Work Life 2000 Yearbook 2

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Work Life 2000 Yearbook 2 2000

The second of a series of Yearbooks in the Work Life 2000 programme, preparing for the Work Life 2000 Conference in Malmö 22–25 January 2001, as part of the Swedish Presidency of the European Union

Organised by:
Swedish National Institute for Working Life
Swedish National Board of Occupational Safety and Health
Swedish National Labour Market Board
Swedish Joint Industrial Safety Council

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Springer

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ISBN 1-85233-290-5 Springer-Verlag London Berlin Heidelberg

British Library Cataloguing in Publication Data
Worklife 2000 yearbook
2: 2000
1. Labor – Congresses 2. Labor – Social aspects – Congresses 3. Employees – Effects of technological innovations on – Congresses 4. Labor laws and legislation – Congresses 5. Labor policy – Congresses
I. Ennals, Richard
331
ISBN 1852332905

Library of Congress Cataloging-in-Publication Data
A catalog record for this book is available from the Library of Congress

Printed in Great Britain

Typesetting: Gray Publishing, Tunbridge Wells, England
Printed and bound by Athenæum Press Ltd, Gateshead, Tyne and Wear, England
34/3830-543210 Printed on acid-free paper SPIN 10761496

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Preface

The world of work in the European Union is changing rapidly, with great implications for individuals. Labour market issues are of crucial importance, as demands for flexibility, adaptability and education are growing while unemployment remains high in many countries and the number of short-term jobs is rising. Stress and insecurity are increasingly common problems. At the same time, many traditional work environment problems, such as noise and chemical hazards remain, or are getting even worse. There are signs, for example, that repetitive work is becoming more widespread, and that musculoskeletal disorders are common.

A series of some 70 international scientific workshops will provide the basis for the Work Life Conference, scheduled for January 2001 when Sweden assumes the presidency of the European Union. After each workshop, a scientific summary is produced, as well as a popular/journalistic summary. In your hand now you have another product: the second of a series of three Work Life 2000 yearbooks, a detailed account of what has been discussed during the different workshops. It gives you the possibility to enter deeply into the material, and with the help of the index and the comments observe the connections between the different themes.

The Work Life Conference will be held in order to bring the problems and possibilities of modern working life to the fore, and to broaden and deepen discussion about them. The conference is aimed at decision-makers – representatives of governments, labour market parties, authorities, business organisations, and others – and it will be based on the results of the scientific workshops. Work Life 2000, as the project is called, is organised by the National Institute for Working Life, the National Board of Occupational Safety and Health, the National Labour Market Board and the Joint Industrial Safety Council.

Work Life 2000 is thus well under way. Not only is new knowledge developed, but dialogues across nations are going on, new networks are being built – and this is something that will continue long after the conference in January 2001 is closed.

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January 2000

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Work Life 2000 Yearbook 2: 2000 arises from the central phase of the Work Life 2000 Programme, and covers workshops held in 1999. As the second of the series of three Work Life Yearbooks, it builds on the foundations of Yearbook 1. A further Yearbook is in preparation, covering workshops held in 2000. Participants at the Work Life 2000 Conference in Malmö in January 2001 will receive the set of three Yearbooks.

The Context for Work Life 2000

Changes in science, technology and the global economy are transforming the nature of working life. The Swedish National Institute for Working Life is undertaking a major international programme of research and workshops, in association with the National Board of Occupational Safety and Health, the Joint Industrial Safety Council and the National Labour Market Board.

The Work Life 2000 Conference in Malmö will be a major European event at the start of the Swedish Presidency of the European Union. The Conference is part of an ongoing process of European social dialogue, supported by the Swedish Government and Social Partners. This includes a series of over 70 international preparatory Workshops, which started with the first Work Life 2000 Workshop in London in December 1997. Issues involving Working Life and Work Environment have been identified as a major theme for 2001, and as an ongoing agenda focus for the newly expanded European Union.

The Conference is not an isolated event, an objective in itself, but a public reflection of the Work Life 2000 process, and of developing European policy.

The design of the Conference is consistent with that of workshops and the three Yearbooks, published by Springer-Verlag, which arise from the Work Life 2000 workshops. The set of Yearbooks prepares participants for the Conference, and offers a dissemination route for the Workshops, which have resulted in agendas for future work.

The Workshops are organised in seven themes, which run through the three Yearbooks, and which will be presented at the Conference.

1. Labour Market
2. Work Organisation
3. Work Environment
4. Gender
5. Multicultural Society
6. Small and Medium Sized Enterprises
7. Information Society

The Workshops have typically been held at the office of the Swedish Trade Unions in Brussels, involving 15–24 invited participants over two or three days. Others have been held at venues around Europe, in London, Copenhagen, Amsterdam, Paris, Stockholm, Bilbao and Dublin. The approach has been based on dialogue, rather than on formal presentations. Participants have come from all European Member States, from researchers, governments and the Social Partners, as well as

from European Union institutions, with some invited non-European experts. There have been popular journalistic reports of each Workshop, and scientific reports from the Workshop organisers. The reports which follow are condensed from workshop reports which were approved by the participants.

The Malmö Conference is for about 650 invited decision makers in the European Member States, drawn from EU Member State governments, relevant public agencies, labour market parties, business organisations and other interested parties. It is intended to reflect the atmosphere of the Workshops, while requiring less specialist technical expertise. The proceedings and conclusions of the Workshops will be made available through the Yearbooks, provided to those who attend the Malmö Conference in January 2001. Workshop leaders will be invited to lead Conference Knowledge Update sessions, where participants will have chosen to attend, and will have had access to the Yearbook reports. These sessions, together with Round Table discussions on each theme, will be concerned to set agendas for action during the period of the Swedish Presidency and beyond.

Thus the Yearbooks are seen as a means of communication between the expert groups who have attended the Workshops, and with the decision-makers attending the Conference. The set of Yearbooks are also published on CD-ROM. In each volume the indexes will facilitate cross-referencing.

Work Life 2000 Workshops

The workshop series commenced in 1997, laying the foundations for the Malmö Conference in 2001, and developed its own distinctive patterns. The workshops are reported in the three yearbooks as follows:

1. Labour Market

Yearbook 1

1. Transnational Trade Union Rights in the European Union
2. Rights at Work in a Global Economy

Yearbook 2

1. The Employment Impact of Innovation
2. Innovations, Improvements, or just Change?

Yearbook 3

1. Labour Market Institutions and Employment
2. The Role of Local Government in Industrial Development and Job Creation
3. EU Enlargement – Working Life
4. Just-in-Time Employment
5. Employment Union: Legal Framework, and Economic and Social Conditions

2. Work Organisation

Yearbook 1

1. Ageing of the Workforce
2. Psychosocial Factors at Work
3. Managing and Accounting for Human Capital
4. Occupational Health and Safety Management Systems and Workplace Change
5. Developing Work and Quality Improvement Strategies

Yearbook 2

1. Managing and Accounting for Intangibles
2. International Transfer of Organisational Innovation
3. Interactions between Human and Machine in Future Technology

Yearbook 3

1. Sustainable Workplaces
2. Structures and Processes and Managerial Challenges
3. Work Life at Schools
4. The 24 hour society: work hours, health and safety
5. Work Health Promotion

3. Work Environment

Yearbook 1

1. Space Design for Production and Work
2. Medical Surveillance and the Framework Directive
3. Environmental Management and Health and Safety
4. Occupational Trauma – Measurement, Intervention and Control

Yearbook 2

1. The Welding Industry in Technological Change
2. The Workers Experience of the Working Environment
3. Isocyanates – Measurement Methodology, Exposure and Effects
4. Prevention of Work-Related Contact Allergy
5. Rehabilitation: Prevention and Treatment
6. Etiology and Prevention of Musculo-Skeletal Disorders
7. Health Effects of Electromagnetic Fields
8. Psychosocial Work Assessment

Yearbook 3

1. The High Prevalence of Airway Allergy – Implications for Work Life
2. Does recycling lead to new problems in the working environment?

3. Future Work – Occupational Health Research and Training of Health Professionals
4. Neuro-muscular mechanisms behind work-related myalgia
5. Government intervention to influence enterprises in improving the environment
6. Normative actions concerning work-related musculo-skeletal disorders
7. Control of Thermal Stress in the Workplace
8. Room Air Flow and Climate Predictions

4. Gender

Yearbook 2

1. Retraining Women in Restrictive Jobs
2. Labour Market and Social Policy – Gender Relations in Transition
3. Household Services, employment and gender equality?

Yearbook 3

1. Women's conditions in work life

5. Multicultural Society

Yearbook 3

1. Workplace Diversity
2. Labour Market Transformation, Skill Requirements and Migrations
3. Multicultural aspects of trade and industry

6. Small and Medium Sized Enterprises

Yearbook 2

1. Jobs in EU Micro Firms
2. Voluntary Guidelines for Management Systems for the Working Environment
3. Job Creation

Yearbook 3

1. Work and Health in Small Enterprises
2. Methods for small companies to improve their own working environment
3. Leadership, Personnel Management and Work Environment in SMEs
4. Chemical Exposure Assessment and Exposure Data Handling in SMEs

7. Information Society

Yearbook 1

1. Research Dissemination

Yearbook 2

1. ICT, Work Organisation and Human Beings
2. New Management, ICT and the "New Working Life"
3. New Media Industry Development: Regions, Networks and Hierarchies
4. The New Media Companies: work, organisation and employee relations
5. Telework – Labour Market, Health and Well-Being

Yearbook 3

1. The Information Society – A Challenge to Health and Safety at Work
2. Balanced IT in a fast changing industrial environment and labour market

General Themes and Conclusions from the Second Year of Work Life 2000

1. Cross-references and Inter-relations of Themes

The pace of the workshop series has accelerated in 1999, as leading Swedish researchers have sought to bring together their international networks of colleagues, often linking the workshops with research meetings or specialist conferences. It is rare that a workshop stays entirely within one subject area. For example, when considering occupational health problems from particular exposures, the circumstances of small and medium sized enterprises (SMEs) need to be considered. Similarly, it is clear that changes in work organisation and the increase in part-time and contingent working have had implications for psychosocial aspects of work, gender balance, and the developing information society.

The rapporteur and editor has had the privilege of attending numerous discussions with leading international researchers, who have the capacity to communicate their views without resorting to obscure terminology or complex numerical data. At the highest levels of scientific expertise, it is possible to concede that one does not know the answers to what seem like basic questions. Science does not offer absolute answers, so it is a question of judgement: what lines of enquiry are worth pursuing, and which related disciplines have something to offer? Some researchers have attended more than one workshop, and can act as network links, connecting separate discourses.

2. The Importance of the Process of Dialogue

Work Life 2000 is a dialogue process, and has achieved a life of its own. It is now proposed to extend the process in 2001 to include those nations applying for membership of the European Union. Already in 1999 participants from Poland, Hungary, Czech Republic, Slovakia, Croatia, Latvia, Lithuania, Romania, Slovenia,

Ukraine and Bulgaria have made active contributions. They are already part of the European dialogue.

3. Workshops as a Means of Strengthening International Networks

Sweden is a recent member of the European Union, and Work Life 2000 has provided an opportunity to link existing networks with this new development organisation. New projects are likely to develop, under the Fifth Framework programme, taking advantage of increased contacts. The Malmö conference may provide an opportunity to launch new international programmes.

4. The Emergence of a European Approach to Productivity and Innovation

Across the set of workshops we can identify common elements. There is acknowledgement of diversity, and of the need to develop new forms of communication between theory and practice. Practice is gaining precedence, as we come to appreciate skill and tacit knowledge. The limits of quantification are apparent, as data in different EU member states is found not to be strictly comparable in areas such as SMEs. Economic relations are culturally situated. It is understood that the way forward is in terms of networking, learning from differences in good practice, and not simply replication of supposed best practice. As has been discussed, there is a preference for a human centred approach to working life, developing a knowledge-based "high road" to productivity and innovation.

5. Action Research as a Critical Resource

In 1999 the transition has been made from words to action. A number of workshops have concluded with agreed position papers, which in some cases have led to international journal articles. One of the strengths of the Scandinavian research tradition, reflected in this Yearbook, is the depth of involvement in practical case study work, engaging in reflective action.

Dialogues on Working Life

What is the Work Life 2000 Dialogue about?

Each workshop dialogue has its own distinct characteristics, but some general trends can be identified in the way in which they run. The chairman is not also the main speaker. In some cases there have been two workshop organisers, taking the chair alternately to enable the other to speak. Speakers have been discouraged from "grandstanding", giving pre-prepared formal presentations. The workshop

environment has favoured discussion rather than lectures. Equal respect has been shown to all participants and contributions, with a view to learning from different experience, and from systems in different European member states. There has been interest in case studies, which cast light on differences. The desired outcome of each workshop has been the identification of a framework for ongoing dialogue in the field.

Approaches to Dialogue

Some of the more technical workshops have had a number of formal expository presentations, which have been helpful for the rapporteur, but the events have come to life in the discussions that follow, as experienced experts explore new ideas. The atmosphere of concentrated intensity has enabled groups, such as in the field of human machine interaction, to arrive at new descriptions of their field. The quality of international presenters and practical examples, as in the field of skin contact allergies, has led to new exchanges of material and proposals for collaboration. The dialogue has been among professional peers, making it easier to concede, as in the case of back pain, that there are serious gaps in current knowledge.

Conclusions

The overwhelming conclusion is of the richness and diversity of experience reported at the 1999 workshops. It provides a foundation for a new generation of innovative projects and developments.

Labour Market

1. Innovations and Employment

The workshop was led by Kurt Lundgren, and held in Stockholm 30–31 January 1999. This account is based on a report by Borje Nenzen.

Introduction

New technology has led to growth, which in Europe does not have the same ability to create new jobs for those whose posts have been rationalised away, as in the United States. Jobs are vanishing in manufacturing, while new jobs are appearing in the service sector. The appearance of new jobs, and the type of jobs, depend on demand, the nature of the technological development in question, the industrial structure, the educational level of the workforce, and the way institutions adapt to technological progress.

New Technology Behind Growth

Growth has depended on innovation, primarily the introduction of new technology. Traditionally this has been associated with increased employment, but no longer. In Europe new manufacturing techniques in the 1990s have led to rationalisation, increased turnover, better products – but fewer jobs. The major changes are due to information and communication technology, making technological unemployment a reality in Europe. This is not the case in the US, where unemployment is half that in Europe. This is partly because the US labour market is deregulated, and vast gulfs between salaries are accepted. At the same time, service sectors have experienced strong growth and provided new jobs, but not to a sufficiently high extent to absorb excess available labour.

Compensatory Mechanisms

More intensive use of technology has led to a global market for labour and products. Production and jobs have moved to other parts of the world, leading to a drop in employment and, in certain cases, falling wages in Europe. A number of compensatory mechanisms have arisen, helping to create new jobs. The profits

from rationalisation create new demand, not necessarily in the same market which had experienced the rationalisation. Manufacturing and secretarial posts vanish through rationalisation, but programmers, network technicians, and computer technicians are hired instead. New technology paves the way for the new products, and a new form of employment.

Structural Factors

Mario Pianta emphasised that structural factors are key reasons behind unemployment in Europe. The 1990s have brought increased international competition, squeezed costs and low demand. Technological changes introduced by companies have focused more on rationalisation than on developing new products and markets. Recent decades have seen foreign investment increase, as have acquisitions, mergers and outsourcing to small businesses, which carry out some of the work formerly done by the company itself. This affects service functions, explaining part of the expansion in the service sector.

The structure of economic and labour market policy at national level is another key factor. It is about having the ability to quickly transfer labour and capital from one sector in which production is declining, to one in which it is expanding. A further structural factor is companies' production organisations, which have become less dependent on labour. Trade unions and employers' organisations are also important in this context, as are public institutions. The view that high salaries and prices and inflexible labour law automatically lead to unemployment is incorrect. Importing the de-regulated American labour market model to Europe would be unsuccessful, as Europe has different economic structures, and the workforce is organised differently.

Lifelong Learning

Kurt Lundgren emphasised the importance of lifelong learning, if technological development is not to lead to high or long-term unemployment. Being used to solving problems at work and to coping with change is fundamental when it comes to being able to switch, from a job, which disappears, to another in a new sector. Another major challenge is offering employees career opportunities, variety and problem-solving activities in a learning organisation.

Measures which aim to equip employees for the changing world of work include surveying the company's opportunities to allow employees to take on new duties throughout the company. This requires that the personnel departments are active. Employees should take part in project and development work, enabling them to work on other tasks and with other people. A salary system which rewards learning and development is desirable. The potential of career development interviews must be exploited. Those who run training interviews must have an overview of the opportunities and resources available in the company, not necessarily the case today. There should be a system for IT-based training, including distance learning. Better systems can be produced to assess the skills of the employees.

Finding the Right Rate of Change

Paulo Pini showed that growth of both production and demand has tailed off in Europe in the last 30 years. It is not technological changes themselves which create unemployment, but the speed of change, which can be too quick or too slow for various companies, sectors and markets to adapt successfully. New investment can enable wages to be raised temporarily to recruit labour, but as automation increases, raises tail off and employees are made redundant, as shown by an example from the chemicals industry in Turkey. The profits the foreign investors gained from fast growth have not been re-invested in other sectors in the country.

Taking the Context into Account

Marco Vivarelli emphasised that technological changes must be studied in context.

Knowledge-intensive high-tech companies in innovative environments seem to create jobs, while this does not occur in traditional areas. With certain technological changes, compensatory mechanisms may appear, aiding further employment. These may be lower wages, costs and prices, competitive advantages, higher income from services or new investment and products. We need analysis of when and where the mechanisms arise.

Service Sector Innovation

Rinaldo Evangelista said that the service sector is an important part of the national economy and uses a great deal of technology. A study of 6000 Italian companies in the service sector with over 20 employees showed that one in three had made innovative changes to products or processes in the years 1993–95. Low-qualified workers in large companies were most affected by the changes.

Kurt Lundgren argued that there is only limited potential, if any, to increase employment in large companies. The conclusion is that the new jobs have to come from small and medium sized businesses.

Conclusions

Development must move from a focus on sales to a focus on need-oriented demand: it is more important to focus on the needs of users than those of the producers. Who, for example, are the best administrators of development resources when it comes to providing distance learning for continuing education? Technology companies, or organisations such as the Society of Engineers, which represent the users? Productivity gains need to be re-invested in new production, higher wages or shorter working hours. Society must ensure that everyone wins from technological progress, to avoid a two-thirds society. Developing staff resources and expertise can turn the slogan that "the information society is the learning society" into reality. We constantly need to obtain expertise and develop

skills, even after arriving on the labour market, and it must be made clear who is responsible for ensuring that this is achieved. What is the role of the EU, national governments, employers, and individuals? Strategies are required to create jobs in employment-intensive sectors. **Kurt Lundgren** pointed out that it is impossible to predict which sectors will employ the most people, but that population development indicates that the care and health sector will see an increase. In terms of the public sector, innovative thinking is required. What can it do to create alternatives to the defence industry as the driving force behind technology? Can sectors over which the public sector has control take over entirely, or in part, the role which the defence industry no longer plays in most Western countries?

Workshop Participants

Kenneth Abrahamson, Consultant, Sweden
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Jean Bourles, European Commission DG-XII, Brussels
Eskil Ekstedt, NIWL, Sweden
Åsa-Karin Engstrand, NIWL, Sweden
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Anders Forsman, Consultant, Sweden
Gainluca Grimalda, University of Pavia, Italy
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Mario Pianta, ISRDS-CNR-Rome, Italy
Paolo Pini, University of Bologna, Italy
Mariacristina Piva, Catholic University, Piacenza, Italy
Erik Reinert, University of Oslo, Norway
Lennart Sjögren, Consultant, Sweden
Marco Vivarelli, Catholic University, Piacenza, Italy

2. Innovations, Improvements – or just Change?

The workshop was led by Claes Edlund and Lars Karlsson, and held on 1–2 February 1999 at the offices of the Swedish Trade Unions in Brussels.

Improvements, Innovations, Implementation

Claes Edlund introduced the workshop, derived from work of the European Continuous Improvement Circles project (ECIC), funded by DG-XIII of the European Commission, and links with a Swedish national programme concerned with continuous improvement.

Improvements

Improvements at Work: An Introduction

Paco Fernandez argued that understanding innovation as a process is a way of reaching SMEs. The key to innovation is understanding complexity, facing challenges, and avoiding short-termism and linear approaches. He considered social and individual dimensions, rights and responsibilities. The priority is community development in a balanced context. Workers are not conventionally expected to deal with complexity, and to innovate. There are issues of equal access to information in organisations, and the empowering effect of new technology. New organisations and job structures require culturally neutral measures and tools. Globalisation needs to be accompanied and complemented by the regeneration of local structures and resources: discontinuity provides possibilities for innovation. We face problems based on technology provision, in an economic environment, taking account of social and public interest. We have to consider decision-making processes that enable innovation at the national or European level. He cited the optimistic view that innovation and improved production approaches will generate jobs. The pessimistic view is that innovation is at the expense of jobs. Teamwork and quality circles can fit either model. There can be no overall judgement based on a local temporally located event: wider evaluation is needed. Reducing employment in one region may be due to technological change and conversion, but, with appropriate education measures, the longer term impact can be favourable.

