanotechnology in particular are proceeding at such a pace that it is difficult to predict their consequences on working conditions in concrete terms. Since so much remains unclear and unknown, there is a tendency to focus on the risks involved in new technological developments. But technology does not only present threats; it can also help enhance safe and healthy working conditions. In this paragraph, I shall briefly examine several technological trends that are expected to have a significant impact on work in the coming years.

**ICT and telecommunications**
ICT and telecommunications involve information and communication technology. Their impact is most significant when both these technologies are applied in combination. This includes data storage and data connections, computer networks, modern telecommunications and satellite communication. These hardware technologies enable the development of even more advanced software and lead to a far-reaching virtualization of social processes and therefore also of work.

Virtualization involves people working together remotely in virtual teams, mobile working, shared services or virtual networks. It has major consequences for the content, organization and execution of work. Virtualization can enable an employee, team or organization to work independently of place or time and coordinate with clients, colleagues, teams and other organizations. All kinds of creative and design processes also increasingly take place virtually. In addition, virtualization makes new forms of education and learning possible, including E-learning, gaming and communities. The more time people spend in the virtual world, the more this is expected to have an impact on the real, tangible world. For example, the recent credit crisis has clearly demonstrated that the virtual financial economy has a direct impact on the real economy (Van Genabeek et al 2009).

**Automation and robotics**
Automation involves replacing human labour by automated systems and processes, using computers and computer programs. It is driven by an economic imperative: automation allows a reduction in the total labour and raw materials required. Automation also takes various forms and can be applied in offices, industry and in graphics. It is expected that corporate processes will be subject to even further automation in the years to come. The use of robots is also predicted to increase, especially in industry and transport. In robotics, tasks originally carried out by humans are completely achieved by machines. The first visible uses of robotics occurred in the automobile industry and were especially employed in welding. In the coming years, robots will be increasingly deployed in the logistics sector (warehouse management and container transfer), an area crucial for the Dutch economy, as well as in transport (unmanned vehicles).

**Biotechnology**
Biotechnology is technology that applies biological knowledge for practical purposes and covers a wide spectrum ranging from cheese production to high-tech laboratory work. One area of biotechnology currently in the spotlight is genetic manipulation. This involves deliberately changing the DNA in the genes of an organism in order to modify the phenotype (the traits of an organism, as distinct from the genes inherited from parents) without resorting exclusively to using the organism’s normal reproductive process. The resulting organisms are known as genetically modified organisms.

**Nanotechnology**
Nanotechnology makes it possible to manipulate particles as small as one billionth of a metre, at the scale of atoms and molecules. The idea behind nanotechnology is that knowing the chemical composition and the three-dimensional structure of a substance should make it possible to create a substance by adding the right building blocks in the right place. In the last decade, interest in nanotechnology has increased enormously among the scientific community and more widely. This interest is expected to continue as more and more applications are
discovered. According to the OECD (OECD & Allianz Group 2005) global public sector expenditure on nanotechnology is in the region of €3 billion. The combination of biotechnology and nanotechnology is expected to lead to significant breakthroughs in medical technology.

Implications for the working environment

Although there remain many uncertainties about the possible applications of new technological advances, they are expected to be used on a wide scale in products, technologies and systems. The impact on productivity and the content of work is predicted to be enormous.

Opportunities and risks of virtualization, automation and robotics

The further development and wider application of automation, robotics and the virtualization of manufacturing processes will enable employees to work at a greater distance from materials, machines and products, reducing or even eliminating physical exposure to the risks of poisoning, contamination and faults or breakdowns. On the other hand, these technologies also enable significant increases in labour productivity, potentially making the work more mentally challenging for employees. This applies especially to the virtualization of work since thanks to these technologies almost unlimited flexibility becomes possible in terms of working hours and working relationships. As a result, it will become increasingly difficult to monitor working conditions since the virtual working environment offers fewer opportunities for the enforcement of rules relating to occupational safety and health (for example because of the lack of a clearly defined place of work).

Safety technology

Vehicles and machines will continue to become safer as they replace the tasks traditionally carried out by the driver or operator and reduce the impact of human error (Van Genabeek et al 2007I). For example, the freight truck of the future will brake automatically if it approaches an object too closely, its windscreen wipers will automatically be deployed in the event of rain and the vehicle will warn the driver about hazardous situations in traffic. In recent years, the use of advanced security cameras, motion sensors and smoke alarms has made it easier to ensure safety on construction sites, in machines and electronics. At the same time, machines are increasingly fitted with safety mechanisms designed to reduce damage during use.

The use of safety technology is expected to result in a further decrease in the number of industrial accidents in the coming years. However, faults in these security systems can present a new kind of threat to safety. Drivers or operators accustomed to being assisted by built-in safety mechanisms are suddenly left to their own devices in the event of a fault in the system. This can actually increase the likelihood of significant damage. Safety technology can also create unsafe situations at work if drivers/operators are too easily distracted by signals on dashboards or displays.

More intensive use of space

New technology also makes it possible to use space more intensively. The high population density in the Netherlands means that space is limited and expensive. As a result, businesses are continually in search of new ways to use the available space more efficiently and effectively. The resulting increased intensity in the use of space can have repercussions for safety in business premises and on means of transport (Van Genabeek et al 2007I).

Business premises

Recent years have seen the development in the Netherlands of numerous business complexes in which different companies share specific spaces and facilities, such as the reception, restaurant and sanitary facilities. Combining a wide range of activities in a single building, which may also be subject to frequent changes, increases the risk of fire or equipment failure. This means that although the risk of fire for one user may in itself be limited, it is actually increased by the activities of other users nearby. When various different activities are coordinated, this
can also present additional risks. If one activity in the coordinated process suddenly fails, this can have serious consequences for the safety of the workers involved. Finally, the increased intensity in the use of space has also led to significant growth in underground construction. The risks of working in such confined spaces can have far-reaching consequences. If fire breaks out or if an underground area becomes flooded, the consequences for staff working in that space can be incalculable.

Means of transport
In the Netherlands, the available infrastructure is being used more and more intensively. This applies to roads, the already congested Dutch railway network and shipping. Although the vehicles and vessels used are becoming ever safer, the increased intensity in the use of the road and railway network and shipping routes raises the likelihood of accidents and collisions. The chance of damage occurring that has major consequences has also increased. When space is used so intensively, a motorway accident in a heavily populated area can set off a highly destructive chain reaction.

Biotechnology and nanotechnology
Much remains unknown about the risks of such major trends as biotechnology and nanotechnology. If one examines the potential risk scenarios, it is possible to identify several trends.

