Contribution of ergonomics to occupational, safety and health.

2nd Canary Island Conference on Prevention of Occupational Risks

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- Prevent Academy (link with different universities)
Contribution of Ergonomics to OSH

1. What is ergonomics?

2. Ergonomics related to:
   2.1. MSD
   2.2. Fatigue
   2.3. Accidents
   2.4. Company Performance

3. New challenges for ergonomics in the changing world of work

4. Conclusions
1. What is Ergonomics?

- Ergonomics comes from the Greek words:
  - “Ergon” = work
  - “Nomos” = law, science

- “Science of work”
Ergonomics is about the fit between people and their job.

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Ergonomics (human factors)

- relation between human beings, their work and their work-life environment
- better design of work systems, taken into account the human physical and psychological abilities, limitations and needs
- better design in order to optimize human well-being and overall system performance.
Ergonomics – different domains

1) Physical ergonomics:
   human anatomical, anthropometric, physiological and biomechanical characteristics

2) Cognitive ergonomics:
   mental processes, such as perception, memory, reasoning, and motor response

3) Organizational ergonomics:
   optimization of socio-technical systems, including their: organizational structures, policies, processes.
Ergonomics in an historical perspective

- First tools: witness of ‘ergonomic design’ to survive, to reduce fatigue and pain, … human creativity
Ergonomics in an historical perspective

- 15° Century: L. Da Vinci: abilities and limitations of people as the basis of good design...
Ergonomics in an historical perspective

- World War II ... Royal Air Force (UK): Importance of ‘good’ design to avoid “human errors” of pilots.....

- 1949 Ergonomics Research Society
Ergonomics approach

Better design of jobs, work places, equipment, tools, organisation,…

- **global** and **holistic** approach: consider the whole system
- **multidisciplinary** team
- **participation** of everybody involved in the work system

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2.1. Ergonomics related to MSD

Main work related problems in Western countries:
- Musculoskeletal system (MSD) > 30%
- Mental health stress > 30%
Self-reported work related problems.

- **European Survey on Working Conditions (ESWC, by European Foundation for the Improvement of Living and Working Conditions)**

- **“Does your work affect your health in terms of ...?”**

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<thead>
<tr>
<th>Symptom</th>
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<td>Other</td>
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Self-reported work related problems.

4th ESWC (2005):
- backache (±25%)
- muscular pain (± 23%)
- fatigue (±22%)

are the most often reported symptoms by workers within the EU (31 MS)
- ~ 60 million workers

![](image1.png)

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Causes? Risk factors?

- Multifactorial problem: mixture of personal (genetic and behavioural) and work related factors
- Work-related risk factors:
  - Physical (biomechanical) risk factors:
    - Manual handling of loads
    - Forced/prolonged/awkward body positions (posture)
    - Tasks involving increased effort or force
    - Repetitive work
    - Exposure to vibrations
  - Psychosocial risk factors:
    - Psychological: time pressure, job insecurity, poor promotion prospects,…
    - Social: isolation, lack of social support from co-workers or supervisors, etc.
Ergonomic risk factors

- Repetition
- Force
- Duration
- Posture
- MSD

Psychosocial factors

Environment: vibrations, climate, lighting, noise
Trends

- Self-reported WRMSDs: ESWC 2000 ⇒ 2005
  - Increase in Estonia, Greece, Ireland, Latvia, Lithuania, Poland, Slovenia
  - Status quo in Hungary
  - Decrease in other Member States

- Recognised WRMSDs: EODS 2000 ⇒ 2005
  - Increase of musculoskeletal diseases and neurological diseases (carpal tunnel syndrome)
  - Differences between Member States
Why do something about it?
Human aspect

- Reducing health problem
- Increasing comfort and job satisfaction
- Increasing quality of life
Economic aspects

Direct costs:
- Insurance
- Compensation
- Medical costs
- Administrative costs

Indirect costs:
- Hiring and training of new employees
- Negative social climat
- Losing the best people
- Reduced productivity levels
- Effects on quality of work
- Legal fines / claims

(ANACT, 2005)
Cost

- Cost due to WRULDs $\sim 0.5-2\%$ of GNP (European Agency for Safety and Health at Work, 1999)
- Netherlands (Min SZW, 2005): total yearly cost due to RSI $\sim 2.1$ billion euros
  - Sickness absence $\sim 962$ million euros
  - Productivity loss $\sim 808$ million euros
- Germany (BAuA): productivity loss due to WRMSD $\sim 0.4-0.6\%$ of GNP in 2002-2004
Legal aspect

- Obligation to assess occupational health risks and to avoid or reduce them
- Manual Handling Directive
- Visual Display Unit Directive