Perspectives on Continuous Improvements

Keith Forrester's work at Leeds is concerned with disempowered and excluded audiences, for whom job-hopping and portfolio working are not common. For most people, work is boring and mundane; negativity needs to be removed through learning. Work is unimaginative, uncreative, does not involve continuous improvement. A change of resources may make a difference. His collaborations

are with community groups, building confidence and skills of the partners over time. A Leonardo project working with women in retail has just finished, supported by employers, with remarkable changes. Case study evidence suggests that continuous learning programmes can make a real difference. These groups have tended not to be involved in company programmes. Involving people works, but obstacles are huge. Employers are not interested in serious learning, focusing on task-related training, which does not develop people as a resource.

Learning has to do with economic competitiveness, at the same time as social exclusion, equity, ethnicity and decision-making issues, and forms part of the linking of these policy areas. Learning in the workplace is a way of addressing continuous improvement, often ignored by post-Taylorist, post-Fordist enthusiasts. We should think less about formal learning approaches, and more about informal learning. We tend to consider only formally structured processes, while learning takes place outside this framework, and outside the workplace. We do not understand what people learn at work, or how. This raises questions about the nature, control and accreditation of knowledge, and links with the strategic requirements of the company.

Bengt Brattgård declared that we know little about individual motivation and values when it comes to learning. He has been studying approaches to participation and improving work organisation, involving action research, enabling people to build their own solutions. The methods work, but take time. Conclusions regarding information systems relate back to work organisation and technology. Piles of documents result, with representatives bewildered by complexity. New ways of dealing with complex information are required, with space to create new solutions. Moving from text to pictures, and using different techniques addresses many problems, but visualising organisational structures can be difficult. He described a development day presented for staff in a call centre and office. Issues included design of the workplace, tackled in physical terms, building a call centre facility in a laboratory space. Presentations of information were short and intensive, with attention given to attitudes and richness of perspective. Groups dealt with workplace design and organisational issues. Videos showed experience in other organisations. At the end, there were notes, pictures, models and action plans for future developments.

Huw Edwards coaches people rowing, dealing with communication problems and different styles of learning. Some learn by watching, some prefer to listen, some feel, some remember pictures from the lecture, others recall the textbook. There are different ways of learning, and different challenges for the teacher. There is a balance between structured and unstructured learning.

Lars Karlsson discussed the ECIC project, located between research and the market, dealing with long term processes in organisations and companies in constant change. Innovation is an attitude, connected with learning and the preparedness of the organisation to cope with circumstances and create the necessary culture. The project produces deliverables: manuals, videos, CD-ROMs and website, but the real outcome is a system for training change process monitors. The focus is on positive change: improvement is a sounder objective than full continuity. ECIC is a process, based on sound principles in Scandinavian theory and broader practice. Olaf Palme described Sweden as a "study circle

democracy", with established rules. We need to communicate a problem-solving and learning agenda. Despite the participative agenda, we still have to give lectures. The most important outcomes should be sustainable networks of partners.

The basic approach to participatory research can be shared broadly, but the focus is often on SMEs. Creation of networks is vital, along with learning and strategy. Many partner companies focus on the same market, and develop similar tools: they talk to each other, and this has led to an effective consortium. Tools without carpenters are worth relatively little. The network will continue, and participants extend the work themselves. More discussions are required before elaborate systems can be implemented. Institutional change is like turning round a tanker. Swedish trade unions are starting to train change agents, taking on the managers.

Paco Fernandez outlined the European Commission context, providing a framework of management development to complement the technology and economic environment. A number of projects were launched to deal with diverse beneficiaries, emphasising traceability and follow-up. The idea was to test the universal nature of the outcome of the process: opportunity networks, involving people on the same wavelength, and manuals.

New Ways of Spreading Knowledge in Applied Contexts

Lea Witmondt introduced her innovative European project, supported by DG-XIII, the European Theatre of Science. The project includes training, a festival, a manual and a website. The target group combines actors, workers and educators. Workshops have been given in Italy and Netherlands, and there will be events around Europe before June. The results are amazing, with companies expressing serious interest. They can see a new method of implementation, using theatrical skills to extend and spread knowledge. **Tony Maples** gave details of the audiences recruited by venues. In Naples the Science Centre recruited leading scientists from across Italy, with a local theatre group and cultural communicators. The aim is to inspire people, and give them basic tools for the creation of Science Theatre as a mode of science communication. The balance varies: in Holland there were more communicators and teachers than actors. The initial workshop introduces the ideas, opens up possibilities, and provides minimal tools. There is then a need for more specific tailored workshops.

Innovations

Innovation Processes: An Introduction

Claes Edlund reflected on twenty years of industrial consultancy in innovation, research and development, based on a framework of social psychology. He presented a three step model of innovation processes: experience confrontation, idea break through and testing/integration. The starting point was the need to innovate, whether to earn money, or to solve a particular set of problems. The

needs of others can be more of a driving force than personal need. Companies can make a mistake in choosing similar people to develop innovations. Some difference is needed, but also compatibility and cohesion; some kind of framework to keep people together, accompanied by ongoing incongruence and tension. Recognition of differences is important. Innovations are the result of a complicated web of social processes. Friction and restriction characterise its development, reaching a level of sparking intensity, opening new possibilities. This is not a matter of calm negotiation, but involves sensations of emotion. Testing and integration follow, locating new ideas in a broader context, including the market. Some ideas are discarded, or passed to other specialist groups. New ideas may need to be located in the context of a different innovation process, and taken further. Leadership activities in initiating negotiations, and making sense for the group, are crucial to the outcome, including steering, governance and administration. There has to be some order, even in the creative process. There are then issues of diffusion, spreading knowledge, and links can be made with learning.

Paco Fernandez considered institutional innovation, where need is often replaced by demand, in a continuous process. SME innovators can be isolated, making dissemination harder. Dissemination can be a feedback loop process to innovation.

Perspectives on Innovation Processes

Organisational Innovations

Paolo Martinez is based in Florence, working in an innovation agency, CESVIT, supporting the multimedia industry, linking artists, institutions and companies. MCUBE is the multimedia support centre, engaged in talent scouting, development agents, and multimedia brokerage. New potential for wealth and employment is identified; publishers and distributors are introduced to promising products. Hundreds of companies and ideas are encountered, and choices must be made. Companies may be innovative, but conservative towards the workforce, and find it hard to recognise intellectual property rights. An example product, the "virtual postcard" has a growing international market. The originating company needed commercial support and international partners, and a French partner proposed an alternative innovation, taking the same core idea but a different medium and packaging. A further Italian company took up the idea and licensed it on to museums as a niche market. The MCUBE network is international, and the idea spread rapidly. The attempt is to build an overall joint venture. The problem for SMEs is developing critical mass. Big companies can be built on these technologies in the USA, but it is hard in Europe. Innovation starts at an individual level, but to succeed at a business level requires trust, clustering and integration. The alternative is crude macho management, the exercise of power. The European carrot and stick can improve good practice on intellectual property. Italian chaos and the French Napoleonic approach are distant from the Scandinavian context. Levels of development vary across Europe. In areas without work, there is less concern for working life issues. Much multimedia work is piecework, often unpaid.

Work Analysis and Work Organisation

Jerome Bertin, of ANACT, sees a black box where SMEs are involved. The missing link is work and work organisation. ANACT start with a concern for the workplace. A cultural revolution is required. Individual and collective innovation means a joint process, using workable and practicable ideas. ANACT present innovation as continuous improvement. ANACT is tripartite, with government funding and regional agencies. Work organisation, new technologies, employment and competencies, occupational health and safety, and social dialogue, are main concerns, meaning technical assistance, research and development, and dissemination.

To improve work organisation, we need to understand the nature of work. This involves competitiveness, responsibility and change management. He described an intervention in an automobile company with problems of quality, defined in terms of the percentage of defects. Quality was seen as having only a financial meaning. Two strategies were identified in the workplace: high quality could mean rejecting potentially defective products; an alternative was toleration of minor defects in light of time pressures. Change was needed at the organisational level. Workers were assigned responsibility without the means of delivering. Quality had to be redefined in terms of the customer, and the changes needed at the workshop level. New methods had to be designed, in a non-Tayloristic manner, enabling workers to know what they need to do when encountering defects, and to judge what constitute allowable defects. The results enable ANACT to move to define organisational issues. Organisation and teamwork are not recipes; they depend on understanding the work concerned. There are three scenarios:

1. The classic *Tayloristic* company needs to adjust to meet demands. Pressures are from cost performance, with centralised responsibility. Rules are vertical and Napoleonic. Quality control comes at the end of the process. Learning processes are involved; management change can mean reversion to old habits. Sustainable change is needed. The learning organisation means adaptation is required in response to results.
2. The second scenario involves *improvement and responsibility*. The driver is economic performance, including quality and time as well as cost. Workers are given some responsibility. Quality circles and teamworking are required. Learning is in the context of improvement, double loop learning.
3. The third scenario is *innovation and the learning company*, different in terms of aims. The core value is global performance, economic and social. People are given responsibility. Stress should be reduced, through jointly specified responsibility, and joint design. The real organisation has to be adapted to the real task. It is a question of learning how to learn, how to adapt to new situations. Continuous improvement should be an outcome of learning organisation, where people have the means of exercising responsibility.

Cultural Issues

Jonathan Feldman was concerned with power and knowledge, with particular reference to SMEs. Collaboration can break down as the company increases in

size. New recruits need to be trained, and to understand core issues. The innovative product cycle can cause problems at particular stages, unless they understand the process and reinvest. With integration problems, collaboration between departments declines: between departments, managers and staff, and supplier and customers. Barriers face SMEs, as in the area of finance. Organisational integration can be dealt with by job rotation, developing a research and development group, and through stock ownership. The separation between managers and financiers has to be bridged: the case for networking and collaboration is strong. There can be diversification barriers, as small spin-off companies emerge from large defence companies. Power problems have to be addressed, setting up new small groups. Innovators become managers, taking their learning opportunities. There are benefits for procurement agents, imposing pressures to improve, combining carrots and sticks. Learning is important for innovation in SMEs, but it can break down through short-termist management and competing markets.

Implementation

Scenario Methods as Tools in Improvement and Innovation Processes: Mini Workshop

Paolo Martinez introduced scenario workshops, developed in Denmark to deal with sustainability issues, with a structured methodology involving stakeholders in a particular problem. Participants have to imagine life 20 years ahead, then consider how to get there. The approach is supported by DG-XIII. How do we do things (technology)? Who is involved (the social organisation)? The same method is used across Europe, with some Mediterranean elements included. Everyone is treated as an expert, all are involved in a democratic way, and the outcomes are structured. A divisive issue is chosen, which can be resolved through collaboration. The stakeholders were citizens, technologists, entrepreneurs and public administrators. What will happen to continuous improvement by 2020? A slogan is needed. A facilitator seeks common grounds. Next comes idea generation, more concrete ways of reaching the chosen visions. Ideas are shuffled to enable continuous representativity of the stakeholder perspectives. Each group has to distil 5 ideas between them, from the 25 collected by the individuals, using votes. Each idea has to state "who?" and "how?". This works best at the grass roots level. The idea is to stimulate participants to imagine a future where the problems are solved, and identifies the role of knowledge and social organisation. There are 4 extreme scenarios from a science fiction tradition, stimulating the imagination, and based on "how?" and "who?". Variations can be introduced, comparing and contrasting. Sometimes the sessions go directly to vision making, scenario building. These need to include organisational and technological conclusions. Written scenarios can provide valuable information for a wider audience.

In the exercise on the future of the Information Society, two groups were formed, focussing on process, conducting interviews on catastrophic and positive scenarios. They design a common group vision of each, considering collective and individual solutions, and the role of explicitly structured knowledge and skills.

Facilitators find common items. Ideas generation begins, collecting ideas and assembling a preferred list, resulting in a poster. The plenary chooses ideas, and develops a manifesto for action. This has involved creating more problems than solutions! Wise local government leaders use it as a system to involve the population.

Workshop Participants

Jerome Bertin, ANACT, France
Bengt Brattgård, Institute of Applied Psychology, Lund University, Sweden
Isabelle Dussutour, CCRE-CEMR, Brussels
Claes Edlund, Institute of Applied Psychology, Lund University, Sweden
Richard Ennals, Kingston Business School, Kingston University, UK
Huw Edwards, Oxford Innovation, UK
Roger Falk, Swedish journalist, Brussels
Jonathan Feldman, Centre for Innovation and Entrepreneurship, Linköping, Sweden
Paco Fernandez, DG-XIII, European Commission, Brussels
Keith Forrester, School of Continuing Education, Leeds University, UK
Lars Karlsson, Hippopotamus Education, Vienna, Austria
Tony Maples, Amsterdam, Netherlands
Paolo Martinez, CESVIT, Florence, Italy
Mathias Ottitsch, Institute for Prospective Technological Studies, Seville, Spain
Di Sherlock, Pandemonia, London
Maud Werner, National Institute for Working Life, Solna, Sweden
Lea Witmondt, Pandemonia, Amsterdam, Netherlands

Reflections on the Workshop

The group arrived prepared for alternative approaches to presenting the themes of the workshop. Rather than assuming a continuous discussion around the table, they planned a series of experience-centred activities. The workshop leader made explicit from the outset his interest in developing and maintaining a network to address the themes discussed. The origins of the workshop were in a European collaborative project supported by DG-XIII, who were represented at the workshop. Many participants are preparing for involvement in the European Fifth Framework programme, as researchers or evaluators.

Work Organisation

1. To Manage and Account for Intangibles

The workshop was led by Jan-Erik Gröjer and Ulf Johanson, and held at the offices of the Swedish Trade Unions in Brussels, 15–16 February 1999.

A Management Control Perspective: How Do Firms Control Intangibles in their Management Control Process?

Ulf Johanson referred to results of the recent qualitative study under the Meritum project, conducted in six European countries. In Sweden research drew on companies who were advanced in the measurement of intangibles. The result is a grounded theory study, starting without bias as far as possible, then trying to apply theoretical perspectives. How are measurements performed in best practice cases? What is measured? How is management control obtained? Which intangibles are defined as important? How are they classified? What have been the dynamics of the development of the system? What are the consequences of measurement? There were numerous questions, but no single questionnaire. In Sweden there are 12 cases: office equipment, PR, telecoms, two banks, transportation, construction, an education consultancy, two software businesses and a retail company.

Companies want to measure anything measurable, and have started on employee and customer attitudes. Regarding intangibles, they favour a simple approach, including the Balanced Score Card concept. Intellectual capital was not mentioned by respondents. There has been an impact from ISO 9000 quality assurance systems. Companies seek to understand generic intangibles, for internal managerial purposes, not for publication. Marketing and external reporting is a separate issue. Many companies have ideal pictures showing links between intangibles, telling the story of what they mean. Even if they start with simple classifications, underneath there is a complete mess. Numerous items are measured: 72 items in one company. Looking for underlying documents with classifications is futile: what is classified is measurement, conducted continuously.

Measurement is not the only issue: it is a matter of encouraging change. Responsibility is assigned: the indicators are owned. He cited examples of full

documentation and use of measurements. Repeated use of the pictures is used for communication. Benchmarking is a major force for driving change, comparing units. Bonuses are linked to changes in performance measurements. Data is collected and compiled into the database for analysis, in order to reveal correlations, driving forces and impacts on performance. Leadership is linked to empowerment, links with customers and customer loyalty. Links to financial performance are harder to establish.

There is a mass of new information. Learning and change are central. There are new styles of argument. These measurement systems have become part of the management control process: measurement needs to be followed by action. In some cases this was the original motivation, while in other cases the new measurement system is a product. There has been a change in management since the 1970s, with more emphasis on routines, procedures and processes, and more willingness to follow procedures.

A Capital Market Perspective: What are the Needs from Capital Markets with Regards to Increasing the Transparency of Intangibles?

Baruch Lev argued that, in the past, capital markets were said to reflect financial reality; increasingly they influence corporations through feedback. There is an expectation effect, predicting responses of capital markets. Feedback to companies is usually through cost of capital, not just costs of flotation, but also interest rates on loans. High cost of capital means effective shrinkage of the company. In the USA almost all employees are now given compensation packages including stock options: this means numerous employee millionaires are created in Microsoft, Cisco etc. There can be institutional intervention in the USA or UK, rather than just selling shares. In extreme cases there can be take-overs, removing old management in virtuous and vicious circles. Modern day capital markets thus impact the day-to-day operations of companies of all sizes.

A key aspect of capital markets is information: in the USA there is a constant deterioration in the usefulness of external financial reports to the capital markets. As the quantity of information increases, one might expect that it would influence investor decisions. Research suggests that the association between earnings and stock price changes has weakened dramatically. It is a matter of studying stock price movements, not statements of intent. The prime reason is organisational change, which cannot be captured by accounting systems. Change has been driven by innovation and deregulation: financial accounting cannot deal with change. We see the destruction of the backbone of the traditional accounting system, where costs may be expensed in one move. There are serious information problems, many of which are the result of innovation and investment in intangibles. Research and development can be seen as a cost, but in certain areas, such as pharmaceuticals, longer term benefits flow. Financial accounting is not working in the leading knowledge sectors of the economy. Firms are likely to face serious problems, with "lemons discount": if you don't know much about something, you assume it is a lemon. This means potentially undervaluing the future potential of product returns. On average, firms heavy in intangibles may be

assumed to be undervalued in capital markets, with all the consequences including cost of capital, which prevents firms becoming public companies or impedes further investment.

The Intangibles Research Centre has documented this phenomenon, particularly with firms with average or below average profitability. The damage is to the firms, and thus national economies. This problem may be worse outside the USA, because of the active venture capital market. Information problems lead to high volatility, for example in Internet stocks, which also reflects technological uncertainty with the pace of innovation.

What can be done? What are the policy implications? Where is the damage to the economy? How can we justify public policy interventions? His research has dealt with insider gains, where insiders buy and sell the stocks, which form part of their compensation package. Are they using inside information to make gains at the expense of outsiders? Given that outsiders know little about innovation and intangibles, well-informed insiders can gain. This research studied 120,000 insider transactions by corporate officers. There was a difference between firms with and without reported research and development expenditure, the only reported intangible, and the subject of vast investment. This includes investment in people. The difference related to insider trading can be 1.65% per month in knowledge sectors. Improved financial reporting is needed. Improved disclosure is not just a matter of fashion, but fundamental to the business model. What can be done by governments or super-governmental institutions? US biotechnology companies have experimented with new kinds of securities, noting the importance of fundamental research.

IBM and AT&T have moved out of fundamental laboratory research. McKinseys, working for AT&T, had concluded that cellular phones had no commercial potential, and AT&T ended their programme, without retaining key patents. IBM cut their R&D budget by 34% in 1994. The biotechnology firms formed new public companies, secured early R&D projects, then gave rights to the shareholders to buy stocks. This gave shareholders the opportunity to participate in early research, involving risk sharing. Firms with high expenditure on intangibles lack markets to share the risk. The investments are not liquid, but high risk. This means under-investment. Governments can help develop mechanisms for risk-sharing. Mortgage backed securities provide a model, based on Fanny Mae's purchase of portfolios of mortgages. The mortgages were securitised, using an initial government guarantee, insuring both principal and interest. A similar approach could be taken to R&D. Government could provide initial support. The market then decides.

Government statistical accounting is messier than company financial reporting. The USA has the lowest rate of investment of any developed country, which led people to conclude that Japan and Germany were doing better. In recent years, performance in the USA has been outstanding. The key issue is investment in intangibles, human resources and research and development, where the USA leads. This demonstrates the practical policy nonsense which flows from the lack of adequate figures to reflect intangible activities. Public policy, including tax policy, derives from government statistical accounting.

A Growth and Employment Perspective: What Are the Effects of Intangibles on Growth and Employment?

Hans Lööf presented growth, innovation and intangibles as been a theme of Nordic research. Innovation has been studied as a distinct activity at the firm level, to learn the value of intangibles. He outlined an econometric model, which explains productivity growth in terms of innovation output, and innovation output in terms of intangibles and investment in intangibles. There is a negative correlation between economic growth and failed innovative projects. He presented turnover growth in Swedish manufacturing, highlighting those where R&D is important. Renewal is comprised of R&D, together with investment in technology, knowledge, design, training and marketing. However, it does not cover the full range of service activities.

He divided the Swedish economy into knowledge intensive, labour intensive and capital intensive. Measuring renewal costs provides more information. He distinguished between innovative and non-innovative firms, noting higher productivity and turnover growth in innovative firms. Why do some firms have much higher productivity growth than others? Why is productivity growing faster in knowledge intensive areas? He compared the Finnish and Swedish performance, identifying better performance from Finland. He looked for correlation between innovation and economic performance, and between innovative sales and renewal intensity. There is correlation between growth and innovation, both positive and negative. There are correlations with capital intensity, and between growth and size. Knowledge intensive firms do not of themselves grow faster, unless they are innovative.

Innovation comes from firms who want to replace old products, close to the front line of development, and have maintained strategies of knowledge intensive firms. The period of study has been too short to see impacts over time. It is over-simplistic to see new knowledge, in universities and business partners, as always leading to innovation and growth. Innovation has been hampered by the lack of financial resources. This has meant delays, or incomplete projects. The most effective correlation has been with firms with high levels of external co-operation and renewal. Innovation input is hard to study and correlate, but outputs can be usefully studied. Economic growth is linked to failure of innovation, in turn linked to lack of financial resources. Innovative sales are seen as arising only in manufacturing, rather than in services. The focus tends to be on technological renewal. The research will proceed to further analysis of data in the Nordic countries, including the service sector, investigating problems of financial resources. Then, taking examples from knowledge, labour and capital intensive sectors. Finally, there will be a study of molecular biology, seeing a firm as a cluster of collective knowledge. The spill-over effect between activities and firms will be investigated.