In the near future, it is highly likely that biotechnology and nanotechnology will be applied in corporate processes and products on a major scale. This will result in growing numbers of people being exposed to products generated by these technologies. The potentially damaging effects remain largely unknown, partly because it can take a long time before they become evident (as such they may be compared to the effect of asbestos on human health). In individual cases, it is likely to be extremely difficult to identify causal relationships between the application of biotechnology and nanotechnology in corporate processes and the emergence of health problems among employees.

Dominance of the service sector
Specification of the trend
Analyses suggest that in the coming years the service sector will continue to increase its share in the Dutch economy. Commercial services (especially transport and communication services) have seen more than average economic growth over a long period. Over the same period, there has also been an identifiable shift towards service-related tasks.
The share of the service sector in total employment is expected to continue to increase in the coming years. Although substantial job losses are predicted in the business services and transport sectors between 2009 and 2011, the growth in jobs in the health care and education sectors is expected to continue undiminished. The demand for health care will grow as a result of the rapidly ageing population after 2010 (since elderly people tend on average to require more health care). At the same time, there is also expected to be an increase in the number of jobs in higher vocational education and higher education as more students continue their studies in response to rising unemployment. The service sector will therefore maintain its dominance in the coming years especially in view of the significant fall in industrial employment.

Implications for the working environment

Aggression and intimidation

The dominance of the service sector will lead to an increase in social interaction at work. This will place greater demands on employees’ social and emotional intelligence. (Weehuizen 2006). This increased interaction with clients, patients or students for example will also raise the likelihood of people being confronted with undesirable behaviour at work. The National Survey of Working Conditions commissioned by TNO and Statistics Netherlands or CBS (Koppes et al. 2009) shows that in 2008, 19% of employees in the Netherlands experienced sexual or other intimidation and/or bullying by their clients and 6.5% of employees reported physical violence by clients. The health care sector is particularly risky in this regard. Comparison with previous Surveys of Working Conditions shows that the number of employees reporting intimidation and violence has fallen slightly in recent years. This positive trend can perhaps be explained by the successful application of preventive measures in the form of anti-aggression training and improved security in health care, the police and education. However, incidents involving extreme violence at work appear to have increased in recent years. This may be seen as a reflection of a wider trend in Dutch society as a whole.

The increasing dominance of the service sector means that by 2020 we expect more than one third of the total working population to be exposed to undesirable behaviour at work.
Work pressure and psychological pressure
Following a rapid acceleration in the 1990s, the pressure of work in the Netherlands is relatively high. Figures from Dutch Statistics (CBS) show that the number of working people who claim to have to work at speed has stabilized in recent years. Pressure at work is high especially in the service sector (hospitality and catering, education, financial and commercial services and health care being the most obvious) and low in the agriculture and fisheries sector. In 2009 and 2010, we expect to see a slight drop in work pressure as a result of the sudden economic downturn, followed by a gradual resurgence from 2011. In the longer term, the ageing population, the decline in the numbers of young people and the shift in employment to the service sector will lead to a further increase in the psychological pressure faced by those in employment (see figure 2).

Figure 2. Pressure of work in the Netherlands 1994-2020 (need to work against the clock).

Pressure at work is experienced as less of a problem if one is able to control the work one does. Fortunately, this kind of independence at work is common among Dutch employees. When high work pressure is combined with a significant degree of autonomy, this is more likely to be considered as challenging work. TNO research shows that workers in the financial and commercial services sector and in public administration in particular experience their work as challenging. Work is considered to be exhausting if there is high pressure and limited autonomy. This is relatively common among employees in the hospitality and catering sectors, in education and health care. Work is considered to be easy if the work pressure is low and autonomy high (e.g. the cultural sector). Finally, if low work pressure is combined with limited autonomy the work is considered to be boring. Easy and boring work occurs most frequently in agriculture, fisheries and the transport sector.

In view of the growth in services, we expect to see an increase especially in challenging (high work pressure, high autonomy) and exhausting work (high work pressure, limited autonomy) and a rapid fall in boring work (high work pressure and limited autonomy) in the coming years.

Upgrading and downgrading
Specification of the trend
The process of skills upgrading means that employees are increasingly expected to be more highly qualified as a result of the growing complexity of the work they are required to do. This may also be caused by a shift in employment from lower to higher positions and careers. Up-
grading is not a new phenomenon on the Dutch labour market since it has been in evidence to varying degrees for many decades. Figure 3 shows the skills upgrading trend since 1996 (ROA 2007). The interrupted lines show the trend in the demand for labour at a specific skills level assuming that upgrading increases at a constant speed. Based on these trends, the demand for academics is expected to increase in the coming years while the demand for unskilled or poorly qualified employees drops.

ROA (2007) does however show that the speed of upgrading has slowed somewhat since the end of the last century (see the uninterrupted lines in figure 3). This is largely due to organizational changes combined with the introduction of new technologies. In recent years, organizational changes have often gone hand-in-hand with a shift in demand for labour: from more general to more specific skills. This last trend is expected to continue in the years to come. This means that there will be an increasing demand for high skilled labour and for specific skills. On the other hand, there will only be a limited decrease in the demand for low skilled labour. This is because technology will not only result in more complex work but will also simplify tasks that were previously much more onerous. This leads to the emergence of both more complex work and simpler work. This diverging development presents a threat for the demand for middle management positions, previously considered to be the backbone of many organizations: this demand will fall and the people holding these positions will be either need to upgrade or downgrade.

**Figure 3. Upgrading, 1996-2009 and forecast for 2010-2020.**

![Figure 3. Upgrading, 1996-2009 and forecast for 2010-2020.](source)

This last prediction is confirmed by the most recent labour market forecasts from ROA. Table 1 shows the upgrading for each level of education for the period 2007-2012. The effect of education column shows the degree of upgrading within professions or the effect on employment of changes in educational background required. The effect of higher education is positive while the effect of a lower education is negative.

The table also shows that in the coming years employment will increase at all levels. ROA also added a note to the table indicating that in previous forecast studies, upgrading was far more evident (and the effect of education significantly stronger). There is also a reference to the decreasing speed of the upgrading.
Table 1. ‘Upgrading’ per educational level, 2007-2011.

<table>
<thead>
<tr>
<th>Educational Level</th>
<th>Effect of education/ ‘upgrading’</th>
<th>Employment change</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>%</td>
<td>%</td>
</tr>
<tr>
<td>Primary education</td>
<td>-0.5</td>
<td>0.1</td>
</tr>
<tr>
<td>Lower secondary education</td>
<td>-0.5</td>
<td>0.2</td>
</tr>
<tr>
<td>Higher secondary education</td>
<td>-0.4</td>
<td>1.0</td>
</tr>
<tr>
<td>Intermediate vocational education</td>
<td>0.0</td>
<td>0.8</td>
</tr>
<tr>
<td>Higher vocational education</td>
<td>0.4</td>
<td>1.1</td>
</tr>
<tr>
<td>Higher education</td>
<td>0.6</td>
<td>1.6</td>
</tr>
<tr>
<td>Total (including others)</td>
<td>0</td>
<td>0.8</td>
</tr>
</tbody>
</table>

Source: ROA (2007).