Legal penalty / fine / claim…

(in some of EU MS a company can be closed based on ergonomic RA…)

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Ergonomic prevention principles

- Avoid manual handling
- Automation and mechanisation
Ergonomic prevention principles

- Anthropometric design & lay out of the work place
Ergonomic prevention principles

- Work organisation: job rotation
  - job enlargement
  - job enrichment
  - shift / breaks / recuperation time
  - team work (+on the job training)
2.2. Ergonomics related to fatigue

- Fatigue
- General Fatigue
- Cardiovascular Load
- Static load
- Mental Fatigue
- Local Muscular Fatigue
- Energy Consumption
2.2. Ergonomics related to fatigue

Ergonomics:
- Heart Rate Measurements,
- EMG,
- Subjective Rating & Questionnaires to study the work load and the fatigue

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2.2. Ergonomics related to the prevention of fatigue

- Fatigue
  - More human errors that can lead to accidents...
  - Negative impact on performance and quality
  - Complaints, health problems, less quality of life

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2.3. Ergonomic related to accidents

- **Accidents** related to poor and inadequate relationship between operators and their task, machine, equipment, work organisation,……
2.3. Ergonomic related to the prevention of accidents

**Abilities and limitations of the human computer:**

- information detection / perception / selection
- interpretation / decision making / use of human memory
- action
Taxonomy of Human Error

Unsafe Acts

- Unintended Action
  - Slip
    - Attentional Failures
  - Lapse
    - Memory Failures
  - Mistake
    - Rule-Based Knowledge Based Mistakes
  - Violation
    - Routine Violations
      - Exceptional Violations
      - Sabotage

Intended Action

(Reason, 1999)

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“human errors” – possible impact

- Accidents with severe injuries, fatalities or serious material damage
- Environmental catastrophes
- Business impact by losing people and material / installation (continuity)
- Loss of image and local reputation

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Ergonomic design: reduction of “human errors”

Ergonomics: avoid or reduce probability of human errors:
- design human-machine interface (displays – controls)
- adapted work environment
- ergonomic lay out & presentation of information
- correct communication
- adapted work organisation
- training & support
2.4. Ergonomics can contribute to general company performance.

- Reduce discomfort and increase work satisfaction, motivation, productivity and quality of work
- Reduce absenteeism
- Reduce human errors with less accidents and mistakes in production or quality as a consequence
- Better cooperation between employer and workers (participative ergonomics)
3. New challenges for ergonomics in the changing world of work

- **Work organisation** changes …due to competition/market, increase productivity by doing more with less people, change in working hours/workload

- **Who is doing the job?** Subcontracting, temporary work, self employment and outsourcing increases
Challenges

- **Restructuring** is daily business (economic crisis)

- **Globalisation**
Challenges

- Changing workforce:
  - ageing: capacity?

- immigration: new cultures, other languages
Challenges

- **New technologies** occur everywhere in the production process and in the way we communicate
More technology

Technology may fail... human errors can occur
Office environment

- More complex tasks / dead lines
- New software
- Long working hours
- Lack of space
We don’t move anymore…
Communication changes...

- mobile telephone (call, messages)
- e-mail
- Tele / video conferences

Always and everywhere…

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Take breaks and stretch!
Conclusions

- Ergonomics contributes to **health and safety**
- Ergonomics contributes to **company performance**

**Challenges** are:
- new work **organisation**
  - globalisation, restructuring
  - changing **work force**
  - new **technology**
  - **office** environment / lack of movement
  - new way of **communication** in a virtual world
Conclusions

- Work Life Balance: a matter of culture (ethics)

- Need for **Simple Legislation covering all risk factors** (not only manual handling, VDU work stations, Vibrations)… Also repetitive movements, static and awkward postures…

- Implementation of **ergonomics in Small & Medium Enterprises** is still a challenge
Conclusions

- Need for **reliable statistics** (harmonisation of recording and monitoring?)
- **Accident approach**, not focused on ‘the one who pulled the trigger’ (human error) but on the errors in the design of the system
- Train and provide tools for **Labour Inspectorates** to stimulate enterprises to improve their ergonomic status
Conclusions

- Extension of **ergonomics and safety culture in education, in family and at work**: experience has shown that, achieving significant improvements in workplace safety and health, is not only a matter of technology but of more of **culture**.

- Instead of ‘prevention of MSD’ we have to go to the next ergonomic maturity step, which can be ‘promoting of **Musculo Skeletal Health**’: related to work health promotion.

- **lack of movement = emerging risk!!!**

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Conclusion

Ergonomics is investing in your company and investing in your human capital!