A Classification Perspective: How Can Intangibles Be Classified to Promote Understanding and Control for Both Internal and External Purposes?

Jan-Erik Gröjer described the work of the Meritum group, dealing with classification. Philosophers see classification as a problem in terms of vagueness. There are overlapping definitions for the phenomena we are studying. Philosophers favour "a good classification". Like quality, you know it when you see it. Simplicity is important, and the classification process involves loss of information about the specific while clarifying the general. He distinguished different kinds of simplicity: concentrating on notation, logical structure and the mode of use. How can we test the definitions in practice? We need to develop a new base for classification, and the construction process is a matter of creativity. There are numerous attributes from which to choose. The theory needs to be associated with the aim of the classification process, which may influence the desirability of linkages between categories.

When considering financial accounting, the issue is value relevance. One view is to separate accounts and value relevance. The intention of the statement may be to make direct links, or to act as an interpretative lens, creating a picture. We often try to link financial accounts directly to the events, rather than offering a picture. The interpreter chooses which events to address, and indeed we may see the interpreter as in some sense creating the events. We need to know the history in order to understand what is going on. Fund managers use financial reports as a lens to look back on the past of an organisation, and to understand events as they proceed. What is problematic is the design of the background picture, enabling better interpretation of events. It is a matter of classifying different transactions into accounts. Is this just a matter of standardisation, a task for a committee, not for scientists? As with the fisherman, is a standard fishing rod the right choice, when it is unsuitable for all applications? Is it a matter of auditability? What then constitutes auditability, and what constitutes evidence?

A third perspective comes from management control, with concerns for cash flows and earnings. New models are being considered, including renewal. This is an ongoing debate, with a mixture of description and classification. Is there a classification problem, working bottom up? The other side of the coin is division, top down: more concepts are needed. A complete picture would have both.

Jan Mouritsen has been asking firms about R&D: they tend to see such activity as problem solving. Small firms embody research in the provision of new solutions. Perhaps there is no definitive measure. We are measuring organisational structure, not activity. Does what we measure relate to the concepts which we attach to the figures? Can we do better than ask the managers, and then audit the answers? Consistency is important: are current classifications consistent, and in what sense? We talk of reliability and auditability. There is no event or transaction to parallel that in financial accounting. This is the top down issue, and the conclusion is that there is no consistency. How can firms live with these classifications and divisions? What are the pragmatic situations which we can support through our new metaphors such as Balanced Score Card? We want to link it with, for example, Porter's account of competitiveness. We are concerned with more than entries: it

is not just people, but capital. We appeal to the idea of a ledger. This is the "labour of division": what are the pragmatics by which divisions emerge?

Are There any Needs for Some Kind of Regulation Within European Union Member Countries of OECD (or IASC, FASB)?

What Are the Implications for Further Research in the Area?

Stephano Zambon declared that we have entered a complex world. The firm is an entity with a systemic nature, the firm, taking its value from interconnected parts, and embedded in national accounting traditions. The challenge is to give relevance to financial accounting. There are problems with consistency and mutual exclusiveness. For external purposes, he recommended choosing certain areas of intangibles, putting together deductive and inductive approaches. Classifications are culturally and historically determined. He suggested dealing with human resources, external activities and internal processes. Research is needed, including cross-country research, possibly following the same companies in different national markets.

Michel Cross recommended measuring things. Government statisticians are waiting for accountants to produce new measures, but the statisticians will need to make a start on intangibles. For example, he would like marketing expenditure and software expenditure.

John Flower emphasised auditability and comparability, and favours moving towards the imposition of standardisation. He places less emphasis on theoretical characteristics of classifications. The key is disclosure.

Baruch Lev recalled a programme about the Internet, which made no mention of intangibles, their valuation and classification. The Internet firms have vast lobbying power. Discussion of policy making needs to be based on a proven market failure. The Internet works, and does not need intervention. Capital markets are undervaluing firms, raising the cost of capital and impeding investment. High technology companies need to be able to raise money against intangibles, especially in Europe. Corporate governance, and the monitoring of what managers are doing, is a key issue. How are enterprises being managed and controlled? National accounts are a clear problem. Policy makers lack the data to make crucial decisions. Internal management may or may not be failing. Our key concerns are not being discussed. There are major problems with high technology firms.

Irén Gyöker identified cultural differences between the USA and Europe. The roles of the state and regulators have been different. In Europe regions are significant, and privatisation has raised new issues regarding intangibles. There are numerous SMEs which are knowledge-based, but struggling through lack of finance.

John Holland suggested that **Baruch Lev** has demonstrated an information failure, but the market for information has found a new route through. This involves fund managers, analysts, credit raters, auditors and banks. The problem might be solved, in that the system works. It works for large-scale players over small

investors. Perhaps auditors and other intermediate players should be obliged to publish the information they are using. There are signs of failure in the market for corporate governance, with a failure to get the information required, and a case for increased disclosure. The major auditors use information for their consultancy purposes, and should be obliged to disclose.

Workshop Participants

Guy Ahonen, Swedish School of Economics, Helsinki
Zoltan Boross, Technical University, Budapest
Leandro Canibano, Universidad Autonoma, Madrid
Michel Cross, Statistics Netherlands
Richard Ennals, Kingston University, UK
John Flower, Centre for Research in European Accounting
Jan-Erik Gröjer, Stockholm University
Isabelle Guerrero, University of Aix-Marseille, France
Thomas Gunther, Technical University of Dresden
James Guthrie, Macquarie University, Sydney
Irén Gyöker, Technical University, Budapest
John Holland, Glasgow University
Merja Hult, Eurostat
Ulf Johanson, Stockholm University
Bettina Knauth, Eurostat
Alexander Kohler, European Commission DG-XXII
Baruch Lev, Stern School of Business, New York
Helene Löning, HEC Paris
Hans Lööf, Nutek, Stockholm
Jan Mouritsen, Copenhagen Business School
Lena Skiöld, NIWL, Sweden
Graham Vickery, OECD, Paris
Stephano Zambon, University of Padua

Reflections on the Workshop

The second workshop from the same organisers showed the same flexibility and preparedness to respond to circumstances. There was particular interest in the concept of renewal expenditures, which cut across the distinction between tangibles and intangibles. Traditional accountants like to be able to assert and maintain control over managers, by financial means, and this includes restricting the capacity of managers to change accounting practices. By contrast, modern managers in knowledge-based industries, seeking to establish and maintain growth based on innovation and organisational renewal, require different accounts of their activities. For the managers, their business is change, whereas accountants require a stable basis on which to form financial judgements.

2. International Transfer of Organisational Innovation

The workshop was led by Bengt Stymne and Harvey Kolodny, and held at the Office of the Swedish Trade Unions in Brussels on 21–22 June 1999.

Theme 1: Organisational Innovation. Theory and Examples

Bengt Stymne was concerned with research into organisational innovation, a source of productivity and competitiveness. It represents radical breaks with traditional logics (path dependencies and contingencies). Old approaches to technological innovation have been relatively ineffective. Within particular sectors, successful examples could be identified, following different logics. The role of the designer is important; new ways of organising are needed. Many major innovations have been outcomes of contextual idiosyncrasies.

He cited Benetton, where siblings had a set of relevant employment competences that could be combined to form the basis of a virtual organisation, building on the local Treviso traditions of outsourcing and entrepreneurship, in both production and retail. As with IKEA, local organisation can become the basis for global expansion. Pressure for organisational innovation, due to concerns for the welfare of the population, unemployment, demographic change, maladapted structures and perverse effects, and information technology are enablers of new forms of work organisation.

Organising is about combining and co-ordinating resources to obtain certain outcomes. Key resources are traditionally defined as labour and capital, including machinery and technology. This raises issues of the division of labour. Is intellectual capital to be seen as labour, or separate? Co-ordination involves creating and channelling information. New patterns of division of labour in the intellectual area make the grouping and classification of jobs difficult, challenging traditional principles. We lack clear rules on how to proceed in this new context. Intellectuals tend to be reluctant to build on the skills of others without an equivalent background. Large-scale projects now have the same problems as companies. New forms of organisation are being designed, communities of practice, to address future challenges. How are these new groups integrated into management structures in large companies such as Renault?

Economists have addressed production functions, analysing different balances of labour and capital. Traditional theoretical models are breaking down, and cultural differences are shown to be significant. Disembodied productivity growth is not explained by the models. This could derive from learning, from differentiation of labour (increasingly based on knowledge management, rather than human resource management), and from structural capital (routines and organisational capacity). Technology had previously been seen as the critical factor, but now is regarded as an enabling factor, making different forms of organising possible.

Divisionalisation represented a clean break with functional factory workshop approaches. In accounting terms it eases establishing profitability and the effectiveness of managers. General Motors in the 1920s decided to produce a car for each social group, providing a means of learning about each specific market, forcing organisational learning.

Lean production has enabled removal or restructuring of management levels; it can mean control or motivation. MRP2, for example, could be used for ongoing control or for short-term monitoring. Lean production adds an additional driver to the production design process, derived from response to the customer. Further drivers can be envisaged, seeking to make the structure attractive to potential workers (or investors in intellectual capital). This in turn links back to the importance of competitiveness. New products can create new markets, not just a response to the market.

Innovation may be regarded as part of routine, as structural capital. If we see organisations as having life cycles, the development of innovative capacity is vital for continued organisational existence.

SAP was founded by IBM consultants in Germany; the initial idea was to deliver complete tailor-made systems, using standard systems, based on common modules and variations. SAP constituted an organisational innovation, growing fast and giving high shareholder value. The structure was based around developing new systems with key customers such as ICI, with core systems components. The outcome is a mixture of customer orientation and standardisation. Sales are achieved through partners, who use SAP products for their customers. The key to success is effective filtering of information.

The SAP system is a controller's dream, with standardisation easier than in other consultancy areas, such as human resource management. Linked to this can be standardisation and certification, for example in network management systems such as Novell. The key issue is the shift, from discovering modularisation, to its use as a means of business expansion, taking advantage of local circumstances. SAP is a tightly controlled system. These characteristics may reflect German approaches to control, which may not be shared by managers in other locations and sectors. Independent consultants and contract workers play key roles in the expansion of some of these new approaches. SAP target large companies, supported by large consulting companies.

Bengt Stymne presented the model used in the research project for considering organisational innovation. Starting with a "mess", interpretation and invention is required. This involves industry logic and active design. Organisational design requirements emerge from cases such as SAP, choosing modes of organisation, sales strategies, etc.

Theme 2: Diffusion of Innovation. Theory and Examples

Harvey Kolodny asked what are the right levels and units of analysis for the diffusion of innovation. Transferring innovations seems very difficult, and the cost of failure, in terms of lost opportunities, is high. The key examples, taken from the research study, are divisionalisation, integrated work teams and concurrent

engineering. Should we see SAP and MRP as technology, or as organisational innovation? Is lean production a form of organisational innovation? Yes, he declared, and so are balanced score cards, organisational learning, etc. This leaves out only technical changes without direct impacts on the workforce, if there are such changes.

For each example, he considered drivers and barriers. *Divisionalisation* came to the USA in the 1920s, to the UK in the 1950s, and to Germany and Sweden in the 1960s. It is a consideration for the organisation of privatised enterprises. Competitiveness of those who have divisionalised drives change among the others in the market. Management consultants then serve as a diffusion device. Academic researchers are a further driver. Local drivers of diffusion vary. Family controlled organisations are often slow to change.

Integrated work teams can be seen as a revival of traditional craft-work teams, but those were different. Construction has long been based on teams working on projects. Drivers include external demand, swamping conventional structures. Managers and supervisors were left to handle variety, now the concern of teams.

Socio-technical studies at the Tavistock Institute provided sound foundations, as alternatives to Taylorism. In Sweden labour shortages in the 1970s and 1980s were important, as workers needed to be attracted. In Japan the origin was linked with quality control circles, and teams within functional units. Diffusion of socio-technical systems in the UK was less effective than lean production, with a different model of teamworking. Most organisations claim to have teams, but the reality is limited. In Germany workers had been asked whether they co-operate at work; the conclusions were pessimistic. There have been some high profile successes. Unions have objected to lean production, and prefer the socio-technical alternative. In the USA, machinists have a high performance philosophy, and the union trains members. Barriers include the practical difficulty of teaching new methods. Humanistic advocacy of teamworking has not been enough to effect change. Industrial democracy through representation at board level proved to inhibit of team working.

Concurrent, or simultaneous, engineering is a response to pressures for rapid innovation and better communication within the production process, challenging conventional divisions of labour. We have to look at the complete value chain, from supplier to customer. Supply chain improvements are longstanding, but less work has been devoted to the early stages of innovation and production. In Sweden there has been diffusion of co-ordination across processes since the 1960s. In the USA a variety of measures have been used to co-ordinate horizontally while managing functionally. International competition and success stories have been drivers. Just-In-Time has been influential. The recognition of knowledge workers means the need for co-ordination. Linking designers with engineers was complicated by problems of lack of mutual respect.

Diffusion of innovation could be characterised by a saturation curve. Integrated work teams have been more cyclical, with successive initiatives. Concurrent engineering has yet to acquire a pattern. Re-engineering usually fails, but learning results from such experience. What levels of analysis are appropriate? Some are at societal level; or multinational (with large-scale roll-outs); regional multi-plant multi-location; single site, multi-product; networked community (Connect,

Emilia-Romagna, Silicon Valley); or union-sponsored (partnership agreements with the US Steelworkers).

In the field of *continuous improvement*, the key examples were Komatsu and General Electric, freeing people from their previous ways of working. Jack Welch of GE set a new paradigm for the corporation, with a series of incremental improvement strategies. Understanding diffusion enhances our understanding of how to sustain a change initiative. GE have used a number of approaches, including restructuring (divisions that could not be best or second best in their field could face closure); workout (staff training); best practices (based on benchmarking, providing copying rather than innovation); process improvement (based on business process re-engineering and a review of processes); change acceleration (rolled out across the organisation); strategic initiatives (Quick Market Intelligence, Order-To-Remittance, New Product Introductions; making customers winners (involving customers); and six sigma (Total Quality Management extended to a series of levels of techniques, aspiring to "black belt").

It is important to maintain the momentum of a series of innovations, with successive layers and initiatives, though there is a danger that the workforce can lose motivation. These are building blocks of an innovative organisation, a learning organisation. Generations of innovation can be linked to generations of managers. Hewlett Packard, use "demand pull" rather than "technology push". HP hold conferences for managers, where they present successful cases of innovation in HP. The strategic change management team work as action researchers, not as consultants, teaching managers how to articulate what they have done.

Dragon Fly

Morgan Fransson of Saab described the plant which produces two complete cars, through all of the production stages, in Trollhättan, near Gothenburg. In 1998 107,000 cars were produced; in 1999 it will be 125,000. Half of the company is now owned by General Motors. The "Dragon Fly" project involved collaboration with Ogihara of Japan, with collaboration from 1992–1994. He outlined the production process in the press shop, working close to full capacity. The project concentrated on one press line, with the aim of passing on benefits of changes to other processes. One objective was to reduce change times between production runs. At the start of the project, there was already a Saab production system in place, but by learning from Japanese experience the performance has now reached world class. A number of changes have accompanied the reduced change time, including bringing back in-house previously outsourced volume manufacturing work. The General Motors idea had been to consider selling the Saab press shop, and the joint venture with Ogihara, an independent family-owned company who produce dies and stamps, has succeeded in opening new possibilities.

The Kaizen programme is human-centred, moving from the current to the ideal situation. The performance at Saab was compared with Ogihara, with analysis of numerous characteristics, including die change. The equipment compared was similar, from Hitachi. The core "body" of the "Dragon Fly" in the project diagram was the same men, material and machines. Kaizen improvement and management

were driving forces. Benchmarking was conducted inside and outside. Kaizen is about changing people, not changing machines. Previous consultants had argued for new machinery. This project worked with current staff, and no specific additional investment. There was a sound foundation of knowledge of work in Japan.

Three major activities concerned increasing awareness for all managers, basic Kaizen for all press lines and the tool & die shop, and problem solving, in all press lines and the tool & die shop. Ogihara provided a support team, based in the USA and Japan, whose task was to help cultivate the organisation. The project helped develop the relationship between the companies. The target was to bring large outside panels into Saab press lines.

All staff were taught self-discipline, and self control, self-reliance and self judgement, applied to maintenance. No robots were used, but strong operators who use their whole body, including the brain. Operators prefer the current situation.

The results showed considerable improvement. The plant now receives a flow of international visitors, and the future is secure. Kaizen has spread horizontally across the organisations in Saab and GM, but it was not possible to change ways of working. At GM in the USA, restrictions were imposed on the seniority of Japanese staff, and the duration of their periods of work. GM plants in the UK adopted a similar process to catch up with German productivity levels, and the approach is being adopted across Saab, supported by senior management. Ideas from the press shop are being transferred, and there is confidence of continued success.

There have been no problems with trade unions, who have collaborated throughout. There was discussion of sustainability of the workplace, in terms of job security and satisfaction. General Motors have good knowledge of Japanese practices, through their links with the Toyota NUMMI California and Suzuki CAMI plant, but have not changed ways of working, despite having all the information they need. In the Saab case, there has been joint working with Nissan. Local management operates under Japanese board level managers. The same approach is used for the new generation of projects, looking, for example, to reach Nissan levels of performance. In some cases there are too many people engaged on the production line.

CONNECT San Diego

Mary Walshok was the originator of CONNECT, and talked about both theory and practice, concerned with the transfer of organisational models across cultures, with some underlying social principles. There are cross-cultural imperatives of technology, demography and globalisation. In the USA, demography means issues of diversity and gender. Global competition requires responses from companies across the world. She emphasised the global nature of intellectual capital, comprising basic research, technology partnerships, global culture, economic drivers of social trends and structures. Culture and historical contexts affect the integration of similar ideas and technology into society. They affect perceptions, understanding and integration. Taking the product rapidly to market can involve

large teams interacting with customers to deal with early problems in new products. This concept of taking imperfect products to market causes shock in some contexts. The contrast is between Microsoft and Volvo. Emerging is a new debate about quality, with cultural dimensions.

Comparing CONNECT Networks

She compared venture capital (USA) with risk capital (Sweden). Swedes are concerned not to be driven by wealth, while in Scandinavia the conspicuous display of wealth is seen as problematic. In the USA, success is seen as linked to wealth accumulation. She compared the social structures and cultures of the USA and Sweden. In Sweden there is a communitarian approach, compared with American individualism. There is more official planning, and concern for goals. In the USA public policy is concerned with business development and incentives, making the world friendly for entrepreneurs. Tax systems differ considerably. Americans like individualism and beating the system, while Swedes do not like to stand out from the crowd. Swedes are concerned with the common good, whole Americans value heroism and individualism. Swedes want security, while Americans like risk. Swedes value truth, honesty and teamwork, while Americans value cunning, inventiveness and achievement. Her own Swedish background contributed to CONNECT.

She outlined the approach taken in California, and the issues in Sweden. CONNECT is a regional network of entrepreneurial high technology companies and those concerned with technology development and industry. The focus is not technology transfer or assistance, but doing whatever it takes to accelerate dissemination. It brings together partners on a pro bono cross-professional basis, and all concerned learn from the process. The system is volunteer based, not based on a small core of officials. The volunteer tradition is important in the USA, and may be hard to transplant to Sweden and elsewhere. The honest broker dimension is important: the organisation was brokered and catalysed by the University of California. The role and processes grew through discussion. About 1,000 new firms have emerged, with 70,000 new jobs, many high wage based. Businesses need licences or patents in order to participate. The key objective is building a high wage economy and attracting inward investment. Coaching and advice have proved effective.

Sweden faced some challenges in transplanting the CONNECT model. Scottish Enterprise had also decided to transplant. The motivation was the need to create high wage jobs. Issues included open ended opportunistic approaches, as opposed to planning. Private funding and underwriting contrasts with the use of public funds. CONNECT members pay annual fees, using a stakeholder investor model. CONNECT is based on pro bono services (in contrast with Nutek), and charismatic leadership. Underneath the particulars there are transferable social principles. The strategy must be able to respond to the unexpected in a culturally sensitive manner. It is a matter of combining speed and control. A broad base of stakeholders is needed. Competence and expertise must be shared, to reduce costs and improve quality. Leadership needs to be credible, inspired confidence, and builds networks of important influential people. It must be fun, when fun is appropriate.

Lessons from USA and Sweden

The convenor needs to be a stable and respected institution. In the USA, universities fulfil this role, as does Edinburgh University. The overall programme is crazy, so the convenor must be sound. The organisation must be participatory, sharing knowledge, with fluid teams, collegiality and confidence. It is a matter of building a new community around new technology. Leaders need credibility among entrepreneurs. Early successes are important. There needs to be a shared investment in time and money. In the USA public funds are used only for research and not for profit work. In CONNECT the key organisations today had not existed 14 years ago, when the network started. In California, innovation includes start-ups becoming large-scale companies. Regional collaborative networks are therefore interesting.