Shifts in the employment structure at lower levels

Although employment at the lower levels of the labour market remains to a certain extent guaranteed, there are significant changes underway. These changes can best be described as a shift in the structure of employment. By 2020, the demand for low skilled work in industry and agriculture will be substantially lower than is currently the case. This can perhaps be explained by a reduction in the agricultural area exploited, the deregulation of agricultural markets, the relocation of industrial production to low-wage countries and the further use of technology and automation for more rudimentary activities (see chapter 2). Job relocation leads to the disappearance of jobs at the lower end of the market, the use of technology and automation makes the jobs that do remain (maintenance and repair) increasingly complex meaning that increasingly higher demands are made on employees.

Another shift in the employment structure at the lower end of the labour market comes as a result of women’s increasing participation in the employment process. This leads to increased demand for household services, childcare etc. The ageing population, the desire or necessity to continue working for longer and the desire to live independently for longer also result in an increased need for personal services and care. Work at the lower end of the labour market is therefore changing significantly in character and this has repercussions primarily for poorly qualified men. This people currently tend to work mainly in the industrial, construction and agricultural sectors. Owing to the decreasing employment in these sectors, a large part of this group will ultimately need to find work elsewhere. The question remains however as to whether they will find the transition to a job in personal services or in health care to be an easy one.

Implications for the working environment

Upgrading and cognitive pressure

Upgrading entails more demanding requirements for the positions involved. This can make the job more interesting and increase the opportunities for development. On the other hand, it can lead to greater cognitive pressure in such jobs. TNO figures (Van den Bossche, Smulders, Houtman 2006) do not yet show any increase in the number of employees in the Netherlands
exposed to a high degree of cognitive pressure (see table 2). Indeed, for certain indicators the opposite would appear to be true.

### Table 2. Complexity of work (percentage often/always).

<table>
<thead>
<tr>
<th></th>
<th>2000</th>
<th>2002</th>
<th>2004</th>
</tr>
</thead>
<tbody>
<tr>
<td>Does your work demand intensive thought?</td>
<td>57</td>
<td>54</td>
<td>56</td>
</tr>
<tr>
<td>Do you need to recall large amounts of information over a long period?</td>
<td>50</td>
<td>48</td>
<td>50</td>
</tr>
<tr>
<td>Does your work demand that you keep track of your thoughts?</td>
<td>90</td>
<td>86</td>
<td>87</td>
</tr>
<tr>
<td>Does your work demand a lot of attention?</td>
<td>80</td>
<td>77</td>
<td>77</td>
</tr>
<tr>
<td>Do you have to monitor a lot of different things at the same time in your work?</td>
<td>74</td>
<td>72</td>
<td>70</td>
</tr>
</tbody>
</table>


The extent to which the supply and demand of highly qualified labour (in other words the relationship between cognitive pressure and the ability to take such pressure) remains in balance will determine whether the increase in knowledge-related work proves to be detrimental or indeed beneficial to the mental health of those working in the Netherlands. Nevertheless despite the positive figures above we expect that skills upgrading in the service sector will lead to an increase in psychological pressure on employees over the longer term.

**Health risks at the lower end of the labour market**

As a result of upgrading, the lower end of the labour market is likely to decrease in size in the coming years. This applies in particular to those carrying out work for which high qualifications are not required (low level of education, low salary) with an employment contract or agency contract¹. The health risks of this declining group will remain limited in the coming years because they generally have access to company health care from health and safety professionals, company physicians or in the case of agency workers insurance doctors from the social security agency UWV. However, there are indications that casual labourers (including growing numbers of illegal workers) will form an increasingly substantial portion of the lower end of the labour market in the coming years. For some years there has been a major influx of foreign labour onto the Dutch labour market from EU member states in Eastern Europe and the Ukraine, who work in construction, transport and agriculture as agency workers, on standby or independently. This group often has limited or no access to company health care or health care provided by the UWV and can be inhibited from accessing curative health care (no health insurance, high excess payments for health insurance and fear of discovery in the case of illegal workers). There is also an increasing use of subcontracting by companies who pass on the risk of absence caused by sick leave and incapacity for work to third parties who do not provide company health care. At the same time, research shows (Fouarge et al 2006) that poorly qualified employees are faced with difficult working conditions relatively often (see table 3). These are permanent working conditions that are highly likely to remain relatively unchanged in the years to come.

---

¹) For a breakdown of the lower end of the employment market in the Netherlands, see: De Beer, 1996 and Netherlands Centre for Occupational Diseases (NCvB), 2009.
Table 3. Working conditions by level of education in percentages.

<table>
<thead>
<tr>
<th></th>
<th>Primary education</th>
<th>Lower secondary education</th>
<th>Higher secondary education</th>
<th>Higher vocational education</th>
<th>Higher education</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dangerous working conditions</td>
<td>25</td>
<td>21</td>
<td>15</td>
<td>8</td>
<td>4</td>
</tr>
<tr>
<td>Working with hazardous materials</td>
<td>16</td>
<td>18</td>
<td>16</td>
<td>8</td>
<td>5</td>
</tr>
<tr>
<td>Unpleasant smells, noise, draught or high/low temperatures</td>
<td>46</td>
<td>49</td>
<td>38</td>
<td>25</td>
<td>18</td>
</tr>
<tr>
<td>Physically demanding work</td>
<td>45</td>
<td>45</td>
<td>33</td>
<td>17</td>
<td>5</td>
</tr>
</tbody>
</table>


We can therefore make the following conclusions about the lower end of the labour market in the coming years:

– upgrading will reduce the supply of work available;
– working hours and working relationships will become more flexible;
– measures to prevent illness or promote health will increasingly be lacking or will not be applied;
– the work will therefore remain relatively unsafe.

**Occupational Safety and Health**

**The general health of the working population**

The health of Dutch employees has improved in recent years. Sick leave has fallen from just 5% in 2005 to 4% in 2008. Furthermore, the percentage of Dutch employees with a positive perception of their own health has increased from 86% in 1990 to 91% in 2007.

The increasing number of healthy employees may be largely due to the changing structure of employment. In sectors with the most risk, such as the agricultural sector and heavy industry, the number of people working is decreasing, reducing the number of employees exposed to health risks. Another explanation for the improved health of Dutch employees is what has been called the healthy worker effect. This is the phenomenon whereby relatively large numbers of people with health issues gradually disappear from the employment process over the years. Although average participation in employment (based on a working week of twelve hours or more) has fluctuated between 64% and 70% since 2002, participation in employment by those with occupational disabilities fell from 44% in 2002 to 40% in 2006 and has remained stable since then. Within the Dutch working population a process of selection takes place (selection on entry). Unhealthy employees are either not appointed in the first place or disappear from the employment process more quickly than healthy workers as they are more likely to be made redundant or not have their temporary contracts renewed in the event of reorganizations or mergers.

Until recently, this healthy worker effect was expected to decline after 2010. The increasing scarcity of labour was expected to force employers to increasingly consider the supply of less

2) Although some of this group of employees do have work related health problems. See 5.2 for more information.
employable people causing the average employment participation of those with occupational disabilities and chronic illnesses to increase. Recent forecasts however have suggested that this scarcity of labour is not likely to emerge until 2015 (Van Ewijk, Teulings 2009; De Beer 2009). The current economic crisis is predicted to lead to a substantial rise in unemployment in 2009 and 2010, after which (from 2011) employment will gradually recover. The obvious conclusion is that there will still be little room in the labour market for those with occupational disabilities and chronic illnesses in the coming years.

Despite the fact that the healthy worker effect is likely to continue, there are indications that the health of the active working population will worsen in the coming years. Firstly, the Dutch working population faces the problem of rapid ageing (although compared to other EU countries, the Netherlands is slightly behind). This pressure caused by the ageing population (expressed in terms of the number of over 65s as a percentage of those between 20 and 64) will increase from 23% in 2007 to 35% in 2020 (Huizinga and Smid 2004). This ageing process is also accompanied by increasing health problems which seriously limit people’s usefulness in the labour market. Examples of illnesses that occur on average more frequently among older workers include cardiovascular diseases, cancer, osteoarthritis, bronchitis and contact eczema. These illnesses are obviously likely to become increasingly prevalent in the coming years.

The growing problem of obesity is another indication that the health of the Dutch working population is likely to worsen more acutely in the years to come. Dutch statistics from the Ongoing Lifestyle Survey on Health and Well-being (Permanente Onderzoek Leefsituation Gezondheid en Welzijn) show that the percentage of adults who were moderately to seriously overweight increased from 35% in 1990 to 45% in 2007 (with as many as 11% of adults being morbidly obese in 2007). The percentage of overweight children aged seven and above almost doubled between 1997 and 2004. If this trend continues, the percentage of adults who are seriously overweight (obese) will increase by 50% in the next twenty years (Bemelmans et al 2004).

People who are overweight are relatively more likely to suffer health problems that inhibit their ability to function physically. Examples include back, hip and knee problems, fatigue and shortness of breath. Obesity can also cause diseases such as cardiovascular diseases, osteoarthritis and diabetes. According to a study of trends by the Dutch National Institute for Public Health and the Environment (RIVM, Bemelmans et al 2004) by around 2020 the total number of deaths and prevalence of strokes, heart attacks, and osteoarthritis of the hip will have risen as a result of the expected growth in the numbers of people who are overweight or obese. The most significant impact will be in the numbers suffering from diabetes mellitus type 2. The expected increase in the number of people who are moderately overweight or obese is expected to lead to an increase in the number of diabetes patients of as much as 9% by 2020.

**Occupational safety and health of Dutch workers**

**The Netherlands compared with the rest of Europe**

Within Europe, the Netherlands scores relatively well in terms of physical and environmental risks. This is not only due to the relative scarcity of physically demanding work in the Netherlands, the relatively large size of the service sector or the fall in the numbers of physically demanding jobs over recent decades. A sector-by-sector comparison of reported exposure to risks at work by Dutch people and other Europeans shows that it is precisely in those areas of industry and construction that are most physically demanding that Dutch people report fewer risks than those in the rest of the European Union (Bakhuys Roozenboom et al 2009). It is only within financial institutions and health care and welfare that exposure to risks at work in the Netherlands does not score better than in the rest of Europe (but nor does it score worse).
Employment-related health issues

To what extent are health problems caused by work? According to the report on Dutch occupational safety and health, Arbobalans 2007/2008 (Bakhuys Roozenboom et al 2009) 17% of the working population say that they have one or more health problems caused by factors at work. The most common health issues reported are physical symptoms involving the musculoskeletal system (back, neck and arms, hands, legs and feet). In the case of 6% of employees, these symptoms are caused by their work. The type of physical complaints also varies according to the different professional groups. Administrative staff are more likely to suffer from RSI and unskilled workers and labourers in the agricultural sector, construction and in transport tend to suffer more from back problems.

Psychological health problems caused by work are significantly less common (just 2%). The professions that do report psychological problems caused by work relatively often are primarily those involved in less physically demanding work, such as teachers and senior or medium-level professionals.

In recent years, there has been a noticeable increase in the number of employees reporting damage to hearing caused by work, although this involves only half a percent of employees. This increase is primarily accounted for by employees in catering and hospitality (nightclubs, pop concerts, musicals, house parties, etc.).

Health problems caused by exposure to chemical or biological agents are relatively rare in the Netherlands. Less than half a percent of employees suffer work-related pulmonary problems (asthma, bronchitis, emphysema) and only 0.1% have skin complaints that are linked to employment. This is despite the fact that as many as 10% of Dutch workers are regularly exposed to dangerous substances. These are predominantly hairdressers and beauticians (63%), painters (50%), machinery workers, assembly workers and instrument manufacturers (45%), and plumbers, fitters, welders and sheet and construction workers (42%). In practice, it appears that employees exposed to chemical and biological agents are happy with the protective measures taken. As many as 95% believe that the protective measures taken are adequate (Koppes et al 2009).

Expectations for the future (2010-2020)

It seems that in the coming years there are likely to be no major changes in terms of the health problems caused by work. However, the situation is likely to worsen as a result of the following factors:

– the increasing dominance of the service sector and the related increase in work pressure, psychological pressure and incidents involving aggressive and intimidating behaviour at work;
– new applications of technology whose effects on health are still insufficiently understood (especially biotechnology and nanotechnology);
– increasing flexibility in terms of working hours and working relationships, especially at the lower end of the labour market;
– the ageing population and the decline in the numbers of young people making up the working population along with the related increase in the number of age-related health problems;
– unhealthy lifestyles (obesity, alcohol and drug use, regular exposure to noise);

Occupational health and safety is likely to improve as a result of the following factors:

– the use of new safety technologies;
– the use of automation and robotics in work that involves a high level of risk;
– health and safety measures designed to combat work pressure, RSI, physically demanding work and exposure to noise and safer working conditions intended to prevent aggression, intimidation and violence;
– improved information designed to promote health at work, especially at the lower end of the labour market.
Knowledge gaps

What gaps are there in our knowledge and where can we predict that further research will be required?