CONNECT Scotland

Ian McDonald claimed to have lifted his ideas from CONNECT San Diego. Scotland has strong universities, concerned with the commercialisation of invention, but Scottish ideas tend to be developed elsewhere. In Scotland, R&D is in the university, while the major multinationals merely undertake assembly. Can universities replace industry in R&D? Key issues have been growth and academic spin-offs. What is missing is infrastructure. Spin-off companies are seen as un-academic. There are gaps in entrepreneurship, and clear institutional barriers. He presented a SWOT analysis of Scotland, with a strong institutional science and professional base, and strong public sector commitment. There is a weak commercial research basis, weak management in growing companies, and terrible marketing, a lack of seed and growth funding, and public sector ventures have a poor track record. Companies of a certain size tend to get bought by Americans, and the benefits leave Scotland. The opportunities for growth are there, with a technology hub and learning to learn. Under threats he listed the loss of stars, and an over-emphasis on making technology work, rather than selling it. CONNECT is part of the solution. The mission of CONNECT Scotland is to support the development and growth of technology-based companies.

Several groups needed to be involved: universities, government, professionals, financiers, regional authorities. As in San Diego in 1984, there was a core of high technology, and threats from declining defence businesses. Professional skills needed to be developed, and there was little focus on high technology companies. CONNECT provides a channel for participants, increases opportunities for collaboration, helps in raising finance, and assists new entrepreneurs. There are now 13 universities, leading business organisations, large corporates, seven local enterprise companies, and initial grants from the Scottish Higher Education Funding Council and the European Regional Development Fund. The universities contribute on the same basis as private sector companies. He emphasised the role of technology companies and entrepreneurs. CONNECT is developing a market-place for new companies, providing a mechanism for developing management and technical skills, increasing interactions between campus based researchers and technology companies, offering technical briefings and education about the unique characteristics of technology development and technology companies, and

providing one-on-one assistance to individual entrepreneurs and companies. Scotland has many creative innovative people, and the need is for general management skills, through networks, know-how and events. The goal is to move some inventors to be entrepreneurs.

Lessons from UCSD include using a university host; securing private sector sponsorship to avoid bureaucracy; running CONNECT as an entrepreneurial business; finding a technology entrepreneur to chair the board; and taking a long term view.

CONNECT is a resource, a network of the best organisations. The operational role of CONNECT in San Diego and Edinburgh is as moderator and gatekeeper. Members are highly qualified and experienced, with CONNECT as enabling others to share resources, and building a base of trust.

CONNECT Stockholm

Örjan Isacsson noted that Sweden is a big company country, with few new companies. In social democratic Sweden it has not been good to be rich or self-advertising: a bad start for entrepreneurs. In 1996–97 the Royal Swedish Academy of Engineering Sciences tried to change perceptions of business and wealth. One problem was with risk money, venture capital. It was decided to visit the USA to study technology transfer and venture capital, to build on the strength in R&D and in patents. The group visited San Diego, and found it interesting by comparison with Silicon Valley, and based on a model that might work in Sweden.

He was asked to investigate the feasibility of the CONNECT model. There needed to be a credible board, made up of experienced businessmen and university rectors. The mission is to link entrepreneurs with the resources they need. This must be done by volunteers, not by government. Inventors need to be linked with entrepreneurs, who need the support of service providers with the best possible expertise, with venture capital and large industrial companies. The large companies need a flow of new ideas, and a creative atmosphere in the region. In Sweden there are numerous agencies seeking to support start-ups, 36 in the Malmö region alone, many saw CONNECT as a threat.

He listed the set of CONNECT activities, and identified practical problems, such as how to pay staff in high technology start up companies, rather than see them emigrate to the USA. The cultures are different in the USA and Sweden, and within Sweden, where activities are tailored to regional needs, not structured in sectors. He wanted to avoid splits, and hoped to maintain a unified approach. The system is hierarchical, by comparison with flatter structures in San Diego and Scotland. Companies such as Arthur Andersen operate in several CONNECT regions. CONNECT Sweden is intended to operate without public funding. He reported on regional developments to date in Sweden, in the early months. Early networks are in Stockholm, Western Sweden and Skäne, and others are under development. The first forum presented 22 new high-growth companies, and after three months 70% had secured venture capital. A growing activity has involved some 250 professionals, working as volunteers. The goal is to involve 1200 new companies, and 240,000 new jobs. This requires 1000 volunteers.

Mats Robertsson described activities at CONNECT Stockholm, bringing together universities, the public sector, and private sector industry. The quality of service depends on the quality of the members. Members come from as far as Helsinki. The model is of networks of networks, and sets of capable speakers. The intention is to build on an organic basis, using Springboard sessions. 150 volunteers participate each week. Preparation is needed before Springboards, developing business plans and presentations.

CONNECT is privately financed, concerned with knowledge and capital, with the entrepreneur in focus. The company uses volunteers at the interface, but has to finance activities through membership fees and an operating company.

Conclusions from Case Analyses

"Dragon Fly"

Erich Latniak argued that it had been important that the project had a coherent starting point, support from top management, and involvement of expert consultants. Awareness was raised in the press shop, leading to changes in management style. Employees and supervisors visited the benchmark company in North America, observing greater productivity with similar resources. They studied the reasons for the difference, and then implemented changes in their own workshop. There need to be places for the exchange of these experiences, such as the "ecology of work" conference in North America. The knowledge of engineering students in business reengineering is limited, and needs to be enhanced. Consulting companies would benefit from further training in this area.

Considering differences between Saab and Ogihara, it is worth noting more worker involvement at Saab. Union organisation was stronger at Saab, maintaining employment, while Ogihara are not unionised. Unions differ between Sweden and the USA, with an active sponsorship role in Sweden. The transfer from Ogihara to Saab was easier than the transfer within Saab. In 1982 organisational structure change was seen as the solution to problems at Volvo and Saab, but now new solutions have been identified. What should we expect in the future?

CONNECT

Peter Clark tried to get to grips with the process, going beyond theoretical accounts of the process, and the nature of packaging. CONNECT as a package deals with the commercialisation of invention, with patents already in place. We have before and after accounts, but the innovation itself was only sketched. In San Diego there has been a rise of new large organisations in the sector, and **Mary Walshok** asserts a causal link, not proven. She has been labelled a civic entrepreneur. San Diego had taken actions, and articulated processes which had been successful and bottom-up. She had built a mechanism, whose details are not given. The transfer of the innovation to Scotland and Sweden is still at early stages. There is no clear evidence of copying in Scotland, and in Sweden it appeared to be

a matter of influence, not copying. Both may be going for the underlying principles, rather than surface practices. If **Mary Walshok** has an innovation, she would be involved in bundling the elements and branding them. Relevant rules would be: relative advantage; compatibility; low complexity; divisibility: it should be possible to experiment with parts; and communicability. He added further rules of appropriability; dominant design: this could be the Swedish version, rather than San Diego; and complementary assets: accessing skills of service providers.

This set of features could also apply to "Dragon Fly". He wanted to add relational definitions of organisations, and to capture the distinction between the specific and the general, as cited by **Mary Walshok**. In the case of CONNECT the innovation is the set of processes, which could take different forms at different times. She cited distinctions between transactions and relationships: the possible general principles go beyond the particular. CONNECT is a set of relationships that yields outcomes, and builds capacity.

Peter Clark turned to lists of success factors, and cited available consultancy expertise and the preparedness to take up new ideas. The capacity to notice and describe innovations is crucial: Americans are more effective than Europeans in this sense. With respect to transfer to Europe, it is a question of appropriate networks. He discussed whether CONNECT represents a hybrid: Scotland is reproducing, while Sweden is different: this is work in practice.

How can different actors contribute? The original innovator **Mary Walshok** is bundling, branding, encouraging and imposing constraints. She emphasises the context and the principles. She represented a stable respected organisation. There should be support for this kind of experimental work at national and European Union level, providing evaluation independent of the original innovator. **Peter Clark** described co-evolution of the three contexts and the original innovation. There are limited zones of manoeuvre in each of the three settings.

The Role of Unions, Works Councils and Employees

Erich Latniak was concerned with mediators and adversaries, and with taking action rather than waiting for time to pass. A German research and consultancy project, showed limited diffusion of group working and decentralised forms of working. Works councils have formal rights of co-determination in Germany, relevant to change processes, if, for example, wages are to be changed as part of a move to group working.

This involves unions and works councils. Works councils are statutorily independent of unions, and represent all employees, established if the initiative has been taken by employees. In a company with a works council, unions may be influential if innovation is proposed. The roles can change during the change process, involving levels of managers, workers, and works council members. Successful innovation involves influencing change in these groups. Organisations exist in the minds of their members; discussion may be needed to introduce new images and approaches. Opposition can develop if resources and respect are threatened. Beneath the explicit surface level of structure are implicit cultural aspects, in the form of rules, habits and values, which are hard to change.

Individual solutions are thus needed for each company, taking into account the process perspective. The active designer (top down) and the emergent organisation (bottom up) have to be brought together. Innovation is a sequence of measures, which logically fit together.

The RAMONA project on divisionalisation and semi-autonomous group working was concerned with 4 SMEs (employing 130, 500 and 700 workers, and family owned manufacturing companies; and a third sub-division of a gas transport company), supported by consultancies and research institutes, with public co-funding for the publication of the results. There were three groups of obstacles: hard facts (e.g. wages), soft facts (e.g. company culture) and local images of the change process. The emphasis was on production, rather than distribution. The intention was to develop new organisational structures, implementing regulations, developing company culture, and managing the change process. There were common procedures across the four companies, involving employees and works council, and accepting conflict as an unavoidable element of change. External support was arranged as effectively as possible, with a single sponsor interface. The companies were linked through visits and workshops.

Participation was important, as were works councils. The employees were empowered, given opportunities at the initiation, development, implementation (based on joint development) and feedback stages. Workshops took deep slices through the organisation, discussing ways forward. The external consultants came with an analysis and objectives, subjected to discussion and revision. Works councils were integrated into decision processes, and provided with continuous information. The background of participation in the organisation made change easier and better supported.

The development of adapted regulations and wage systems helped accelerate the process. External support was needed. Managers had not been trained in organisational change. Works councils were a valuable feedback channel. Mutual trust developed in the process. He identified a number of consequences. External support processes need to be improved, with education for consultants. Union discussions need support, as do company networks for mutual learning. Works councils can operate as partners in negotiation, seeing conflicts as a means of learning and improving.

Conclusions and Recommendations

Bengt Stymne spoke of a relay process, with diffusion and adoption. He listed key roles in diffusion: inventor, reporter, theory-builder, tool-maker, professional association, educator, consultant, business press and neighbour. The place of the "researcher" and "case author" was open to debate. Often the inventors cannot recognise themselves when described. The adoption process involves initiation, legitimation, internal diffusion, explanation, analysis, experimentation, interpretation to make sense locally, application, routinisation, and legitimation of further extension. On this account, Stockholm and Scotland adopted the CONNECT model pushed by San Diego. It is not possible to over-communicate: there are several types of communication, and of legitimation. There could be effective

European approaches, but there is a lack of diffusion between European countries. There is no steady state in diffusion, but continuous change.

Workshop Participants

Peter Clark, University of Birmingham, UK
Richard Ennals, Kingston University, UK
Roger Falk, NIWL, Sweden
Morgan Fransson, SAAB Automobile, Sweden
Örjan Isacsson, Royal Swedish Academy of Engineering Sciences, Sweden
Harvey Kolodny, Toronto University, Canada
Erich Latniak, Institut für Arbeit und Technik, Gelsenkirchen, Germany
Ian McDonald, University of Edinburgh, UK
Mats Robertsson, Royal Swedish Academy of Engineering Sciences, Sweden
Bengt Stymne, Stockholm School of Economics, Sweden
Mary Walshok, University of California, San Diego, USA
Maud Werner, NIWL, Sweden

Reflections on the Workshop

The workshop was based on a report for DG-XIII of the European Commission, completed in 1996, which was the work of an international team including a number of the workshop participants. It might be concluded that organisational innovations originate elsewhere, and have to be imported into Europe, where national and cultural differences present barriers to diffusion. An alternative view would be that European cultural differences represent a great potential resource, if we can learn from differences. Can we identify special characteristics, opportunities or advantages for Europe, in this area of work organisation? Do the star cases still have to be taken from the USA and Japan? What is the role of the case studies?

Is knowledge about organising separate from the reflective activity of organising? How is this knowledge transferred? Does this imply a central role for consultancy, or a more general requirement for mediation and intermediary organisations? What is the role of action research? What is the role of the social partners, and of social dialogue?

Are the models under discussion primarily based on large companies? Should we be addressing new forms of work organisation between small companies? How do we best address technological and organisational innovation in small companies? At what level should we work for innovation? The traditional approach has been at the level of the individual firm and at national level. We need to consider intermediate levels of local productive structures, networks, coalitions, sectors and regions. Is there an essential enabling role for the state? This has implications for the organisation of government (at regional, national and European levels) and of education?

3. Interaction Between Human and Machine in Future Technology

The workshop was led by Lena Mårtensson and Mats Ericson, and held at the office of the Swedish Trade Unions in Brussels, from 18–20 October 1999.

Human Error Management: Visions and State of the Art

Carlo Cacciabue asked where further development is needed with human factors work. The number of accidents with a human factors element has increased. There is extensive use of automation, meaning that working environments are more demanding, cognitive and reasoning abilities are required, and when something goes wrong, problems may be increased as systems are governed by automation. People have not changed, but the technology they use, and the contexts in which they work, have changed. We can identify organisational and cultural traits, which vary even across Italian regions; random personal and external factors, based on characteristics of small groups; working conditions; and defences, barriers and safeguards.

Technical measures include engineered safety devices; procedures, instructions and supervision; training; protective equipment. Non-technical measures include policies, standards and control; procedures, instructions and supervision; training; and safety practices. Overall objectives include developing a sound safety culture; to influence the efficiency and reliability of human performance; create awareness and understanding of the hazards; support the detection process of abnormal conditions; protect from injury; support recovery; contain consequences; and support escape. The Fifth Framework programme addresses some of these issues in terms of corporate culture. The philosophy of developing safety measures is being studied inside companies.

Human error is the failure of planned actions to achieve their desired ends without the intervention of some unforeseeable event. It should be seen as a consequence of prior events, and not just as a cause of accidents. He distinguished active errors (made by front line operators, and clearly visible) and latent errors (made at higher levels in organisations or in remote systems, hard to spot at first sight). The example of latent error was of maintenance on a BAC 1–11, where a supervisor used the wrong bolts.

In the normal way there is design, safety assessment and implementation, in sequence. When an accident occurs, it results in reactive measures, resulting in regulations and proactive measures to prevent further problems. In principle there should be underlying theory, generating improvements, but in practice change is driven by accidents. Error management enables an organisation to be aware of its own safety health, allowing evaluation and identification of critical areas of concern, through testing and auditing. This requires an available structured architecture of human machine interaction (although in some settings this is seen as a radical proposal). There needs to be both prospective and retrospective

analyses, with common analytical models and data, making use of simulation where appropriate.

The Airbus accident at Strasbourg was at first blamed on an apparent mis-reading of an instrument reading. The necessary human factors research had not been undertaken. It is vital for near miss data to be analysed, giving evidence of previous similar events, where accidents may have been prevented due to the installation of further safety equipment. The rules of interface design have been well established for over a decade. Design, safety assessment, training and accident analysis need to be integrated. In the 1970s good design maximised the margin for safety, and identified the maximum credible accident, with means by which safety could be assured. Accidents do not occur in this way. Probabilistic Safety Assessment must include human contributions, but change nothing. There must be independent assessment of the design basis for accidents. Training of pilots is difficult, as they find it hard to accept that non-pilots can be involved in such training, bringing external human factors knowledge. Issues of leadership are raised in simulator training.

Cognitive Task Analysis involves selecting a theoretical model, defining the aims and boundaries of the simulation, undertaking cognitive task analysis, undertaking field study of working contexts, and arriving at a reference human machine interaction model. Data have to come from actual events and simulators, observation, interviews and questionnaires, and mandatory and confidential reports. Prospective and retrospective task analysis needs to be integrated, with common models for use of the data.

Accident analysis, data collection and analysis as proposed by international air safety bodies, is being implemented at European level, taking on the ADREP1987 and ADREP 2000 models. All EU nations have accident investigation bureaux; they will now be obliged to collect data, following a common model and aided by common software tools. In addition a user interface and capacity to undertake analysis are required, offered by ISPRA, but resisted by European officials. Design should include analysis and simulation of potential accidents, including the machine model and the human model. The aircraft wind-shear recovery problem was addressed with a crew model, dealing with competence and control, and providing a model of the crew mental workload. Errors can be compensated by design.

From Human-Machine Interaction to Joint Cognitive Systems

Erik Hollnagel agreed that it is a matter of modelling and classifying. We extract meaning from what we know. The classical human-machine view is a closed loop control system based on the Shannon-Weaver communication paradigm. Talking of humans and machines is not the only approach, and introduces particular problems. Decomposing the model into humans and machines is reinforced by the information processing approach, which leads to a "gulf of execution" and "gulf of evaluation". He distinguished inner processing mechanisms and outer world.

In a sequential paradigm, actions are taken as discrete, rather than continuous. Users are seen as single individuals, with a focus on response rather than anticipation. The influence of the situation or context is indirect, and models are structural. Cognition is embedded in a context, which includes demands, resources, physical working environment, tasks, goals, organisation etc. A model of cognition must account for context as well as input. The perceived context depends on cognition.

A cyclical paradigm, takes actions together, seeing users as parts of a whole, focusing on anticipation as well as response, with the influence of situation and context as direct, and models functional. He gave the example of shipping in the English Channel, where judgements are made based on anticipating decisions of others. He addressed the issues of joint system boundaries, taking the case of the car, driver, roads and traffic infrastructure. The car and driver have to be considered in a wider context. The system has no overall boundary, but there can be a variety of focus points. Similarly the telephone and user must be seen in the context of communication acts and the telecommunication network.

He distinguished intentional and accidental users of particular products. We are all accidental users at times, for example of telephone banking services. As such, we have little or no motivation, may misinterpret product functionality, may not have the knowledge or skills that designers assume, may do things that are not expected, and may respond inappropriately. **John Wilson** added an account of accidental users due to new generations of technology, such as timers for heating systems, which cause problems for elderly users. Digital displays and touch buttons have made accidental users of former intentional users. **Erik Hollnagel** asked how accidental users can be helped? Systems could be more robust. There should be more observability and feedback. Functioning should be flexible. There should be clear state indication, avoiding multiple modes. Time pressure should be reduced, perhaps by having more machines available. Some problems could be avoided by better design and assessment studies. Foolproof design would avoid the effects of human incompetence, error or misuse, with no adverse effects on systems, from systems, or on users. The intended goal should still be achieved. Error tolerant design is not affected by incorrect use. User-friendly means ease of use without special skills or instruction. Reliable means that it will function under specified conditions. Robust means that it will function under conditions other than those specified. Facilitators and barriers, prevention and protection need to be considered. There are a number of different barriers: physical, functional, symbolic and immaterial. Facilitators include good interface design, simplicity in functioning, clear indications of operational state, and clear instructions.

Understanding People and the Things They Use and Do: Visions and State of the Art

John Wilson argued that we can only understand people and actions in terms of context. Context relates to the political, economic, social and organisational settings just as much as the work environment. An example was the recent rail accident at Ladbroke Grove. He argued for field work as well as laboratory activity, and concluded by redefining ergonomics in terms of interactions and networks.

Prediction is dangerous: earlier in the century, illustrations showed flying machines, but unchanged clothing styles. Learning machines have not progressed in the way that had been predicted, even in accountancy. Thirty years ago it was predicted that routine factory work would be done by robots or other automated processes. More recent predictions concern Artificial Intelligence and Expert Systems, robotics, personal vehicles, nuclear power and flexible manufacture. They have been relatively marginal in impact, though in some cases the developments may come. Nuclear power is in decline, and manufacturing is not flexible in the way we had envisaged. Human factors specialists need to understand sociology.

We are becoming familiar with intelligent agents and organisers, but what about software to support fuzzy reasoning, and parallel unresolved trains of thought? We may have neural networks to detect the emergence of ideas, and interactive interrogation of models. We would like soft models for qualitative simulation. We may share tools for distributed networks, including a transparent blackboard and automatic speech translation. Virtual reality is seen by some as preventing misleading intuition. Sound displays of information, together with gesture and textile interaction, could extend our sensory range. Personal information gatherers might help us cope with complex information flows. A future could enable the consumer market to support the capital market, rather than vice versa.

What should we be thinking about as human factors professionals? What is the context in which we work? Change is rapid and there is a widening user base. There are concurrent user generations around the world. Control room designs have changed and developed. Issues of information integration are raised. The move to object-oriented displays was intended to help. In emergency conditions, do we understand how people use the diverse information sources? Do we know how people make use of closed circuit television systems? Many production systems, and such things as baggage handling systems, are now controlled in this way.

The next concern is over working in teams and networks, rather than as individuals. Control may be distributed, which can mean the driver in the cab planning and implementing delivery runs. Collaborative working tends to involve unsatisfactory use of monitoring systems. There will also be the lone individual, with sets of monitors.