Firstly, we know relatively little about the relationship between chronic illnesses and employment. It is expected that the ageing population and increasing obesity are likely to lead to large numbers of employees suffering from chronic illnesses such as diabetes, rheumatism, psoriasis, osteoarthritis, etc. It still remains unclear as to how these people will be able to continue to be employable and productive in a rapidly changing labour market in spite of their illnesses. What types of work are more appropriate for such people and what kind of work exposes them to health risks? What changes will be required to the workplace in order to enable people to continue to play a productive role in the workforce until a later age? What kind of support will they require and who will provide it (employer, personal coaches, medical specialists, etc.)? Experimental research in companies and in health care will provide a better understanding of these gaps in knowledge.

In the context of the above, curative health care will need to focus more specifically on work-related health issues. Various publications have highlighted the fact that work remains a neglected area among general practitioners and medical specialists. At the same time, there are increasing indications that work is beneficial for health and equally that health is advantageous for work. What health benefits could be achieved if general practitioners and medical specialists were to focus more specifically on work-related health issues? What can be done to improve coordination between company health care and curative health care? These gaps in knowledge demand research into the cost-effectiveness of work-related care, the development of concepts to enhance communication and coordination (public information, guidelines and strategies for effective cooperation between company medical officers and general practitioners) and the testing of such concepts by means of experimentation.

The effectiveness of safety technology in different working environments has not yet been proven. Research is required to identify in which sectors, in which specific working conditions and for which workers, the application of safety technology actually results in increased safety or in increased risks.

Finally, there is still insufficient understanding of the health effects of biotechnology and nanotechnology for people in general and for occupational health and safety in particular. In the Netherlands, guidelines are currently being drawn up by the Social and Economic Council to regulate work with nanotechnology (SER 2009). However, the drafting of such guidelines will be of little use until more evidence-based knowledge is available about the health effects of this technology.

Overview of national strategies and policy priorities in the Netherlands

The Dutch national strategies and policy priorities are largely based on the report issued by the government’s Labour Participation Committee (Commissie Arbeidsparticipatie 2008). Since this report took no account of the consequences of the current economic crisis, the Dutch national government has also devised a number of additional strategies and policy priorities. These are included in the overview below.

In terms of occupational safety and health, the national government sets target regulations for the degree to which employees should be protected. The target regulations are laid down in the Working Conditions Act, the Working Conditions Decree and the Working Conditions Regulation. Employees and employers then have to agree on how to achieve these targets on healthy and safe working conditions. Beside the regular administration of current legislation
and regulation the government has selected a number of areas for additional focus in the upcoming period. These areas are incorporated in table 4.

Table 4. Overview of national strategies and policy priorities in the Netherlands.

<table>
<thead>
<tr>
<th>Strategies</th>
<th>Policy priorities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Involve more people in the workforce as soon as possible.</td>
<td>A. Short-term  – Introduce a temporary scheme for part-time unemployment benefits in order to maintain essential employment in companies hardest hit by the economic crisis  – Set up mobility centres to find new employment for redundant employees as soon as possible  – Reintegrate the unemployed and those with occupational disabilities  – Provide incentives for part-time workers to increase their working hours  – Promote continued employment until pensionable age  – Improve the links between (vocational) education and the labour market  – Improve employability through the introduction of e-portfolios and talents scans  B. Long term  – Introduce an employment budget for training designed to improve employability  – Transform unemployment insurance into work insurance (from income support in the event of unemployment to incentives designed to encourage participation in the workforce)  – Place the responsibility for reintegration of the unemployed and those with occupational disability in the hands of the municipalities  C. Sustainable labour participation  – Gradually increase the pensionable age from 65 to 67  – Introduce taxation on pensions  – Shift taxation on employment to taxation on expenditure (homes).</td>
</tr>
<tr>
<td>Target: increase labour participation from 70% to 80% of the working population</td>
<td></td>
</tr>
<tr>
<td>Promote occupational safety and health</td>
<td>A. Physical pressures  – Prevent damage to hearing by means of additional inspections by the employment inspectorate at nightclubs etc.  – Prevent construction site accidents by means of additional inspections by the employment inspectorate of the construction site and use of scaffolding  – Promote the use of machinery in street paving work in preference to manual labour  – Extend legislation on emergency response first aid to cover the self-employed  – Introduce measures to prevent the spread of influenza A H1N1 (Mexican flu)  B. Psychological pressures  – Introduce subsidies for initiatives to prevent aggression and violence  – Combat discrimination at work: employers to be compelled to introduce anti-discrimination policy as part of their working conditions.</td>
</tr>
</tbody>
</table>
Literature

The majority of a population of workers as well as a population of public is subject to simultaneous exposure to electromagnetic fields (EMF) from broadcasting and power distribution installations, as well as various electrical and wireless appliances. Relatively new environmental factors are multi years exposure to low-level of radiofrequency EMF from wireless communication results from new and emerging technologies. For such exposure to EMF, including a radiation from mobile phone systems, the results of investigations are still inconclusive. The possibility of elevated hazards of cancer were published. On the contrary, in industrial and health care centres various new applications are related to significantly growing up exposures to static and low frequency magnetic fields (e.g. high field MRI scanners, welding devices, electrolytic installations). For low frequency exposure to magnetic fields possible link with carcinogenic process and neurodegenerative diseases were found. The results of research related to EMF health hazards remains uncertain.

Special attention is needed for particular groups, like electronic active implants users or persons supported by electronic monitoring of life parameters. Population of such persons is increasing in aging society.

Public concern linked with EMF in environment is therefore rapidly growing up.

Examples of significant challenges for future management of electromagnetic component of everyday environment are:
- evaluation of health hazards related to new EMF components of environment – both multi years exposure and high level exposure
- harmonisation on preventive policy on EMF in work and public environment
- management of public concern related to growing up use of wireless systems in work environment open to public access
- harmonisation of electromagnetic compatibility (EMC) requirements with parameters of EMF environment accessible for electronic implants users
- efficient allocation of budget dedicated to solving of OSH practical problems for solving appropriately identified EMF related issues.
Horizon Scanning and Futures in the Health and Safety Executive – Selected Topics

By Dr. Peter Ellwood, Health and Safety Laboratory, United Kingdom

Introduction

This paper gives a brief introduction to horizon scanning and futures activities in the Health and Safety Executive (HSE) together with a few examples of some of the findings. These are not necessarily the top priorities for HSE, but they are interesting examples of change likely to affect the workplace.

Background

In 2005 HSE introduced a formal horizon scanning system, whose aim was to identify and analyse trends and emerging issues with the potential to impact on the health and safety system or with implications for the way HSE operated.