In many countries still there is unhealthy and primitive working, even close to modern university laboratories. In Nottingham some hosiery and building products factories remain primitive. Cultural divides are as wide as ever. We had not predicted the demise of traditional heavy industries such as shipbuilding and mining, and the terrible socio-economic consequences. The future must embrace human-machine partnerships, socio-technical systems in which the role of the technical component is to enable best use of human resources, as well as vice versa, in a mutually supportive fashion. The fear is that for every case where new technology enables or enhances human skill, there are many others where it diminishes or marginalises people's contribution within "good" jobs. We have to be certain that our predictions are not merely wishful thinking if we are to be of value in creating better – and, by implication, more human-centred – technologies and work systems for the future. There is enthusiasm for wearable technology, and

there are rival predictions concerning the Internet: will there be almost infinite consumer growth or implosion; certainly there is a problem of increased work stress.

The job market has changed, in areas such as air traffic control. There are different expectations. We have to design for professional and personal networks. The blame culture impacts on product delivery. Pharmaceutical companies are unwilling to risk side-effects of new drugs. We live in an unstable financial world, and face competing priorities, involving hard decisions over limited resources, and somebody has to take these decisions. The political context affects what is possible. The new computer system for UK Passports, which had great problems of design and implementation was introduced at the same time as did the asylum system and the social security system.

The recent rail accident at Ladbroke Grove, in the context of railway network control, illustrated many human factors issues. The apparent immediate active cause was a Thames train passing through three warning signals, each triggering an auditory warning, which has to be turned off, perhaps almost automatically. The train broke through the points, set against it, and the two trains hit head on. The emerging causes include the possible obscuring of the key signal SN109, which had been approved by the Health and Safety Executive. There had been eight signals passed at danger (SPADs) in 6 years, but no action was taken. There were 643 SPADs in 1998 on the whole network. The closing speeds could have been 100 mph and 70 mph, in part allowed because of the new Heathrow Express, which also brought about higher traffic loadings, high speed and cross overs. The same auditory signal is given for amber, double amber, and red. The AWS system does not distinguish the three levels of auditory warning.

Behind the accident lies the recent privatisation of British Railways, generating revenue for tax cuts and ideological reasons. There are about 100 different companies involved, including sub-contractors. Great Western operated the high-speed train, and were responsible for the earlier Southall crash.

Lena Mårtensson made a comparison with the Estonia tragedy, where everybody in Sweden knew someone affected. **John Wilson** argued that railways had been seen as safe. Anyone could have been on the train.

John Wilson referred to earlier unpublished work with train drivers, conducted by his team and other researchers. Train drivers reported pressure to stay on time, meaning they may not stop at amber, and can forget which light they have passed. Drivers sometimes cannot see the signals, but respond to visible movements of the track sensors. The break-up of the railways destroyed the culture of responsibility: there was no interlock of points and signals once the system was computerised; where Advanced Train Protection is fitted, it is sometimes turned off, as the drivers have not been trained in its use.

Detailed human factors evidence was presented after the Clapham accident, and during early investigation into the Southall accident, and their recommendations could have prevented the Ladbroke Grove accident. It was decided to purchase a less expensive warning system. How should politicians decide between priorities? Who can say that the £14m to £17m per life spent on fitting a more sophisticated warning system could not be better spent on hospitals and schools (provided one

is not directly involved). Whoever has to make such choices has a difficult task. What are the outcomes beyond the obvious? It is a major setback for public transport: the safety cost will raise fares, reduce passengers, and increase road deaths. Railtrack have already lost their safety role, and the contract to renew London Underground. There may also be an impact on the privatisation of air traffic control. In this case, human factors evidence was available. Who is to decide how it is to be used?

The presentation drew on current work at Nottingham University, concerned with the risks and needs of human centred technology. The technologies are complex, and used in interactive socio-technical systems distributed over time, space and function. Ergonomics is the discipline which studies, understands and improves such interactions from physical, cognitive and social viewpoints. Cognitive ergonomics needs to move from the laboratory to the field.

1. A study of performance, workload and staff loading in railway network control, studying the work of railway controllers and signallers, measuring workload, and assessing the concept of situation awareness in the field.
2. A large study of industrial planning and scheduling at collaborating companies, where the aims are to understand scheduling. Relevant themes are collecting evidence from different sources by different means, representation of interpretations and resulting descriptions.
3. The application of virtual environments in industry and education, and related work on understanding how people interact with virtual reality technology. This can best be understood in laboratory work, but the ergonomist needs to develop a use and user-driven examination of which applications might gain added value through virtual reality and virtual environments.
4. Maintenance, and its planning, training and on-line support. This involves the supply chain. Maintenance systems are seen in a broader context, with models of interaction.

He redefined ergonomics in terms of networks over time. Links are both physical and remote. The interactions have become key. Human factors specialists know about interactions, the focus of a new model of ergonomics. An interacting systems model for ergonomics was presented, with human factors expertise as critical. Everything can be seen in network terms, with contextual interactions. How many parallel generations of technology will operate together? Social context, social ergonomics, is what binds. Interactions are the key, not just at the interface but with people, society and technology.

Human Factors Engineering in Medical Systems

Henk Stassen outlined problems, including different cultures and approaches, between medicine and human factors research communities. There is increasing complexity of assistive devices, different industrial goals, and pressure on the biomedical researchers to pursue bionics. Progress takes place at the boundaries of different disciplines. Today we see the integration of disciplines, compared with

previous subject structures. There has been considerable transfer of knowledge from industry to medicine and biology.

Operating theatres are 25 years old, and new technology is now available, but with no integration or human-centred design. Ever narrower specialisation inhibits collaboration. Developments are either technologically or clinically driven. In his laboratory PhD students spend time in operating theatres. Doctors train on a master-slave basis, while engineers follow a team approach. Doctors display skill-based and rule-based behaviour, while for engineers knowledge-based approaches are vital. Doctors have no systems theory, while engineers are systems driven. The challenge is to start with a task and protocol analysis, with all PhDs working in operating theatres, and following a clinically driven approach.

Systems are neither integrated nor necessarily from the same vendor companies. Their introduction has brought benefits for the patient, but complexities for the doctor. We need to develop human-centred approaches, transfer knowledge from industry to medicine, reform medical education and set up a co-ordinated training programme, followed by permanent education. New approaches to abdominal surgery advantages for the patient, but problems for the doctor, including complexity, cost and training. Minimally invasive surgery gives the doctor less feedback, less friction in the instruments, and information in two dimensions rather than three, which presents problems. Hand-eye co-ordination is disturbed. He then gave a diagrammatic account of open surgery in systems engineering terms, compared with minimally invasive surgery, with technical assistance. The surgeon requires a higher level of overall skills and rules.

Man-machine systems in industry and medicine are different, in terms of performance shaping factors (psychological, social and emotional) and the impact of errors and failures (safety, environment and social). Robotics tends to be a matter of automated repetition, and special tasks requiring accurate positioning, possibly in hostile environments. Brain surgery has the advantage that the skull gives possibilities of fixed locations. There are particular industrial goals, such as making profits, controlling the market, and the performance of the patient, and little interest in the long term. Challenges include control by research institutes and universities, taking ethics into account, and securing patents. A new tool was designed, retaining the means of feeling friction, and allowing reusability. Companies have been buying such reusable equipment to prevent sale by rivals, and continuing to sell disposable tools. In the United States there is a problem of insurance, given problems such as AIDS. Bionics presents a problem, as replicas of biological systems are built. Other materials can support the development of other functions. The challenge is to study the anatomical and physiological phenomena, define the functions required, and develop new concepts to meet the design requirements.

Human centred clinically-driven design is the best approach. The problem should not just be left to the doctor. There are key ethical issues, concerning reusability and recycling. These facts are needed for European governments, guiding investment decisions to reduce overall costs. Broader decision-making is needed, breaking down barriers between departments (for example health care and social care) raising the quality of decisions over, for example, treatment for older people.

Advanced Visual and Auditory Displays in Human-Machine Interfaces

Gunnar Johannsen is concerned with systems engineering and human-machine systems. There is work on knowledge-based systems, human computer interaction, decision support and multimedia. The presentation reported research results emphasising design and evaluation of human-machine interfaces for supervision and control applications in industrial, transportation, medical, and service systems. Both visual and auditory displays are considered.

The traditional separation is between presentation and dialogue: the technical system deals with what and why, and the human-machine interface deals with what, when and how to present the information. He illustrated the range of current devices in major plants, with visual and auditory information flows, citing good practice in a Danish plant, which includes regular job rotations between control room and plant roles, meaning that workers have more understanding of the information. Control rooms combine media.

More traditional topological visualisations can be supplemented by functional displays and knowledge support, based on cognitive systems engineering approaches, including task and knowledge analyses, participative design and usability engineering. When human-machine interface functions are being designed, this should be based on goals and means, scenarios and tasks. More needs to be done, involving prototyping and evaluations, with user participation at each stage. This adds to cost, but throwing away useless systems is more expensive. Available personal computer based solutions should be used for industrial process control applications: products, for example from Microsoft, tend to have been subjected to usability testing at different stages of development. User participation is needed at each stage in the life cycle.

An interface for a chemical plant derived from regular communication with operators. The development group built up a model, incorporating the Rasmussen approach to human information processing, and using fuzzy logic. The multimodel system includes topological components at the bottom level, to meet operator needs, but with additional layers of qualitative and causal models. A distillation column, which separates a fluid into pure components, is addressed with a hierarchy of operations and sub-goals, using multi-flow structures and several other methodologies. Particular flow structures in complex process plants can be viewed at a functional level, together with the underlying topology. Research on visualisation is checked with users in the particular plants. Necessities and urgencies are calculated with fuzzy logic, also checked with operators.

He addressed multimedia approaches, with an example from a cement plant. Control staff have always used the range of their senses. Security suffered from the use of limited control systems. Work has explored the full range of multimedia approaches, supporting other sensory modalities. A pilot multimedia control system goes beyond simply linking in with video, and should use experience from the performing arts.

He ended with an account of auditory displays, as yet not appropriately used, with applications for aircraft pilots. The objective was to develop non-speech auditory

displays for autonomous mobile service robots. There is related research at the Royal Institute of Technology in Stockholm, following an air accident where auditory warnings appear to have been inadequate.

How far could we go with non-speech information, using recorded sounds from robot movement and musical instruments or sounds? Experiments were performed in simulated supermarkets, with past research on intelligible sound tracks of predicted robot trajectories. The account continued with directional sounds and their recall. There were experiments in teaching orientation, up and down, left and right, and consideration of melody and rhythm. He wanted to consider levels of urgency, expressiveness and annoyance. Musicians performed better in tests, understanding the robot movements almost perfectly. Trained non-musicians could also do a good job. There is scope for further improvement, and for work with the blind. We can have safer and more efficient process control, taking user participation more seriously. The need for task analysis is increasing, with appropriate choice of media. We should make better use of human capabilities, integrating vision and sound in a task-dependent manner. He referred to the sounds of operating theatre instruments, and noted that doctors depend on auditory feedback. The mixture of media predates multimedia technologies. Auditory displays used by blind computer users potentially bring them into more active society. There are several application domains where auditory information is important in addition to visual information. Why not conduct a power plant as if it were an orchestra?

The Framework Programme of the European Commission: The Impact of Human Factors on New Technology

Carlo Cacciabue explained that the European Commission conducts activities in a series of framework programmes. We are now engaged in the Fifth Framework, 1998–2002, with a budget of approximately14 billion euros (and even more lira). 800 million euros is directed to direct research of the European Research Centre, and the rest funds research in Europe in general. Planning for the Sixth Framework is under way. Research lines cover possible research domains. He dealt with three programmes. Information Society Technology (IST): In the previous framework this was ESPRIT, with information technology. Competitive Sustainable Growth (CSG) follows BRITE, with the engineering technology work. LIFE follows work in biology and medicine. Each is described in detail in Commission technical documents, available from the CORDIS website. Each programme is described in thematic lines, for example new technologies in aeronautics falls under CSG, with numbered items covering funded areas. Certain lines of research specify just what they want, while others are more generic, giving more scope for proposals. Funding is allocated over four years, with periodic calls for proposals. Applications are from consortia of European partners, with a division of roles and activities. Overall success rates are low, depending on funding areas and levels. The Commission is trying to avoid political interference and unfairness.

He outlined different forms of support, including Accompanying Measures. For example, DG-VII (Transport) sponsors accompanying measures where they pay

100% of the costs of the research, but for short periods only. DG-XIII (Telematics) means something else by accompanying measures, a form of horizontal actions, dedicated to a theme or subject that has been analysed in detail. This applies to Human Factors, an issue in each detailed area of subject matter that has been proposed. They see the case for saving money by linking projects with similar interests.

The Sixth Framework programme is now in preparation. He offered insights into the Human Factors programme, where the importance of human well-being at the workplace is accepted. This will affect the whole programme, covering all DGs. DG-V has an interest from a social issues perspective, DG-VII from transport, DG-XII from a research perspective. It is then a question of looking at current expertise across Europe. There is a preference for research institutes, such as DERA and TNO, rather than universities. A committee is to be formed to consider the Sixth Framework. The time has come to enter the committee process. The political line will emphasise benefits for SMEs, as before.

A View from Industry

Tania Hancke left academic work to engage in industry five years ago, and her remarks are personal, not an official view. New technology aircraft are inherently unsafe due to partial automation. For example, the A320 automatically compensated height loss when flying a curve, but only to an angle of 30 degrees. Beyond that, the pilots must compensate. A distraction in the aircraft at the point of landing with a steep turn can be dangerous, and is acknowledged as such by including such cases in simulation training. Modern technology aircraft do not easily support build up of knowledge about aircraft systems behaviour. In traditional analogue systems the knowledge develops organically, while in modern aircraft the knowledge is more fragmented.

It is vital not to forget organisational issues. Automation is rule-based, but so are procedures. There is a danger of replacing common sense with a proliferation of rigid procedures. When trying to develop specifications, getting the complete description in infinite detail rarely succeeds, and may be inefficient. The proliferation of rules can create unnecessary complexity, and introduce mode errors (what am I doing here), a lack of flexibility, and sometimes a failure to meet human factors requirements.

Human factors work to cover safety is relatively well under way in the aviation as well as other industries. One area to be addressed is the quality of authority requirements issued by aviation authorities. Human factors analysis should be improving efficiency (through tools, processes, software and documentation), and definitely needs to be applied further, both in aviation and elsewhere. What are the possible barriers to applications of human factors? There is a lack of understanding of the issues. Engineers in general tend not to be educated in the humanities, and prefer exactness to ambiguity, resulting in an amateur approach to interface design. There is a lack of appreciation of new technologies in management. The costs of bad human factors are not obvious; they are not quantified.

There are issues of image and values. There has been a lack of continuous attention and publicity for success stories: human factors is seen as old hat. It may be seen as having a leftish flavour, linked to working life, involving trade unions, from which managers wish to distance themselves. As for ethics, only some 10–25% of managers may act ethically, rather than in the interests of their personal careers, and less do so publicly. There are general environmental factors, dominated by cost, which seems to be growing in importance. With money against ethics, money tends to win. There is a shortage of top level champions who understand and commit themselves. In company politics, the lone wolf syndrome applies, with career orientation dominant. Power issues prevail, and human factors have to fit in. In a fast-changing environment quick decisions must be made with limited information, and small adaptations are preferred to major changes. In general, the pressures of everyday work present problems.

Human Machine Interaction in Manufacturing Disturbance Handling

Johan Stahre noted that IT and service industry has the interest of the media and financial markets, while we are still dependent on manufacturing to provide food, tools and other products. Work life has changed radically. "Humanufacturing" is set in highly automated manufacturing, for example in the automotive industry, and many of the examples are industrially based. Flexible systems support production of two or more models on the same production line, and the whole plant has recently been radically redesigned. Major R & D efforts have been aimed at net-shape manufacturing and rapid prototyping and production technologies. Modularisation and the emergence of virtual enterprise concepts extend information systems automation. We can predict increased automation and a reduction in the workforce in manufacturing, and thus more vulnerability to disturbances due to inherent complexity. Remaining operators and maintenance staff face increased requirements of skill, agility and situation awareness. This place pressures on work teams, moving them more to a control room situation.

Systems need to be defined to include people. Micro-disturbances result from material and equipment failures at shop floor level, physics-based, propagating upwards.

With regard to micro disturbances, there has been information channel analysis, based on operators on a car-body assembly line. Verbal communication is used more than official information systems, suggesting bad human factors design, a formidable mass of figures and data, which also logs only errors that halt the system for more than 30 seconds. Many workers indicate that they never use the IT system for production disturbances.

Theoretical frames of reference are needed, such as human situation awareness, roles of human supervisory control, and levels of human cognitive behaviour, as seen from task analysis on the shop floor, positioning tasks of the operator. Macro-disturbances in the form of new products or changes of product platforms require changes and resetting, purpose-based, propagating downwards. Both types of disturbance are related to human-machine interaction and human-centred automation, and, given the single production line, each disturbance can have

severe economic consequence. New cars constitute a major disturbance, with escalating and accelerating demands. Acceleration of life cycles in order to produce faster cycles of new products requires concurrent engineering. The tools exist, but this affects modes of working, generating new functional conflicts.

Learning

Mats Ericson commented on personality issues and macrodisturbances, taking the example of his father expressing surprise at receiving bills. There are often problems of communication between management and shop floor. User participation is always too late and easy to leave out, in face of economic constraints.

What is the true nature of learning? Is it reactive or proactive? Do we only learn by making our own mistakes? Can mistakes be avoided? Do we have short memories, cutting off access to knowledge before the Second War? How long will the effect of the sinking of the Estonia last? How do we act? Is it a matter of threats, or management by fear? From ergonomic knowledge, in principle we have most of what is needed. It is a matter of distributing and using the knowledge, which involves individual learning. How do individuals respond, in their professional roles? How can standardisation and inspection operate? Who are the top people, and in what sense are they tough and effective? What is needed for the future? Of course, we need more knowledge and research, but also more emphasis on participation in practice. How should we teach in universities? Do "real engineers" study human factors? We need emphasis on pedagogy and the learning process.

Pilots in Emergency Situations

Lena Mårtensson started research in aviation following the MD-80 air accident in 1991. The aircraft came down on trees close to Arlanda airport, with no deaths. It was thought that lessons could be learned from interviews with the crew, separate from the official accident investigation. The obvious reason for the crash was ice on the wings, not removed before takeoff. There was also a lack of awareness of ATR (automatic thrust restoration). The function had not been used, and was not part of the manual, thus the pilots experienced automation induced surprise. The Swedish investigators referred to work of the UK Accident Investigation Board at Kegworth, where similar problems arose. The MD-80 is a hybrid aircraft system, with a bad display system in terms of the circumstances of this kind of accident. There was information overflow, dealing with multiple warnings, many involving voices. The pilots disregarded the information, and concentrated on basic flying. A research project was launched following this accident, involving work with Saab and other companies, such as Boeing and Airbus Industries.

Given information overload, which problems should be solved first? Airbus Industries claim that their display shows failure information and checklists. However, Boeing take a different view, arguing that such problems cannot yet be solved. Research at KTH and Saab compares what is displayed if all engines are lost, and this has been checked with pilots, monitoring response times and the accuracy of choices. Further research is investigating natural warning sounds.

Pilots complain about too many sounds and voices, and want to be able to turn off the sounds so that they can solve the problem. Asked out of context, pilots were unable to describe the different warning sounds. Urgency, believability and attention getting are being investigated, comparing known, animal and abstract sounds, taking car functions and developing auditory icons (earcons). A KTH project concerns training at SAS, taking more account of automation. A further project concerns the role of the pilot in future automated air traffic management systems. There was debate about the respective roles of pilots, air traffic controllers, and on-board automation. The major contracts are going ahead, among airlines and civil aviation authorities. There has "not been time" to consider the human factors so far.

Pilots of ferries across the Baltic do not use the sidestick, as they do not feel in control. There was discussion of the variations in working life following the ending of Duty Free sales within the European Union, and a new arrangement to pass the island of Åaland, justifying sale of cheap alcohol, but changing working hours of crew.

Human Factors Workshop Document

1. Context

The field of human machine interaction has changed over more than 50 years. The study and improvement of interactions between people and the things they use has undergone many changes of name and remit, and is now a highly mature transdisciplinary area of research and application. Starting with manual control and human performance issues, major concerns shifted towards higher cognitive levels of human control and problem solving in the interaction with computerised (automated) dynamic technical systems (machines), human-machine interfaces, and human-computer interaction (with visual, auditory, and multimedia presentations, flexible dialogues and knowledge support). The field goes beyond human-computer interaction, through the consideration of real-time constraints of the dynamic machine system.

2. Definitions and Boundaries

These roots have led to the general field of human-machine systems, within which ergonomists and human factors specialists work. Such description makes explicit that people are a central part of all meaningful systems. Within this we can describe a key area of interest as being human-machine interaction. We define this as: "mutual co-operation and collaboration, via control and information display interfaces, between networks of people and networks of computer-based and other technical system components, with the purpose of planning, and carrying out meaningful activities."

The HMI community recognise that all aspects of human factors are influential on interaction quality, especially work organisation, training, job design, team support, and broad considerations of political, economic and social contexts. Just as consideration of work organisation will influence information displays, so HMI will concentrate upon the exchange of information between people and machines

in the context of work organisation and social systems. Human machine interaction must, however, be seen as more than the interfaces that people use to monitor and control technology. Human-machine interaction is wider and broader than the human machine interface, and, embraces notions of task (recognition, decision making, problem solving) role and wider communication.

Human machine interaction can be viewed both as a system component and as a professional focus. As the former it is central to any model of ergonomics and thus to the work of ergonomists (taking the broad perspective found in Europe). As the latter it comprises a grouping or community of ergonomists, psychologists, engineers and information and computer scientists who grew by studying work in the nuclear, transport, medicine and other high risk industries but who now have interests throughout human use of advanced technology. Human machine interaction can also be viewed as a central part of what is known as "human factors" – which is both a profession equivalent to that of ergonomics but is also used to denote all non-technical factors in the design and use of human machine systems. An important contextual factor has been the blurring of boundaries between machines – or information and control systems, used at work, leisure, transport and in the home. Complex interfaces may be found anywhere. In transport, we have network control interfaces, individual vehicle driver (or pilot) interfaces, interfaces used by the public or their agents to buy tickets and those used by security staff to monitor activities. Such a broadening of the user base levels to use notions of the "accidental user", giving even greater impetus to the need to design machine interfaces with regard to all potential tasks and users. The methodology and approach to this community will be even more important for such circumstances.

3. Competences and Methodologies

Methodologically, the field is transdisciplinary, based upon approaches and technologies from systems engineering, cognitive sciences, ergonomics and information engineering. Typically, several human user classes (such as operators, engineers, maintenance personnel, managers and sometimes customers) interact with the machine. This calls for different views on the machine, and there are trends towards adaptability of the multi-human-machine interface. HMI specialists possess a unique set of competencies with a holistic view on technical systems design and evaluation. They come from different backgrounds in engineering, psychology, ergonomics, work science and computer science. Beyond these backgrounds, they have built on such basic education transdisciplinary knowledge for dealing equally well with the human users, technical system of a certain application domain, the interface between human and machine, the interaction process, and all facets of human and system performance, reliability, workload and human error.

Special methodologies are, first, those of the cognitive systems engineering repertoire, such as task and knowledge analyses, user participation throughout the systems life cycle, particularly its design phases, with goal, task, and user orientation as well as rapid prototyping and usability testing. Secondly, methodologies are applied for the design itself of the human-machine interfaces, knowledge support, and the whole interaction processes. Such methodologies include those from perceptional and cognitive ergonomics, computer graphics,

knowledge engineering, control and information engineering, multimedia arts, and more. Finally, there is a set of methodologies for analysis and evaluating human performance, reliability and work satisfaction, for the sake of deciding on the quality of and comparison of designed new and re-designed human-machine systems. This includes knowledge in experimental design, statistical analysis, interviewing and other social science techniques, and usability testing. These technologies have been applied (and therefore further developed) with a range of perspectives and investigatory frameworks, from real world observations, field studies, simulation and laboratory experimentation, to model building and theory development.

4. Challenges

Increased efforts in development of the field of human-machine interaction can substantially increase European competitiveness, improve safety for its citizens and increase the quality of life in Europe. The most important domains for these efforts are transportation, consumer products, production systems, and health-care, and public information and transaction systems.

To increase and maintain competitiveness it is necessary to make HMS more efficient.

The effects, numbers, and costs of accidents (transport, industry) are on a level which is difficult to accept. Safety can be increased considerably by appropriate HMI (re-)design. Good HMI improves the exportability of goods and services made in Europe. Good HF-design can considerably improve the quality of life within the EU across all domains through high job satisfaction, good transport systems, a protected environment, better health, etc. HF supports sustainability.

In *transport*, Efficient transport systems for people and goods will sell better (export) and enhance public transport. Today: one driver per car creates congestion, low attractiveness of public transport, life costs, pollution, etc. The impact of big transport accidents is huge: not only through actual losses but also due to follow-on costs, disruption of public life,. (Ladbroke Grove, Gottröra). Safe transport systems will increase overall satisfaction and productivity.

With *products*, highly usable and safe products based on good HF sell well and give a competitive edge for Europe. Design for manufacturing and for maintainability will require full understanding of human factors and will increase the effectiveness of production systems.

With *production and services*, efficient and competitive production systems are the result of extensive human factors considerations. Well-designed production environments attract skilled people and enhance flexibility, responsiveness to market demands, and make better use of the resources (environment and knowledge (culture)). The effects of unsafe production are substantial in terms of injuries, loss of production, damage on production systems, effects on environment, long-term effects (Chernobyl, Nuclear accident in Japan).

In *healthcare*, Better HF increases quality of treatment, reduces overall cost, and is more acceptable to the individual, both medical staff and patients.

5. Conclusions and Key Actions

Products and systems designed, built and used in Europe, are increasingly sophisticated, opaque and have levels of functionality beyond what is required by most users. Human Machine Interaction is extremely important, in order to increase the competitiveness of European countries, and from a safety point of view. It is a matter of making effective use of technology, and improving the quality of life and work. Many users recognise terms such as "user centred design", "design" and "implementation", and perhaps the need for "usable human-machine interfaces", but not how to ensure these. Industry, both producers and end users, need to know how to improve. Human Machine Interaction addresses this field, and offers the key expertise to offer practical support. There needs to be improved training and continuous professional development. It is important to bring European experts together, preparing for the Sixth Framework programme. They represent a well-recognised and experienced community, and a knowledge resource on which governments and industries can draw, for the benefit of commercial organisations, employees and the general public.

Workshop Participants

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Richard Ennals, Kingston University, UK
Mats Ericson, Royal Institute of Technology, Stockholm, Sweden
Roger Falk, NIWL, Sweden
Tania Hancke, Lufthansa, Frankfurt, Germany
Erik Hollnagel, Linköping University, Sweden
Gunnar Johannsen, University of Kassel, Germany
Lena Mårtensson, Royal Institute of Technology, Stockholm, Sweden
Johan Stahre, Chalmers University of Technology, Gothenburg, Sweden
Henrik Stassen, Delft University of Technology, Netherlands
Maud Werner, NIWL, Sweden
John Wilson, University of Nottingham, UK

Reflections on the Workshop

The group was small, offering scope for interactive dialogue from the start. The discussion was grounded in practical experience, and formed the basis for a strong campaigning document.

Work Environment

1. The Welding Industry in Technological Change: A Human Resource Perspective

The workshop was led by Roland Kadefors, and held at the Institut de Soudure, Roissy, Paris, 11–12 January 1999.

Background

In the manufacturing, fabrication and construction industries, world-wide emerging joining technologies, new materials and increased quality demands, automation and robotisation are affecting all aspects of planning and operation of production systems. Conventional techniques, requiring high manual operator skills, remain essential for a large proportion of production. Ways must be found to amalgamate technical demands with demands relating to human factors: management of the workforce, organisation of work, welder qualifications, ergonomics, health and safety.

The welding industry faces difficulties. There are problems with respect to productivity, quality and profitability, but there is also an image problem. The welding industry, in many countries, has difficulty in recruiting and maintaining a qualified workforce. Young people may not choose welding as a career since they consider it a "dirty job". The problem of recruitment is worsened by the problem of early retirement. In many countries it is extremely rare that welders remain active in their profession up to normal retirement age. Demographic trends in Europe point to a shortage of workers in the coming decades. There is an impending crisis for industry relating to human resources that will be felt by manufacturing industry in general. The welding industry is particularly exposed due to its hostile environment and high physical and competence demands. The European welding industry needs sustainable solutions with respect to the human resource dimension, in part be based on benchmarking. Creative engineers and company managers around the world have worked to produce solutions to technical and organisational problems, keeping the human factors perspective while meeting increased productivity demands.

The Welding Workplace Beyond the Year 2000

Richard Boekholt, a senior international welding engineer, set out his model of "operational productivity" based on advanced technology and engineering welding, management and organisation, and human resources (environment and work conditions). He started with audits in advanced companies, where it is hard to measure productivity. Typically production and management teams have difficulties in internal communication, and poor co-operation. It is vital to talk to the workforce to learn about practical problems. Despite all the claims for the advantages of semi-automatic working, work organisation around the welders is fundamentally weak, resulting in a low welding output. Improving work organisation on the workfloor is vital, more important than modernisation of technology or adding more personnel: but involves considerable management effort. The project started from the ideal situation, and from improved work conditions such as reliable equipment for the welding application, in order to allow optimal mechanization and automation using modern welding processes. BT Systems in Sweden demonstrate a Swedish lead in ergonomic production methods. All too often one finds welders on hostile sites, forced to carry heavy welding equipment for long distances, to adopt bending postures, to remain for long periods on exposed platforms, or to lie on their backs to weld pipelines. Mechanisation still requires the machine to be under the control of the human welder, but practicalities can still mean uncomfortable work situations. In principle, he argued, new technology can improve the work environment, but not harm it.

Many shipyards make increasing use of robots, but this technology raises problems for SMEs. New developments need to involve the workers, who tend to have low levels of basic training. The worker needs to understand the task and the work organisation, meaning involvement of workers in design and production. The training and education of welders must go beyond making "a nice weld", including the broader technological and economic context. Workers need to be provided with better tools, and regarded as an important part of the company system.

There are differences between European countries, with generally better use of qualification standards in the North than in the South. As an example, the average educated Swedish worker can easily formulate probing questions. Trade unions in the North tend to be more flexible, recognising the need to understand change. Some shipyards in Europe are older than shipyards in Japan, and are in need of more mechanisation. Japanese workers are hard-working, supported by advanced automation. Older managers are more conservative, while the newer generation are more dynamic, confident of management authority and knowledgeable workers. General trends in organisational change include removal of authority layers. More companies are working in groups, both internally and between companies, in patterns that give more flexibility. Multi-skill training and working is increasing, supporting the development of robotic cells that require skilled co-operation. Job rotation is increasing, with the use of cross-functional teams as was pioneered by Volvo, and working with robots could be seen as having a motivational effect. He compared stereotypical views of Japanese and European managers, noting Japanese concern for continuous improvement and responsive-

ness to the market, and greater European preparedness to keep to routine and push out the standard product.

Knowledge is the key resource. Companies are co-operating in developing data banks, and are taking knowledge management increasingly seriously. This means connecting people who have knowledge, with those who need it. Knowledge is needed at company level, not just by individuals.

He highlighted some of the problems of simple medical advice, given by doctors with limited practical knowledge about welding. At present welders tend to retire or take other jobs at about the age of 45–50. Improved education, motivation and information have led to a reduction in sick leave, but more was needed to increase motivation.

He considered changes in the design of welding equipment like welding guns; some are heavy and unwieldy, while others are light and ergonomically designed in association with university teams. The necessary research and development is expensive, and easier to justify in large organisations, where the investments are rapidly repaid in improved productivity. The differences between factories make straightforward transfer of technology difficult, though there is clearly a case for using new and more up-to-date tools. Investing in quality tools increases productivity, benefits the welder, and produces better quality work. He showed numerous examples of ergonomic features. Without appropriate work organisation, new tools are less likely to be affordably developed and used. Without contexts in which information is exchanged, within and between organisations, the worker's skills will not be contributed, and both quality and productivity will suffer. If the welder is simply obliged to work manually, it can be heavy and inefficient. Alternatively a robotic cell can be the focus, and is often flexible.

He described outsourcing to SMEs, whereby knowledge-rich leading edge companies, competing in a tough market, would deal with problems of capacity, delivery times and personnel by retaining a small skilled staff and contracting out routine work, as in the case of a firm making specialist chimneys. This requires high standards to be maintained, and flexible working arrangements. Increasingly small and medium size companies will work together on technical projects while remaining commercially independent, often with shared knowledge management at the core, as with 6 shipyards in the Netherlands. Issues of standards arise, with common specifications of components where possible, and the development of reliable supply chains.

Beyond 2000

Richard Boekholt noted the acceleration of technical changes. The transistor was invented 50 years ago, and the microprocessor 27 years ago, while the Internet is transforming industry at present. Microsensors and robotics are changing people and design. There are philosophical questions about the position of human beings in the context of increasing automation. He illustrated changes in pipeline welding technology, from an entirely manual starting point to unmanned robots. Pipeline welding can place workers under great). Fully automatic technology is expensive,

and still requires skilled humans in control. Modern welders need to be expert technicians, with the skills to adapt, with their companies, to future change.

Welding Workplace 2000

Bertil Gustafsson showed a video of the Welding Workplace 2000 project in Karlskrona shipyard, where robots were introduced together with new work organisation. There was an education programme for experienced welders, and a new office was built bringing the different specialists together to use common tools, such as the ''operator's computer''. The project involved co-operation and changes in roles, the emergence of process thinking and new patterns of working.

Medical Issues

Particular medical problems face welders. **Grant McMillan,** from experience with the Royal Navy, in the UK, considered workplace exposures. Fatalities tend to be from asphyxia, fire, falls and electric shock. Acute injuries are from burns and cuts, and welders tend to show minor burns, including both UV and IR radiation, which reduce quality of life. The risk of chronic disease increases over time, in particular from musculoskeletal disease. Wear and tear on the body needs to be reduced. In the shipyard the ship has to be seen as the workplace. Noise can also cause chronic problems, damaging social life, including music and conversation. There is no clear evidence regarding low frequency emissions, but they should be reduced. Asphyxia can come from gases. Pneumonia is a common problem, and asthma can be a problem, along with bronchitis, and fibrosis of the lung due to asbestos or aluminium. Lung cancer has been linked to a number of causes, including cigarette smoking. Male welders have reduced fertility associated with electromagnetic fields and other causes, but there are similar reports in many occupations. Welding can lead to exposure to a range of threats to health.

Bernt Engström is an occupational hygienist, concerned to address questions of exposure and continuing work of welders. He presented a table of occupational disease for welders and plate workers in Finland 1992–97. Some of the diseases recorded are due to earlier working conditions, since improved. Exposure to asbestos and noise is reducing, while fumes, gas and physical stress have increased. New consumables are being used, with increased arcing times. On the other hand, technological advances offer the prospect of reduced manual welding. The use of more alloys is increasing toxic fumes in the ambient work environment. Demand for better corrosion prevention leads to different coatings and paints, offering new exposure risks. There are particular concerns about diisocyanates. We do not know enough about the links between welding and illnesses such as cancer and asthma. He illustrated the effect of different face-shields and exposures, and the effect of sampling positions. Standardisation is needed. The key issue for the work environment is the integration of safety and health as a normal part of production management. Information is needed in the workplace, in a useful form for welding engineers and welders, concerning control measures.

Grant McMillan noted that emissions of zinc used to be reduced by grinding; similar issues arise with isocyanates and polyurethane coated metals. He recalled

problems with burning lead paint. Should we encourage the removal of polyurethane paints before welding? Isocyanates have more serious impacts on health than lead.

Ove Näsman dealt with employment of welders through to retirement, drawing on experience at Fundia Wire. He introduced the idea of "Metal Age", a process for improving well-being and total productivity. We now know enough about ageing and work to start interventions at company level. Companies need a tool box: the core concern is with maintenance of work ability. A triangle of work environment, organisation leadership and the individual is involved. Successful intervention gives good work ability, competence and health, meaning high productivity, high quality of life and good retirement ability, a productive "third age". Concern for health is an effective precondition of good retirement. He offered an orientation matrix, from the work of his scientific research colleague **Juhani Ilmarinen**, intended to create engagement in issues of ageing and work. The matrix sets out individual, enterprise and society levels, looking at problems/possibilities, means/solutions and results/aims. The matrix helps localise the topics to raise in particular contexts. He highlighted links from solutions at the company level to results at the individual level. There will be a booklet, with a page for each of the bullet points in each of the nine cells of the matrix.

After using the matrix, the next step is intervention planning. A further diagram supported endeavour for improved total productivity, individual well-being and competent employees, considered at enterprise, team and individual level. The approach appears to work, with participants working in pairs developing solutions. The solutions are then considered with respect to a priority matrix, considering their importance, breadth of relevance, and ease of implementation, and a measure of the combination of these elements. Communication and ergonomics emerge as high priorities, as outcomes of the dialogue process, and avoiding the need for further marketing. Communication involves people at all levels of the company. This was not the case twenty years ago, when it was assumed that the company was healthy and that jobs would continue. Evaluation is difficult: what are the opportunities for alternative work in the area of the company? Is turnover a good measure of success? Is there a problem keeping people working to retirement age? Fundia has been successful in retaining staff to the age of 65, when the mean age of retirement in Finland is 59. He explained the system of early retirement on grounds of ill health.

Grant McMillan noted that the major killers before retirement age are heart disease and lung cancer, neither directly related to work, but linked to social class. He differentiated between expectations of welders in different industries. The key issue is the health of society. More will work to retirement age if the retirement age is lowered. Our children do not expect to stay in the same career through their working life: the challenge is to improve health overall, and to retain choice. The disabled increasingly demand access to the full range of work. At present we select out those with particular problems, but this option is being reduced. If a man survives to 60, he can look forward to long life. Former diseases of the elderly no longer prove fatal.

Ove Näsman has interviewed workers about why they continue to work. Solutions need to be tailor made, as priorities vary: some people want money, others have

not considered alternatives, some feel important at work. The demographic problem in Finland leads to particular concern about ageing and employment in the metal working industries. The Netherlands and Finland in particular face this problem. Losing experienced operators means losing key knowledge, which is vital for productivity.

Richard Boekholt linked welding with long lists of diseases, but there are different processes and materials in different work environments, and generalisation is difficult. There are differences between manual welding with electrodes and modern welding with machines, with different levels of protection and distances from the weld. European welders suffer more from stress than do the Japanese. He noted the trend to change from men to machines. Welding today is not so unhealthy. There are protective devices for manual welding, but some are as dangerous as the job itself. Key research is in the area of man-machine interfaces, as men work with machines in different ways. He discussed the Japanese "grey society", where old people continue in the shipyards and young people are reluctant to become shipyard welders. Health and safety in small welding shops is a mentality and education question: it is not enough for managers to leave workers to choose whether or not to wear protection.

The Future of Work

Bertil Gustafsson asked how automation and robotisation affect working life in welding. What skills are needed? Are new structures required in labour market relations? Drawing on work at Karlskrona Shipyard, he noted changes in product development and production. Traditional methods were slow, but in the information society the customer-sensitive approach has to be rapid. New technology supports simulation and visualisation. Concept design fixes about 75% of production costs: this makes knowledge critical during the iterative process that follows, and co-operation is important. New technology must be linked with organisational development, and a programme of education. This means creating cross-function work groups, integration of design and production, delegation of responsibility and management by objectives. Welding with robots is not new: what was new was the office on the shop floor, with computers used in support of a high quality product (a fast mobile bridge). Welding such products was a new challenge, and robots offered potential. Group working was important, with the "operator's computer". 14 functions required computer support, including the use of the robots and inputs from the full set of specialists. The functions of the robot could be tested in a digital environment, where technicians documented all changes. Programming the robot involves different operators at varying levels. The foreman is less likely to give orders, and more likely to lead a team. Production planning is changing, and the roles of individual workers are coming together. Workers can use their intelligence as well as their muscle. Young people could put their computer games experience to practical use. Attitude change is slow, with gains available for all. Separate individuals can be brought together in teams. Older people were invited to be involved. Some were initially afraid, after being involved in system crashes. Most, but not all, people can develop to a higher level. What is to be done with those who cannot progress?

Ottar Kjörmo saw management as increasingly a matter of motivation. Assuming the workers have the basic skills; what more do they need? The Norwegian Work Environment Act talks of physical health, social work environment and mental health. Maslow's hierarchy of needs cover basic demands, security, social demands, prestige and self-realisation. Workers want challenges and opportunities to express themselves. Maslow's ideas offer some practical insights, as workers are motivated to see themselves as part of a larger team. Work tasks should offer opportunities, not close them down. This means teamworking, dealing with conflict, understanding delegation.

Richard Boekholt talked of the skills of the welder working with the machine. Workers need to be able to implement systems of production. Systems are increasingly automatic, and incorporate sensors. Welders need to be trained to work with robots and robotics. He must also understand economics, health and safety. This means that training and education have high priority. Trained welders can contribute to the success of the company, and become long-term staff members, motivated and protected. Japan has taken a lead in this respect. He reflected that the Karlskrona Shipyards were obliged to change or close, but have largely been concerned with building the new bridge to Denmark. He wondered how the approach would work with shipbuilding.

Grant McMillan asked if we need to develop generic skills for production workers using computer-based technology? He compared workers in medicine, using a variety of drugs, finding increasing information available based on the experience of predecessors. Today's doctor is better able to concentrate on making the patient better. The parallel is with the generic engineering operator, working with technology in practice. This raises questions about educating those now at school, preparing them to use such systems.

Bertil Gustafsson spoke about the importance of tacit knowledge, held by the experienced welder but not by the young school-leaver. The welder has feeling based on experience, essential in the operation of automated devices. **Grant McMillan** argued that tacit knowledge diminishes as automation increases. We may face problems in the future as we encourage people to progress to generic high technology roles. The need for manual welders will fall. New entrants will want to jump to the more prestigious roles, where there may be challenges to conventional engineers.

Roland Kadefors asked about knowledge management, and what happens if those with the key tacit knowledge leave. The third generation succeed those who took over from the initial trainers of the robots, and are reduced to simple button pushing, lacking deeper knowledge. Should there be two separate career paths, blue collar and white collar? This might conflict with current developments in the labour market, where the automobile industry in Sweden is moving to single agreements as demarcations are ending.

Recruitment

Roland Kadefors reported little enthusiasm among young people in Gothenburg to take technical courses. Demands on the workforce are increasing, requiring able

applicants. European regulations define what is required, but we need to look ahead. Having a trade is no longer a matter of pride; they want a profession, a career and a salary. We need either to change or fulfil these expectations. In this case technology may be working with us; we need to look at what people want to do, and build jobs to fit, rather than the other way round.