The formal system was intended to improve on previous horizon scanning practice which tended to be localised within operating units and uncoordinated. The new system was centred on a dedicated team at the Health and Safety Laboratory, whose role was to gather intelligence from a range of sources in order to inform HSE’s strategic planning. Its remit extended beyond the identification of purely technological developments to include also social, economic, environmental and political issues.

Initially the HSL team focused its efforts on the collection of information. Subsequently more attention was given to how the information gathered could be communicated and used to feed into planning. The team extended its activities beyond horizon scanning into other Futures techniques. In 2006 a scenario planning project was undertaken, which resulted in the publication of a set of four scenarios for the future of health in safety in 2017, which can be used in workshops and other planning activities. As the team has become better known in HSE its work includes commissions from colleagues on specific topics, in addition to ‘general’ scanning.

The findings of the Futures team are overseen by the Futures Group, a committee of senior specialists in HSE, which considers the implications of the information gathered and how it can be used by HSE.

Findings of Horizon Scanning

Annex 1 contains a list of subject areas and individual topics currently of interest to the HSL team. Some examples are given below in STEEP categories (Social, Technological, Economic, Environmental, Political). Selected topics have been described in our series of Short Form Reports, available on the HSE website.
Social
Demographics – population, ageing, gender, migration and ethnicity, working patterns, lifestyles, obesity.

Technological
Biotechnology, ICT, nanotechnology, robotics, emerging energy technologies, novel materials.

Economic
Globalisation, sectoral shift – from manufacturing to knowledge and services, changing occupations, SMEs, sectors – eg waste and recycling, skill shortages.

Environmental
Climate change, effect of environmental legislation on health and safety.

Political
Public attitudes to risk, rise of digital government, regionalisation, political disengagement.

Selected Topics

Human Performance Enhancement
Human performance enhancement includes the use of drugs to enhance performance, the use of implants and bionic limbs, replacement body parts, gene therapy etc. Many of these techniques have their origin in therapeutic applications, but increasingly they may be used by well and able-bodied individuals to enhance their performance and extend life. For example:

Drugs
Provagil (modafinil), a brain enhancing drug that keeps people alert for up to 48 hours is increasingly being used as a lifestyle drug and in the workplace;
Ritalin, designed for use by sufferers of attention deficit hyperactivity disorder (ADHD) is being used by well people to improve their concentration;
Ampakines can be used to enhance memory.

As these drugs and their use become more widely accepted, there may be risks attached to their use in the workplace. If some workers use these then others may feel it necessary to do the same in order to compete. Will employers one day expect workers to use these drugs?

Implants, bionic limbs
Advances in the design of bionic limbs and brain implants are making it possible for patients to control devices by thought. Headgear that enables computer games players to play by thought are near to market. In a specific example, a robot exoskeleton that detects faint muscle signals in the wearer and amplifies them has been produced to help older workers and to help younger workers increase their strength, for example in the care sector. The potential risks of allowing someone to lift up to ten times their normal capability need to be considered, as do the consequences of any malfunctions of such devices.

There is a school of thought, transhumanism, which looks forward to the day when nanotechnology, biotechnology, information technology and cognitive sciences (NBIC), the so-called ‘emergent technologies’ or NBIC will lead to a merging of man and machine – a time when we will all be ‘enhanced’.
Pervasive computing

Pervasive computing (also known as ubiquitous computing or ambient intelligence) describes the concept of embedding or integrating computers into the environment with a view to enabling people to interact with them in a more ‘natural’ way. As computers continue to get smaller, cheaper and faster, they are appearing almost everywhere. For example, they are incorporated into buildings, into furniture and clothing. We can change the colour of a wall at the touch of button, Microsoft’s ‘Surface’ offers multi-access touch-screen capabilities in a coffee table format and sports clothing can monitor your vital signs as you exercise. Wireless networking technology is a key enabler.

One particular area – the rapid growth in the use of radio frequency identification (RFID) tags to monitor the movement and status of a wide variety of devices, people and animals offers benefits such as improved productivity and improved resource utilisation.

There are many potential safety benefits from improving computer capabilities. RFID technology offers a range of potential benefits in e.g. access control, process safety, medical, collision prevention and personal protection applications (e.g. safety boots containing RFID tags that can be detected by moving equipment). However, RFID systems provide an additional source of exposure to electromagnetic radiation for both operators and the public, with the associated health & safety concerns, which this raises. Other possible occupational health & safety issues include:

- Hazards resulting from accidental or malicious corruption of data, where the tags are being used in safety-critical situations.
- The potential for interference between the RFID systems and items such as hearing aids and medical implants.
- Concerns, which have been raised already by the Trade Unions over the apparent “dehumanisation” of workers, where RFID tags are used to track and monitor performance. Should workers be or feel compelled to wear such tags, then it may be that this could lead to additional stress in the workplace.
- Increased risk of MSDs, which may result from extensive use of handheld or wearable RFID readers.
- The potential for over-reliance on automated safety systems based on RFID tags, which could result in accidents if the systems were to fail for any reason.

Emerging Energy Technologies

Driven by the need to act against climate change and to ensure energy security, major changes are occurring in the ways we obtain our energy. HSE has embarked on an Emerging Energy Technologies (EET) programme so that it can take steps to prepare for future health and safety challenges associated with these changes. A large number of energy scenarios produced by a range of organisations indicate that there will still be a great reliance on fossils fuels for some years. In the longer term, renewables and distributed generation will have to play an increasing role. The five non-nuclear (nuclear energy is being managed by HSE separately) – work streams that the UK Government through its responsible department, DECC (Department for Energy and Climate Change), has signalled its intention to pursue and are therefore those that make up the EET Programme are:

Carbon Capture and Storage: removing carbon from the power generation process in the form of CO2 and transporting it in its dense (liquid) phase to be stored permanently in deep geological strata.
Natural Gas Storage: replacing locally occurring reserves with imported gas stored in natural strata or prepared underground voids. Also the importation, storage and regasification of liquefied natural gas (LNG).

Renewable Energy: the range of renewable energy sources including; biofuels, wave and tidal, and wind generation (on and offshore).

Distributed Generation: increasing power generation at or close to the end user, including the development and proliferation of hydrogen cells.

Cleaner Coal Technology: the refinement and development of mature cleaner coal combustion techniques and energy abstraction from new coal seams without mining.

HSE made a significant contribution in the form of its Expert Report into health and safety issues to complement the government’s 2006 Energy Review and HSE has already published a range of HSL’s horizon scanning reports on emerging energy issues. HSE will be continuing to work to identify the health and safety issues and the measure and resources necessary to tackle these.

Demographics

Demographics is key to future health and safety issues. The numbers of people at work, the composition of the workforce, the types of work they do and the organisations they work for, all have a bearing on health and safety.