Daniel Beaufils reported no major problem in France. Training as a welder will lead to a job. At the level of technician engineers the schools are full. Some companies continue to provide dirty workplaces, but others focus on quality, involving procedures which require a clean workplace. He described contacts between young people and industry from the age of 14 or 15 for those intending to follow a technician course.

Grant McMillan was chief medical officer for a shipyard of 14,000 workers, now reduced to 3000. A generation have seen their fathers thrown into unemployment. Young people now want a generic education. In engineering there is so much to learn that specialism starts early, as in medicine. There is a Western attitude that it is better to be a manager than a worker using tools. We have to face this: the pride in manual labour has gone. People need control in their life, not narrow training that constrains their future.

Where Do We Go from Here?

Industry needs to reform. We seem to see welders as a basement profession, needing to be advanced. Should we just leave it to the market?

Vladislav Metlitsky described major issues in Russia and the Ukraine, related to working conditions and technical processes. Industry is in deep stagnation, but some hope comes from joint ventures with European and other overseas partners. Developments are seeking to follow international standards. There are particular problems with private sector SMEs, concerning poor labour conditions and low wages. There are many unemployed welders, who accept low wages. His own sons do not wish to become welders, and have chosen careers in new technology. Young people in Ukraine would undertake welding if they could be sure of employment. Employment in Europe is an ambition for many. He described the stagnation of work in robotics in Ukraine. What must be done? The former Soviet Union is now suffering from accidents due to bad industrial practice. Workers lack proper protection, and he described a number of horrific accidents. It is vital to create good labour conditions.

Workshop Participants

Daniel Beaufils, French Committee for Welding Standardisation, France
Richard Boekholt, ICWET, Sweden (represents the Dutch Welding Commission on IIW)
Bernt Engström, Finnish Institute for Occupational Health, Finland
Richard Ennals, Kingston University, UK
Bertil Gustafsson, IVF, Sweden
Roland Kadefors, Lindholmen, Sweden
Ottar Kjörmo, National Institute of Technology, Norway

Grant McMillan, Royal Navy, UK
Vladislav Metlitsky, E.O. Paton Electric Welding Institute, Kiev, Ukraine
Ove Näsman, Fundia Wire, Finland
Lena Skiöld, NIWL, Sweden

Reflections on the Workshop

The workshop touched on each of the themes of Work Life 2000, and picked up debates from the first set of workshops. Each participant brought their own national experience, and the discussion was grounded in practice. The title might have suggested a narrow focus, but this was far from the case. In order to consider the future of welding, there was discussion of work organisation, education and training, health and safety. Welding is part of a major technological transformation, changing relationships and attitudes. The welder faces different circumstances in different cultures, and at times the discussion was underpinned by concerns for human rights and democracy. The clearest exposition of an approach to change in the metal industries came from Finland, where success would depend on rational discussion and decision making.

2. The Worker's Experience of Developments in the Working Environment

The workshop was led by Bo Tengberg, and held at the European Agency for Health and Safety at Work in Bilbao, 25–26 February 1999.

Introduction

Hans Horst Konkolewsky, Director, reported that the Agency has operated since 1996, building basic structures and identifying future activities and priorities. The aim is to collect and disseminate information on safety and health at work, encompassing workplace change and the needs of special target groups, working through networks, with focal points in each member state. There are annual conferences, linked to European Presidencies. In 1999 themes were economic impacts of health and safety, and changes at the workplace. Musculo-skeletal disorder, stress at work and substitution of dangerous substances have been early priorities.

Fewer and Harder Jobs: An Example of a Union Survey

Carina Nilsson explained that since the 1970s LO has conducted surveys of its 2 million members, to develop a better picture of their working environment. It is an important role of trade unions to evaluate changes in working life, and their consequences for members. During the 1980s and 1990s several measures have been taken in Sweden in the work environment field. Legislation has been made more stringent: the employer's responsibility for work environment issues, and for rehabilitation work at the workplace, has been emphasised. It was decided to conduct a follow up of the 1980 LO survey on the work environment, among safety delegates and members. The Work Environment Fund provided 10 billion crowns to employers to improve the work environment, work organisation and rehabilitation. A survey was conducted during 1995–96 of 3000 safety delegates and 3000 members. The questions had generally the same aim and direction as in the 1980 survey. The 1995 survey of safety delegates deals with new issues, including internal control, rehabilitation at the workplace and special efforts to improve the situation of women in LO. The questions to members mainly aimed to describe their own experience of different risks at the workplace.

Ergonomic work environment problems are the most common. Second is accident risk, as common now as in 1980, while official statistics show a dramatic decrease in accidents in LO in recent years. A negative change is that psychosocial work environment conditions are mentioned as a problem by almost 50% of safety delegates, compared with 35% in 1980. A positive change is the decrease in noise, air-pollution and chemical/technical products at places of work, in comparison to 1980. Accident risks, and problems of vision and illumination, remained the same. The priorities of both safety delegates and members were a reduced workload, and less stress at work. She raised problems with statistics on issues such as accidents, many of which have not been reported. The survey shows a shift from physical/

chemical to ergonomic and psychosocial problems. Although increased knowledge has made a contribution, we must take account of structural changes in working life. Major closures and staff reductions have contributed to the increase in psychosocial and ergonomic problems. There have been structural changes in the labour market, a decrease in industrial employment, yet the inspectorate are still primarily directed to traditional risks. Employers want to retain power over work organisation in a changing environment.

Policy priorities have changed: more measurements are being made, making actions easier to justify. The legal framework in Sweden requires improvements in health and safety, and the development of plans of action by employers, to meet the requirements of internal control, but there are particular problems for small companies. Larger companies have made more progress regarding internal control. There are different interpretations of what is necessary: union representatives are more positive than labour inspectors, who set official requirements in terms of documentation. SMEs tend to lack safety representatives if there are less than five employees. Supervisors need to be educated in work environment issues, but there are clear gaps. The need is for new ideas on making internal control more effective, involving occupational health services, certification of work environment conditions, and economic incentives for employers. The surveys have led to media attention, raising the profile of psychosocial issues. We need to discuss the implications of new forms of work organisation.

Changes in Priorities and Strategies in OSH-systems in the Member States of the European Union

Martin Denheld highlighted two major surveys, covering priorities and strategies in OHS policy in the EU, and the economic impact of OHS policy in the EU. The results could be seen in identification of the most important risk factors; opinions about preventive instruments; and possible consequences for the organisation of OHS systems. The studies were not always strong scientifically, or implemented consistently across EU member states, but provide a base of information for the work of the Agency. Statistics are of questionable rigour in some cases, while giving indications of priority areas.

1. Identification of Important Risk Factors

Risk factors were seen as asbestos (old and new); chemical agents (carcinogens, organic solvents, lead); physical agents (noise, EMF, vibration); safety (falling, machine safety, electrical); psychosocial (stress, violence, aggression); and ergonomics (physical strain, RSI). These risks occur in the sectors of construction, hospitals/health sector, chemical industry/waste recycling industry, transport, and agriculture. There are particular risk categories: ageing, young and atypical work situations.

2. Opinions About Preventive Instruments

Legislation is effective over time, but there is need for updating, reorganisation and simplification. Deregulation is not dominant, and guidelines are important.

Legislation and regulations can provide a level playing field for equal opportunities in competition. There are problems of updating guidelines as legislation develops, with a mixture of national and EU legislation and guidelines. This raises questions about the role of Europe, and de facto deregulation. There is insufficient attention to the transposition of directives to the member states, but there can be pressure behind the scenes to effect change in policies of member states. Enforcement can make a substantial contribution to reducing risk. Future focus will be on high risk, OSH expert roles, strengthening enterprise efforts. This means Training, Certification, Campaigning/information/guidelines. Financial instruments include subsidies for companies improving their work environments, premium differentiation, tax reductions for investment, financial sanctions, and cost benefit analysis as a motivator.

Pascal Paoli argued for discussion at the level of production systems, not at the level of individual enterprises. This is the real issue, and needs to take into account national and regional variations, underground economies, and responsibilities of sub-contractors.

3. Possible Consequences for the Organisation of OHS Systems

Martin Denheld speculated on future issues, moving beyond the responses to the Agency surveys. Underlying developments involve more expertise, partly covered by the Framework Directive, a process element introduced: risk assessment, a general level of emancipation, new work patterns, combination with other areas (environment, quality management), and a reducing role for national public organisations. Possible trends include lesser roles for public authorities, more for sector organisations and companies; voluntary measures such as certification and agreements at sector level; inter-company relationships; and the increased importance of monitoring.

Swedish Working Environment Survey

Alf Andersson raised questions of clarity and definition, with reference to survey forms and expenses claims. As confused recipients, we tend to blame ourselves. With questionnaires, the respondent cannot be wrong: fault will lie with the designers. Swedish Work Environment Surveys are undertaken by Statistics Sweden (SCB), by order of the National Board of Occupational Safety and Health. The key is to find social indicators, and questions which provide information on such indicators. It is not just a matter of measurement. First we have to clarify terms: for example, if counting "lean organisations". Validation studies have used different indicators, and compared the results with expert judgements on the same questions, leading to new knowledge and questionnaires. Questions need to be concrete, drawing on the experience of the respondent, as opposed to hearsay. It is important to use timescales: how long, how often? There are three types of questions:

1. Questions about subjective reactions to the work environment
2. Descriptive questions with vague concepts: noisy
3. Descriptive questions with exact definitions: so loud one has to raise one's voice

The third type is preferable, providing a basis for statistics. Subjective questions can give percentages that are hard to interpret. They provide diffuse results, with lower correlations. There can also be fictive correlations.

A nested model was introduced. Within the employed working population, a number face exposures, less face pain, less have problems, of whom some are involved in absenteeism and some have reported injuries or diseases. There will be different levels of responses, depending on the questions: asking combinations of questions can affect the responses.

Since 1989 SCB has undertaken continual surveys of the working conditions in Sweden by questioning 10,000–15,000 of the working population (employees, self-employed persons and family workers) every other year. The Labour Force Survey (LFS) is used as a foundation for the Work Environment Survey. The investigation is carried out through interviews and questionnaires. These studies are very extensive, with 100 questions, and by combining results from several studies over different years a large dataset has been created which makes it possible to subdivide and report on the labour market in many different categories. The latest survey was carried out and reported in 1997. As far as possible, results are categorised into women and men, and then according to age, occupation, economic activity and socio-economic classification. Data are self-reported.

Results were presented. Women face more part-time and temporary employment. In LO, 50% of women have part-time work. Definitions of temporary employment are problematic, as national and EU figures are not directly comparable. Working at a display monitor has increased rapidly, with more women doing it for more of their time. There is no control over activities for the rest of the time. Pain after work in shoulders and arms at least one day per week is more of a problem for women, and increases with age. More women find it hard to sleep, thinking of work: this also increases with age. The more often people lift heavy loads, the more likely they are to have back pain. Working in twisted postures has increased slightly for women. More research is needed on what constitutes good work environment. It is difficult to measure work intensity, which is easier to handle in interviews. Women are more likely to be obliged to engage in repetitive work. Working late, skipping lunch or taking work home has increased. Stressful work has increased, especially for women. Women feel they are seldom involved in planning their own work. Those not involved in planning, and facing more stress, are more likely to feel ill at ease going to work at least one day per week.

The problem of too much to do at work seems to be increasing. These questions are intentionally subjective. Official Swedish statistics of work environment are based on the Work Environment Surveys, also used for special reports from Statistics Sweden. The surveys could be more widely used, and further developed. They cover those in employment, with a better response rate from Swedes compared with foreign citizens.

The EU-Survey

Pascal Paoli reflected on the results of the second EU Survey in 1996, and on the use of surveys in general. The EU started surveys quite late, as power was

transferred to the EU without the necessary monitoring information, and quantitative data was needed. A third survey is now being prepared. The intention is to provide trends, risk factors, costs and time series data. Attention is given to countries and organisations which are and are not collecting such data. Decisions are being made on the basis of less than relevant indicators. He highlighted changes in work organisation. Improvements in working conditions do not occur naturally, and are not an automatic outcome of technological progress or changes in the structure of employment. There has been degradation of conditions. The pace of change varies, and some 10% of the European workforce are over-exposed to all risk factors: this represents 15 million workers in Europe.

The second European Survey on Working Conditions in 1996 interviewed 1000 people in each of the 15 member states, including foreign workers. Each was asked 80 questions, with breakdown into country, gender, age and sector. Organisational, social and time issues are picked up. The questions are as precise as possible, seeking a description of the work situation and then looking at outcomes in terms of self-reported health and absenteeism. He identified the leading occupational health problems, and linked them with absenteeism. Permanent exposure to painful positions makes absenteeism high.

He was concerned with time schedules of work, and the amount of advance notice given. Irregular working time patterns are clearly linked with stress. This raises challenges in light of structural changes: the ageing of the working population, increasing numbers of women in employment, changes in the structure of employment, restructuring, and increased contact in the workplace with the outside world. The pace of work is increasingly determined by the customer or client, and thus reflects a restriction in the autonomy of workers, who cannot choose when to take a break. There have been some worrying developments: work intensification, repetitive work, atypical and unpredictable working hours, violence in the workplace, lack of job security, no decrease in traditional risks. Data from different areas, such as job demands and job control, can be combined as per the **Karasek-Theorell** model. Fixed term and temporary employment contracts have increased markedly: almost 40% in Spain, an average of 14.9%. There is a correlation between contingent workers and lower status jobs with short repetitive tasks, repetitive tasks, heavy loads, painful positions, less training, less consultation, more women. This is explained in terms of the structure of employment. Bad jobs are given to low status workers with a precarious contractual position. Bullying and violence have been controversial, and it has been hard to establish common concepts. Intimidation is worse for women, temporary workers and apprentices.

Men are in less stressful situations, and have more autonomy. There are different glass ceilings, vertical differentiation and different sectoral cultures. Physical risk factors are not decreasing, although in theory we know how to solve them. There are new policy challenges for health in the workplace: control and supervision, multidisciplinarity, prevention and monitoring.

Survey data cannot answer all questions. Further research can be conducted on detailed issues, but general surveys can stimulate debate involving the social partners, national governments and the European Commission. We can identify areas for further research. In 1991 stress was identified as a key issue, together

with sectoral research, OHS policies and ageing. In 1996 there was work on gender, precarious employment, stress, violence, repetitive work, and started new work on flexibility. How can we build new indicators for practical use? The third survey in 2000 will address issues of work organisation and working conditions, demonstrating flexible links with the political agenda, such as the European Green Paper on Work Organisation.

EUROSTAT

Johnny Dyreborg of Eurostat considered administrative data and surveys. He outlined a number of projects. ESAW: European Statistics on Accidents at Work, draws on occurrence related data based on administrative sources in member states. A pilot study in 1997 of commuting accidents is based on data from 8 member states. The EODS Project: European Occupational Diseases Statistics, uses occurrence related data from member states. The QWL Project: Quality of Working Life in the European Union is compiling a social portrait of Europe. He outlined the Labour Force Survey 1999.

He discussed methodological issues in the comparability of data on accidents at work: definitions, reporting procedures, coverage of population, reporting levels, classification systems. Many countries present figures with major omissions, such as agriculture or the public sector. Reporting can be affected by social insurance arrangements. An increased proportion of the population, 92% of all accidents, is now completely covered by Eurostat data. Mining and offshore activities are still not covered, and there are some gaps in health and social services. Reporting levels vary between sectors and countries. The European Framework Directive requires full reporting. Each year there are about 5 million accidents reported which involve over 3 days absence, and over 6,000 fatal accidents. Reports give case by case detail.

Work on occupational diseases is at an earlier stage. There are methodological problems, as criteria for acceptance of compensation claims vary between countries. There is scope for lobbying and campaigning for compensation. There is an agreed list of 100 diseases which are to be acknowledged by EU member states, of which Eurostat selected 31 for comparison, covering some 60,000 out of a total of 80,000 reported cases. RSI is treated very differently in different member states. He took the example of hearing disorders, and compared the levels of loss required in different member states (50 decibels in the UK, compared with 15 decibels in some other member states, on an exponential scale). This can give rise to a new political debate based on non-standard interpretations of statistics.

Different individuals have particular characteristics. There are complications of overtime (concentrating exposures) and the passage of time. Those now unemployed and those engaged in part-time working may have been affected by occupational diseases. It is important to follow work life. Longitudinal material is important, for the period since 1990. It will soon be linked to the surveys, offering a valuable resource for cradle to grave research.

Fabio Strambi noted a discrepancy between self-reporting and expert views on problems of occupational health and safety. SMEs are a particular problem. We

need to know the type of life in the area, the kind of technologies used, the level of IT in production systems, and the status of the work involved. We need to collect data on particular problems or sectors, identifying particular indicators.

Pascal Paoli argued that company working conditions and the company environment, including committees and procedures, are not picked up in surveys. The Dublin Foundation uses qualitative research and case studies, including on work organisation and working time flexibility. This includes relations between companies, externalising tasks. Who then takes responsibility for health and safety, and for training?

Alf Andersson saw the problem as complicated. Work organisation is a good starting point, rather than waiting for accidents. He has valuable experience of surveys and case studies in companies, giving people the opportunity to effect change. The recipient of the information needs to care: this involves the social partners. Case studies can then be influential in assisting change. This means links between the different organisations concerned, and the development of benchmarking, which could lead to the development of general knowledge from which we can learn.

Carina Nilsson outlined the Swedish internal control system. Statistics are needed at the company level, and the employer must make risk assessments. Plans are required, and measures must be taken, with clear responsibilities and follow-up studies. Risk assessments are also needed at national level, together with absenteeism and sickness figures. In Sweden NBOSH has its own plan, which may rely on different figures. There may be a need for European directives of some form. Statistics and surveys are vital. The first objective is raising awareness and offering guidance for policy makers. It is not clear that OHS is getting better. Next we can consider the tools, such as general surveys. The target is high level policy makers. The second objective is prevention in the workplace, where more instruments are needed, with a particular target audience.

Bo Tengberg recalled early Dublin Foundation surveys, which were not directly comparable with Swedish experience. There were very different self-reports on health risks from work. The questionnaires needed to be made more comparable, in order to link to practical measures. How can we cover those who are not the core workforce: short term employees and those involved in outsourcing, teleworking and distance working? There are of course particular problems with SMEs. Surveys are needed. He gave an example of excavators, which need to be checked every year. At any given site there are few relevant pieces of equipment, but viewed at a national level, conclusions could be drawn about particular problems, leading to improvements and reduced risk. This suggests an industry or sector approach.

Pascal Paoli argued that the Dublin Foundation has achieved progress. The surveys have been influential in relaunching health and safety activities in the European Commission. In Ireland it was realised that night work posed risks: Eurostat data supported the concern, and helped build pressure for action. It is important to consider how the results should be presented for a wider audience.

Workshop Participants

Alf Andersson, Statistics Sweden, Stockholm, Sweden
Martin Denheld, European Agency for Safety and Health at Work, Bilbao, Spain
Johnny Dyreborg, Eurostat, Luxembourg
Anders Englund, NBOSH, Solna, Sweden
Richard Ennals, Kingston University, UK
Carina Nilsson, LO, Sweden
Pascal Paoli, European Foundation, Dublin
Marc Sapir, TUTB, ETUC, Brussels, Belgium
Lena Skiöld, NIWL, Sweden
Fabio Strambi, CISL, Siena, Italy
Bo Tengberg, LO, Sweden
Maud Werner, NIWL, Sweden

Reflections on the Workshop

The workshop had a stronger trade union emphasis than some earlier workshops in the Work Life 2000 series, and was the third to be attended by ***Pascal Paoli*** *of the European Foundation in Dublin. The European Agency in Bilbao had been represented at previous workshops, including on Research Dissemination.* ***Anders Englund*** *of NBOSH in Sweden had led a previous workshop on Medical Health Surveillance, addressing health and safety at work from the perspective of health surveillance.* ***Marc Sapir*** *argues for the importance of trade unions themselves collecting information on work environment, enabling the social dialogue to be knowledge-based on both sides. Knowledge thus becomes a matter of process, as much as of product.*

3. Isocyanates: Measurement, Methodology, Exposure and Effects

The workshop was planned by Jan Levin, and held at the offices of the Swedish Trades Unions in Brussels, 26–28 April 1999. Richard Brown took the role of chairman, in the absence of Jan Levin through major surgery.

Respiratory Effects of Isocyanates

Xaver Bauer noted that highly reactive isocyanates (R–N=C=O) are nowadays used in many workplaces. They may become airborne in gaseous or aerosolized forms. When inhaled, they bind to human tissues, proteins and DNA, forming toxic adducts and metabolites which may cause adverse health effects. Detailed investigations of the airway mucosa of exposed subjects or animals demonstrate epithelium damage, cellular inflammation including neutrophils, eosinophils and T-cells as well as an increased expression of IL-4 and IL-5. Bronchial asthma is the most frequent clinical diagnosis in isocyanate workers. Further diseases caused by these chemicals include COPD, non-obstructive bronchitis, rhinitis, conjunctivitis, dermatitis and extrinsic allergic alveolitis.

The diagnosis of isocyanate-induced disorders is based on a stepwise approach, starting with a detailed occupational case history, measurement of specific isocyanate-IgE antibodies, lung function testing, follow-up during working hours and spare time and, in doubtful situations, occupational-type inhalative challenge with the suspected causative agent. Due to the heterogeneous pathogenic mechanisms, negative immunological tests (seen in 85% of isocyanate asthma cases) and the absence of bronchial hyperreactivity to methacholine do not exclude isocyanates as causative substances. To ensure reversability, the early diagnosis of isocyanate-induced disorders is required.