HSL produced a demographics report that draws together information on trends and forecast in areas such as: overall population, the ageing workforce, composition of the workforce by gender, workforce by sector, workforce by occupation, migrant workers, ethnicity, working patterns. This report will be updated periodically to provide a useful resource for HSE.

Robotics

Although there have been tremendous advances in recent years in the physical capabilities of robots, the truly humanoid autonomous robot is still a long way off. Artificial intelligence is the difficult part, and experts differ on whether and how quickly a thinking robot will be possible. Nevertheless, there is increasing use of robots both in the workplace and in the care sector. Robots have high dexterity, and although they may not think like humans, they can take very complex decisions. The US military is working on a robot that will take its own decisions on whether to shoot! In the workplace, robots are no longer behind safety cages and they are increasingly working in close proximity to humans, with sensors being used to prevent collisions. A warehouse can be staffed by robots which fetch and carry items for dispatch, overseen by very few humans. In the care sector, robots are being used to assist patients and the elderly and can even be used in surgery.

The health and safety implications of the use of robots in these ways surround possible malfunctions of the robots and the need for safe design. For example, the Japanese government has commissioned long-term research to establish safety standards for home and workplace robots. Is it time to update Asimov’s laws?
Scenarios for the Future of Health and Safety in 2017

Horizon scanning can provide information on likely developments in particular topics, but in order to build an overall picture of what the future might be like, a ‘sense-making’ framework can be helpful. Scenario building is an established tool used by many organisations to assist strategic planning. Scenarios are not predictions of the futures, but short descriptions of alternative possible futures; they are useful in taking a wider view of the variety of topics that horizon scanning can produce. Scenarios can be used to stimulate discussions about the future or to test out policy options via ‘wind-tunnelling’ — examining the viability of decisions in the various scenarios. HSE’s ‘Scenarios for the future of health and safety in 2017’ were produced to bring together the findings of horizon scanning in the form of four possible futures. Further details are available on the HSE website.\(^\text{XV}\)

\(^{II}\) http://www.hse.gov.uk/horizons/index.htm
\(^{III}\) http://www.hse.gov.uk/horizons/sreports.htm
\(^{IV}\) http://www.hse.gov.uk/horizons/humanenhancement.htm
\(^{V}\) http://www.hse.gov.uk/horizons/computing.htm
\(^{VI}\) http://www.hse.gov.uk/eet/index.htm
\(^{VII}\) http://www.hse.gov.uk/horizons/carboncapture.htm
\(^{VIII}\) http://www.hse.gov.uk/horizons/biomass.pdf
\(^{IX}\) http://www.hse.gov.uk/horizons/sr021.pdf
\(^{X}\) http://www.hse.gov.uk/horizons/wind-energy.pdf
\(^{XI}\) http://www.hse.gov.uk/consult/condocs/energyreview.htm
\(^{XII}\) http://www.decc.gov.uk/en/content/cms/publications/energy_rev_06/energy_rev_06.aspx
\(^{XIII}\) http://www.hse.gov.uk/horizons/demographics.htm
\(^{XIV}\) http://www.hse.gov.uk/horizons/demographics.htm
\(^{XV}\) http://www.hse.gov.uk/horizons/scenarios/index.htm
Annex 1

SOCIAL

Demographics
- Population
- Increase in SMEs
- Migrant Workers
  - Sudden increase as a result of destabilisation elsewhere?
- Back to Work initiatives
  - More people with disabilities in workplace – eg autism example
- Older Workers
  - Increasing life expectancy
  - Decreasing support ratio
  - Growth in chronic diseases
  - Technology to empower greying generation
    - More Women at work
    - Women break the glass ceiling – more women in senior positions
    - Increasing care burden on women (ageing population)
- Working Patterns
  - Increase in home working and telecommuting
  - Rise of teleworking support centres
  - Precarious working – more job changes, less security
    - Design-a-job
    - Growth of part-time, low-paid jobs (see also hour glass economy)
    - People to be psychologically and emotionally more mobile
  - 24 hour society makes households less vulnerable to crime
  - 24 hour cities
  - People increasingly claim to be time-poor
  - Sleep deprivation
    - Continued long working hours
    - Work/life balance – cf globalisation
- Ethnicity – increasing ethnic diversity

Living Patterns
- Increased number of households
- Decreasing household size
  - Single living doubled over last 30 years – predicted to be most common form by 2010
- Increasing urbanisation (but see below)
  - Rejuvenation of inner cities
  - Expanding commuter countryside
  - Smart cities
- Growing counter-urbanisation (but see opposite above)
  - Growth of information economy in the countryside
  - Rural revival?
- Increase in single parent families
  - Shortening of childhood (but see education)
- Growth in gender distinct lifestyles
- Growth of ‘senior enclaves’ offering secure housing
  - Over 50s acting younger
- Increasing drug use among youth
- Increase in home technology leads to more burglary
- Booze Britain
- Growth in virtual communities defined by interest rather than geography

Increasing Obesity
Education

- People starting work later as more go to higher/further education
- Increase in lifelong learning
- Online education creates a glut of academics
- Continuing regional inequities in education
- Increase in home-schooling?

Health

- Growth in infectious diseases
- Pandemics
- People increasingly manage their own health via internet, e-pharmacies etc
- Increasing childhood health issues
- Growth in mental health problems – particularly poor and young adults
- Increasing incidence of asthma, as yet unexplained

Growth in ethical consumerism

Growth in individualism – no such thing as society

Computer simulations the dominant means of predicting human behaviour

TECHNICAL

ICT

Pervasive Computing

- Extension of Moore’s Law – ever faster computing
  - Electronics and photonics merge
  - Room temperature ferromagnets
  - DNA Computers?
- Cyber security
  - Increase in e-crime
  - Increasing potential for technology misuse
- Surveillance
  - Growing pressure on police to enhance intelligence gathering via ICT
  - Loss of civil liberties

Tagging

- Hospitals
- Workplace

Virtual Reality

- Virtual worlds as a business tool
- Increasing use of VR as an educational and training medium
- Growth of 3-D media

Computerised Warehousing

Hyperconnectivity

- Future of Social Networking
- Internet of Things

Electronic paper

Digital pens

Wearable Technology

- Embedded technology – smart paint, virtual windows etc
- Computers self-programming
- Novel interfaces – thought, voice, touch-screen etc
- Soft computing – development of AI
- Developments in mobile telephony
- Increasing demand for IT skills
- Increasingly smart ID and credit cards etc
- Evolution of quantum computing
- Growth of wireless computing
- Increasing ability to manage knowledge
Move towards paperless office
Rise of virtual businesses and cooperatives
Information overload

Cashless economy
Solar Flares cause meltdown?
Human Performance Enhancement
   Drugs
   Chips
   Bionics
      Increasing applications on bio-microprocessor interface
      Artificial organs
   Exoskeletons
   Transhumanism

Biotechnology
   Gene Therapy
      Advances in DNA microarray technology
   Genomics in Healthcare
      Customisation of drugs
   Stem Cells
   Synthetic Biology
   Genetic Testing
   Genetic Engineering of Plants and Animals
   Bioprocessing (see also Manuf)
   Growth of Bioinformatics

Nanotechnology
   Better drug delivery
   Rapid Manufacturing
   Molecular Manufacturing

Energy
   Rising global energy demand
   Potential Energy Shortages
   Advent of low carbon economy
   Hydrogen
   Wave
   Wind
   Solar
   Methane Gas Hydrates
   Biomass
   Nuclear
   Compressed Air Energy Storage
   Clean coal technologies
      Carbon dioxide capture
      Gasification
   Dash to gas – gas to be major source by 2020
      Gas storage
      LNG
   Microgeneration
Robotics/AI
In Manufacturing
In Agriculture
In Care
Increasing availability of domestic robots
Increasing telemedicine and robotic/AI medicine
Increasingly lifelike robots
Legal aspects
New and Emerging Pests
Terahertz Technology
The Singularity
New Manufacturing Techniques
Rapid Manufacturing
New Materials
  Material with variable RI in magnetic fields
  Self organising adaptive integrated circuits
  Polymer gels for muscles
  Atomic customisation of materials
  Intelligent Materials with Sensors
  Membranes with active transport and receptors
  Smart skin for intelligent clothing and direct human repair
  Smart materials
  Conductive polymers – the new silicon?
  Programmable materials
  New quantum materials
  Metal-organic frameworks
  Intelligent polymers – electroactive polymers and shape-memory polymers
  Smart materials that react to the environment
Biomimesis
Bioprocessing
Biotechnology in production processes
Green chemistry
Other Technology
Lab on a chip
Improved sensors
Synthetic chemical cells

ECONOMIC
Globalisation
Increasingly cross-cultural world
Inward investment
  HSE action against foreign owners?
Migration of higher tech jobs
IT Brain gain as BRIC countries lose experts to the west
Increasing numbers of global institutions such as WTO, IMF
Offshoring

De-globalisation
US isolationism?
Britain to leave EU?
High Tech manuf sees jobs come back to the West (Ca example)
Decreasing Union Membership
Corporate Social Responsibility
Corporate culture shift towards open communication and high trust leads to more open organisations

Decline in Manufacturing
- Automotive manuf moving abroad
- Decentralised manufacture – rapid manuf, open source hydrogen car etc
- More SMART style factories – centralisation of production

Growth in Service Sector
Growth of Green Jobs
New supply chain relationships

Increase in SMEs
Growth of Hourglass economy

Sectors
Agriculture
- Effect of Climate Change on crops etc
- Diversification on farming land
- Different visions for the countryside
- Unskilled migrant labour from EU
- Increased use of ICT in agriculture
- Growth in ‘precision farming’—sensors, biosystems analysis, genomic analyses
- Robots in agriculture

Increase in Waste and Recycling
- Increasing computer hardware in the wastestream
- Increasing pressure on landfills

Transport and distribution
- Growth in transport demand?
- Growth in Rail Demand
- Intelligent road vehicle systems – smart cars etc
- Automated ships
- Growth of economically benign transport – light railways, monorails and electric buses
- Growth of UK civil aviation
- Increased traffic and car ownership
- Increase in marine shipping
- Increase in e-business changes delivery methods

Growth in Tourism (climate change)
Growth of Knowledge Economy
- Increase in self-employed knowledge sector workers

Health
- Increased need for healthcare for the disabled

Construction
- Continued growth in housing demand

Growth of Industry Clusters
Science Parks
Increasing Economic Growth of the Countryside

Occupations
- Employment shifting up – more managerial, professional and associate professional jobs

Skills Shortages
- Declining numbers of students taking sciences
- Increased knowledge component of jobs – need scientific literacy, life skills, service skills, interculture literacy etc
Mass unemployment as a result of globalisation and resource scarcity?
  Collapse of western civilisation?
People lose interest in material aspects – economy declines
Emergence of New Jobs, as yet unidentified
Outsourcing

ENVIRONMENTAL
Climate Change
  Runaway warming?
  Decline of Gulf Stream?
  Geoengineering
    Carbon capture (ambient)
  Others
Ozone Layer
Effects on Agriculture
  Low Carbon Economy – Energy Sources
  Heat Islands
  New pests and diseases
  Increased exotic species in UK as a result of globalisation
  Ice caps melt
  Population control as a solution?
Effect of environmental legislation on H&S
Increased tendency to lease rather than buy white goods
Water shortages – water wars
Major US west coast earthquake?
Asteroid impact
GMOs proliferate in nature?

POLITICAL
Public Attitudes
  Increasing emphasis on quality of life, self expression and individuality
  Increased value shift towards the ‘risk society’, ie risk aversion
  Increasing emphasis on human rights
Growth of ICT as a political issue – inequality – the digital divide
Deepening inequality gap
Increase in local power and interest groups – regional government more important
Expanding EU
Generation X
Generation Y
Older Workers
  Older people’s tendency to vote may shift power balance.
Generation No-X – increasing political disengagement
Decreasing deference to authority
Criminalisation of minor transgressions
  Loss of civil liberties
Elf and Safety
- Reputation – eg United Airlines on Youtube

Litigious Society
Rise of the CNN effect – ability of media to shape public opinion
Power shift away from governments – increasing political power of NGOs, pressure groups
Growing demand for more convenience and flexibility in government services
  - Increasing demand for tailored governance, ie more personalised service
  - Rise of digital government

Reduction in regulation
Greening of government – increasing attention to environment on policy making
Case by case policy to cope with niche entrepreneurs
Eco terrorism?
Increasing political clout of celebrities
Increasing power of transnational corporations
Terrorism
On 24-25 September 2009, the Partnership for European Research in Occupational Safety and Health (PEROSH) carried out an international expert seminar on future challenges for the working environment.

The seminar was commissioned by the Danish Working Environment Authority as part of its consultation process leading up to a new Danish Working Environment Strategy for 2010-2020.

14 senior experts from the PEROSH member institutes as well as from the European Agency for Safety and Health at Work (Bilbao), the European Foundation for the Improvement of Living and Working Conditions (Dublin), and from the Institut de recherche Robert-Sauvé en santé et en sécurité du travail (IRSST - Québec) contributed with papers and presentations.

This report contains the written contributions of the participants as well as an executive summary whereas the full material (papers, presentations and videos of the presentations) can be accessed via the PEROSH website www.perosh.eu.