Since the health risk is concentration-dependent, the most important preventive measure is the reduction of exposure levels. Concentrations at or below the current TLVs (mostly 10 ppb) do not exclude affections. This especially applies to MDI and its prepolymers. A problem with the latter isocyanates is that no simple routine methods for reliable measurements in workplace atmospheres are available. The same is true of the many new polyisocyanates used in the industry. Therefore, the development of improved routine analyses of all airborne isocyanates as well as of methods for biological monitoring is urgently required. Further, a health-based TLV comprising all isocyanate groups should be stipulated, and workers at risk should undergo regular medical surveillance programmes.

An Overview of Field and Laboratory Diisocyanate Health Effects Research at NIOSH

Paul D. Siegel discussed diisocyanates, commercially important chemicals used in the production of polyurethane products. These highly reactive chemicals are

capable of mucous membrane irritation, and are a commonly reported cause of occupational asthma. There has also been concern about possible genotoxic and carcinogenic outcomes, primarily due to the potential of aromatic diisocyanate hydrolysis to aromatic diamines. Recently, methylene bisphenyl diisocyanate (MDI), which has a very low vapour pressure, has been used in place of other aromatic diisocyanates, in hopes of reducing the potential for inhalation exposure. Other chemical modifications that may affect health outcomes have included the use of prepolymers and blocked isocyanates in many manufacturing processes. The following is an overview and discussion of the methodology used in a study of new onset asthma and asthma-like symptoms at facilities that utilized isocyanates and of both immunological and genotoxicity MDI laboratory studies.

Health surveys of plants using MDI have been conducted by NIOSH. The construction of a new facility provided the opportunity to study the workers' health, prior to, and after, the introduction of diisocyanate. Several tools have been used to evaluate workers' respiratory status. A health questionnaire was administered prior to, and twice a year for two years after, the introduction of isocyanate. Occupational and work practice questionnaires were also obtained. Lung function testing and skin testing to common allergens were performed. Blood was drawn for MDI specific and total IgE measurements. Nasal lavage was performed on workers at the end of their work shifts.

The data base from this study is now being analyzed, and results are unavailable at this time. The following definitions are being used and variables examined in this data set. Worker exposures have been categorised as High, Medium and Low, based on potential for exposure to MDI or MDI-containing products. Workers are classified as a case of asthma or asthma-like symptoms (ALS) if any of the following three criteria are met:

1. Report of doctor or self-reported asthma;
2. Report of attacks of shortness of breath with wheezing and normal breathing between attacks;
3. Current use of inhaled bronchodilator.

Relationships are being evaluated between asthma or ALS and exposure potential by work area, employee reports of exposure to unpolymerized (liquified) MDI, and work activities and practices. The prevalence of asthma or ALS workers who report brief removal of respiratory protection, as well as those who reported accidental MDI spills on their skin, can also be examined using this data base.

Individuals with MDI specific IgE antibody tend to report asthma or ALS more often than those without these antibodies. However, as noted throughout the published literature, not all isocyanate asthmatics have antibodies that recognise the isocyanate-albumin conjugates used for serology. Isocyanates may bind to other proteins, as well as albumin, through a variety of functional groups to form potential antigens.

Workers are also potentially exposed to other work place antigens such as raw, unfinished wood and MDI finished wood products in places where MDI is used as a wood binder. Extracts from each of these materials were used to screen for potential IgEs. Preliminary data from our laboratory showed that specific IgE to both diisocyanate associated antigens and other work place antigens can be found

in workers from plants using diisocyanates in their processes. The IgE antibodies from some workers recognised diisocyanate-albumin conjugates through both urea and non-urea linkages. IgE antibodies were also found from the sera of one worker.

Further research on the potential biological effects of MDI was conducted using the Brown Norway rat model of pulmorary allergic sensitisation. Inhalation exposure to MDI (7 to 113 mg/m^3, 1 hr, 1 $\times$ week for 3 weeks) induced MDI-albumin specific IgE and IgG antibodies in these animals. Acute, immediate eosinophilic pulmonary inflammation, but not persistent allergic inflammation, was noted. A redistribution of the antigen cells from the submucosa to the epithelium in tracheal sections was demonstrated. Bone marrow from the femur was evaluated for evidence of genotoxicity. A dose-dependent increase in bone marrow polychromatic erythrocyte micronuclei indicated the presence of systemic genotoxicity following MDI exposure in this model. MDI and several potential metabolites including MDI-cysteine and glutathione thiol acid esters, and methyl dianaline, were tested in a Chinese hamster lung fibrolast cell line for their potential to induce micronuclei. The metabolites were able to induce micronuclei in this cell line. Diisocyanate thiol acid esters are of interest as they are labile at physiological pH resulting in the release of free isocyanate. The MDI-glutathione conjugate, in addition, produced an increased number of cells in metaphase and a visible precipitant was seen in many cells. The potential for diisocyanate metabolites to interact with both intra and intercellular proteins may be important in diisocyanate induced health manifestations.

In summary, human exposure studies indicate that asthma or ALS are associated with MDI exposures during work. Such studies may provide insight into the relationship of diisocyanate-induced disease and specific work practices and potential routes of exposure. Among exposed workers, IgE antibodies to MDI may recognise both urea and non-urea linkages. The animal and cell culture assay results support the concept that non-urea MDI adducts may contribute to the toxicity of these compounds.

Isocyanate Exposures in the UK

John McAlinden summarised the UK situation. Workplace asthma caused by exposure to isocyanates has shown no decrease, with some 400 cases per year, while the overall use of isocyanates is increasing slowly. Anecdotal evidence that the majority of such asthmas occurred in the motor vehicle repair industry due to poor work practices and poor maintenance of respiratory protective equipment is not supported by the paper. Incidence of asthma is not restricted to the motor vehicle repair industry, and there may be greater risk in some other isocyanate using industries.

TDI, MDI and HDI account for more than 90% of the commercial use of diisocyanates in the UK. They are widely used in the manufacture of flexible and rigid foams, fibres, coatings such as paints and varnishes, and elastomers. Diisocyanates are increasingly used in the motor vehicle manufacture (manufacture of interior fittings and trim) and body repair industries and in the production of building insulation materials.

Isocyanates are not produced in the UK. Currently, UK industry import between 90,000 and 100,000 tonnes of isocyanate per year for internal consumption, and the potentially exposed occupational population is about 45,000 workers. Isocyanates are asthmagens and most occupational exposures to isocyanates occur by inhalation of the vapour or aerosol. Exposure may also occur through skin contact during the handling of liquid isocyanates. Prolonged contact may lead to irritation or contact dermatitis.

The development of asthma symptoms after exposure to isocyanates does not usually take place right away, but generally happens after several months or years of breathing in the chemical. Once a person contracts the disease, the condition is irreversible, and symptoms can then occur either immediately they are exposed to the chemical or several hours later. If the symptoms are delayed, they are often most severe in the evenings or during the night, so workers may not realise exposure to isocyanates is making them ill. Further exposures can lead to permanent lung damage. Subsequent attacks may also be triggered by non-workplace exposures to agents such as tobacco smoke or cold air. These attacks may continue even if exposure to isocyanates ceases.

In the UK, a Maximum Exposure Limit (MEL) of 0.2 mg/m^3 (8 hour TWA) and a Short Term Exposure Limit (STEL) of 0.07 mg/m^3 (15 minute reference period) are applied to all isocyanates under the Control of Substances Hazardous to Health (COSHH) Regulations. There is no production of isocyanates in the UK, but there can be exposures in the flexible foam manufacturing, rigid foam manufacturing, motor vehicle manufacturing and repair, and printing and lamination sectors.

During 1985–1996 HSE visited at least 50 places of work categorised as isocyanate users, to carry out sampling and monitoring. The Surveillance of Work-related and Occupational Respiratory Disease (SWORD) reporting system was introduced in the UK in 1988. Data is collected from over 1000 chest physicians, with 65 forming a core group. There are about 400 cases recorded for the last three available reported years 1995–97, and no evidence of decline. The DSS Industrial Injuries Scheme has recorded cases of occupational asthma caused by exposure to isocyanates since1982, and there is little evidence for decline after the introduction of COSHH in 1989. Levels of occupational asthma do not appear to have fallen, although reporting levels may have risen through increased awareness. Analysis of the summarised health data shows that incidence of asthma is not restricted to the motor vehicle industry, but dangers may be as great in other isocyanate using industries, such as, for example, spraying isocyanates into moulds to form rigid foam.

Isocyanate Exposures in Sweden

Jan-Olof Norén reported that in Sweden there is an intense debate about isocyanates. Special attention has been drawn to the risk entailed by the thermal disintegration of polyuretan plastics and products containing polyurethanes. Some of these degradations have been unknown or overlooked. What is also new is the newly-discovered generation of low-molecular isocyanates which occur when heating up materials containing some combinations of phenyl-formaldehyde-urea. Examples of workplaces where isocyanates will occur, will include

heating of mineral-wool in oven insulation, of binders for core making in the foundry industry, and hot work in car repair shops. Traditional work with diisocyanates used in the industry has also been discussed. This discussion has emerged from a new measuring method developed by the research group led by **Gunnar Skarping** and coworkers in Lund; the DBA method.

The Swedish National Board of Occupational Safety and Health has been involved in this debate, responsible for provisions on thermosetting plastics, which include isocyanates. The Board has made this a priority area in its main Plan of Activities. This is expressed in a 10-point programme for work in the isocyanate field, established in 1996. This programme, inter alia, states that enterprises handling isocyanates will be looked at with particular attention by the Labour Inspectorate and that the Board will try the new measuring methods 1997–1999. Comprehensive measurements with the new measurement methods will be performed during 1998–1999 within all Labour Inspection districts. The measuring project still continues. It will include a mapping of enterprises handling isocyanates and workplaces where isocyanates may be generated.

In the measuring project different measurement methods have been used. In 1997, the group used DBA-impinger methods, the Isologger, and looked for isocyanate-metabolites in blood samples. In 1998, the group used DBA- and MAMA-impinger methods, the Isologger, MOP (2-MP) on filter. In 1999, a modified DBA-impinger method is used, with a filter device behind the impinger vessel, the Isologger, MOP (2-MP) on filter. A comparison will also be made by the NIWL in Umeå on different measuring methods used at the same time (to be described in the summary from the NIWL group).

The group decided to evaluate all values obtained in the project on completion. Some conclusions will be accounted for. It seems that the Isologger generally gives lower measurement values than values obtained using the DBA-impinger method, when measured simultaneously. Another conclusion from these measurements is that the Isologger can give a false positive response to isocyanates in an atmosphere free of isocyanates, if there is much dust in the atmosphere. A basic conclusion from these measurements is that the Isologger can be of value in "sniffing" for isocyanates, and to follow what happens during working time. The figures shown by the instrument can not be compared with the occupational exposure limit values.

In 1998, the group made 35 measurements with DBA and MAMA impingers simultaneously. 10 of these were outside the measurement range, but 25 gave measurable values for the DBA-impinger method. Of these, only six were also detected using the MAMA-impinger method. The range of values varies between 75 ppb and 0.1 ppb. Of course the MAMA reagent does not indicate MIC and the other low-molecular isocyanates. But it does not show figures for diisocyanates, in most cases, either. From this it was concluded that the MAMA-impinger method should not be used in the "Isocyanate-measuring" project this year. The use of the MOP-method will be evaluated later. The measuring values obtained will be compared by the NIWL group in Umea, and will be presented by them. A deeper analysis of this project will be done in the year 2000 and will be presented elsewhere.

Workplace Air Measurements for MDI in the Polyurethane Industry

Paul Maddison stated that the Polyurethane (PU) Industry routinely carries out occupational hygiene measurements, both in-house and at their customers' factories, to assess workplace exposures during the manufacture and use of PU chemicals. A wide variety of compounds are used by the PU industry, e.g. release agents, blowing agents, cleaning agents, fire retardants, surfactants and isocyanates for routine manufacture of a vast range of products, such as rigid and flexible foams, elastomers, adhesives, coatings, paints, binders, etc. As a supplier to the industry and as part of the Responsible Care programme, ICI Polyurethanes provides extensive ongoing support to ensure safe operating procedures and practices in the workplace. An essential element of this support is the provision of workplace exposure data and for many years, ICI Polyurethanes has carried out occupational hygiene (OH) studies and surveys in-house and at customer premises to measure the concentration of MDI in the workplace during the manufacture and use of polyurethanes.

MDI is used commercially in several forms, i.e. purified monomeric MDI, polymeric MDI (PMDI) and as variants produced either from pure MDI or from PMDI. Monomeric MDI is substantially 4,4′-diphenylmethane diisocyanate (usually containing small amounts of the 2,4 and 2,2 isomers), whereas polymeric MDIs are undistilled MDI compositions consisting of about 50% monomeric MDI and 50% of oligomeric isocyantes with a functionality of 3 and higher. Isocyanates in general are highly reactive to compounds that contain an active hydrogen group(s) and therefore, to allow meaningful workplace measurements to be made, methods used for monitoring airborne concentrations must be capable of trapping and derivatising the isocyanate to a stable derivative(s) in situ.

Exposure limits for MDI set by the authorities throughout Europe are similar in terms of numerical values. However, several countries, e.g. Ireland and the UK, have adopted a standard based on "total isocyanates" for all isocyanate compounds. To comply with exposure limits in some countries, it is therefore necessary to monitor for all isocyanate containing species present in the workplace. By adopting the method issued by the UK HSE based on 1-(2-methoxyphenyl)-piperazine for monitoring workplace exposures, it is possible to assess if other isocyanate containing species are present as well as demonstrating compliance with the exposure limits set nationally, i.e. total isocyanates or single monomeric species.

Data from over a thousand personal samples has been generated. Exposure assessments have included personnel who had the potential, by way of their job activities, to be exposed, e.g. line operatives, line supervisors, maintenance staff, product finishers, cleaners, QA staff, electricians, laboratory personnel,, ware-house staff, forklift truck drivers, etc. Overall, exposure to MDI is well controlled, with only two values from 1327 personal samples resulting in values > 0.05 mg m^3 (8 hour TWA). Adopting monitoring methods capable of detecting and quantifying all isocyanate containing species allows assessment of total isocyanate exposure as well as providing an insight to the physical form of the MDI.

Isocyanate Measurement: Old and New Methods

Richard Brown dealt with isocyanate types. The first; monomeric diisocyanates, comprise TDI toluene diisocyanate; MDI methylene bis (diphenylisocyanate); and HDI hexamethylene diisocyanate; and the second; more complex class of polyisocyanates, comprise polyHDI; polyMDI; and TDI prepolymer. The HSE Guidance Note EH16 regards isocyanates as a serious threat, causing occupational asthma. Limit values vary in different countries, with Sweden and Finland much stricter than the UK. Different measurements are made, with the UK and Australia making broader measurements of all isocyanates. This influences the choice of sampling and analysis procedures.

Taking of samples can be through use of impingers/bubblers or filters, each involving reagents. There can be internal losses of material in both impinger inlets and on the walls of filter cassettes. There are also issues of the efficiency of reactions of particles with reagents on filters. Impingers raise questions of particle sizes collected (for small particle sizes). For instrumental (paper tape) methods, profiling over time is easier than quantification.

Isocyanate reagents were then reviewed, efforts to use new methods to measure. HSE moved to measuring the full range of isocyanates, requiring new methods again. Rival methods have been developed around the world, with methods from **Bob Streicher** and **Gunnar Skarping** as leading contenders. Doubtless there will be new wonder methods proposed. Each of the reagents has strengths and weaknesses. Older solutions are still in use, such as Marcali, ethanol, nitro-reagents and 2MP. On occasions several detectors are required. The reagent 2PP is effective in separating isocyanates, but still finds polyisocyanates difficult. MAMA uses a detector-response ratio as a means of quantification, but the ratio is not constant. Tryptamine also uses two detectors, but is more constant in fluorescent yield. MAP (from NIOSH) combines 2MP and MAMA, and gives the most constant yield. DBA has the fastest reaction time, as high concentrations can be used. At present this is an expensive and non-routine method, though useful for quantification. The Lesage Iso-Chek™ sampler is a hybrid method, separating the isocyanate particles and vapour, but limited to short-term sampling.

There are problems with MDHS 25, from HSE. There is reliance on the EC/UV ratio being consistent, and mis-identification can occur, with incorrect quantification. To minimise errors, a comparison has been made with direct titration of polyisocyanates. Considering industrial isocyanate samples, pragmatic adjustments to the EC/UV ratio were investigated.

National standardisation has been diverse. NIWL in 1997 recommended the **Skarping** (DBA) method. HSE recommend 2MP (which meets EN 482) and Marcali. NIOSH have three methods: 2MP, tryptamine, and the nitro reagent method. OSHA have chosen 2PP. ASTM prefer MAMA, and Quebec the Isochek™. Most methods have supporters.

The ISO standardisation committee ISO/TC146 is convened by **Richard Brown**. Five methods are under consideration: 2MP; and four new work items; DBA, Isochek™, MAP and Guide on selection of procedures. ISO continue to sit on the fence.

A look to the future involves further research, into sampling methodology and a comparison of reagents. There needs to be international consensus. Patterns of exposure and improved monitoring strategies need to be investigated. When **Richard Brown** joined the Health and Safety Laboratory in the 1970s, his first assignment was to visit a polyurethane foam plant with a specialist inspector. The measurements of toluene diisocyanate vapour emissions were made using the Marcali method, which was then the best available. HSE's strategy continues to be to use the best available approach. There was discussion of the reliability of different testing methods, including possible limitations of the long-standing Marcali method.

Considerations in Isocyanate Method Development and Method Selection

Bob Streicher's presentation was based on a NIOSH review article and a starting point for the development of the ISO guide. As originator of the MAP method, he gave it some emphasis. His concern is for total isocyanate determination, dealing with vapour and aerosol, with very reactive unstable substances, and with potentially numerous compounds. He set out six steps in sampling and analysis:

Collection: efficiency problems of aspiration, internal losses and transmission losses; addressed through inhalable sampler, filters and impingers; vapour collection depends on derivatization.

Derivatization: capture, stabilization and enhancing detectability; efficiency is affected by reagent reactivity, concentration and mixing. Flexibility is recommended in sampling, covering collection and derivatization, given the limitations of both filters and impingers, and taking account the environments concerned and the duration of the sampling; filters should be extracted in the field; use of high boiling solvents was considered.

He gave an account of MAP, which in essence combines MAMA and MOPP (2MP), and identified important features of the structure. Using MAP he recommended a quartz-fibre filter. When using impingers, he recommended a non-volatile solvent.

Sample preparation: guidance was given: the fewer things you do, the better. In the MAP method, which uses solid phase extraction, the purpose of which is solvent exchange, and the removal of excess reagent. Losses are a potential problem with solid phase extraction.

Separation: separation has been dominated by reversed-phase HPLC. The Bayer method uses a bulk product for calibration. Monomers can be used for calibration in other methods. Isocratic elution has advantages: simple, stable and unvarying baseline. Gradient elution is more powerful and faster. In MAP, pH gradient elution is used. It is also powerful, selective, and gives a stable baseline.

Identification: retention time is important for monomers, while for oligomers selective detectors are needed, multi-dimensional detectors or two detectors. For identification of MAP derivatives, use bulk products if possible, and a UV/fluorescence ratio.

Most industrial hygiene samples look like the bulk products. Thermal decomposition, as considered by **Gunnar Skarping**, was seen as a separate area. Quantification only based on bulk products could be unwise. Calibrating when the composition is not known is not appropriate. Different views emerged in a spirited debate. **Richard Brown** reinforced generally agreed principles.

Quantification: there can be direct calibration curves of monomers, while for oligomers it is a matter of bulk calibration or monomer calibration. With MAP, monomers are calibrated by FL height, and oligomers by UV area.

He ended with some example chromatograms, using MAP and pH gradient analysis.

IRSST's New Developments in the Global Evaluation of Isocyanates: Surface Contamination and Oligomers Determination

Claude Ostiguy described IRSST research as concerned with workplace hazards, working with compensation boards and companies. The work relates to the needs of workplaces and the state of medical knowledge. The research field involves evaluation of monomers and oligomers, and surface contamination. Exposure is controlled, partly through ventilation, in occupations such as spray painting. This gave rise to the development of a new concept of respiratory protection. Despite these preventive efforts, some workers will be sensitized, and develop asthma. The philosophy is to keep people at work if they have contracted occupational illnesses, when it is possible to do so safely.

He described the sampling device used by IRSST in the search for traces of isocyanates, helping judgements about return to work. He then considered evaluation of work surfaces, where there is evidence of isocyanates causing skin irritation, dermatitis and potentially contribute to respiratory sensitisation. Two techniques are being used, direct (colour indicators: rapid, cheap and sensitive, but we lack chemical information on isocyanates, and availability for skin absorption, and potential inteference) and indirect (derivatization, sampling and analysis). The indirect approach is to use a filter impregnated with MAMA or MOPIP (2MP), and clear procedures. This gives effective recovery of monomers on teflon surfaces, but less for oligomers. The indirect method gives a good evaluation but is more complex and costly. The tool was used in the context of risk reduction in the work environment. He gave an example of nurses who had contracted asthma when making orthopaedic casts.

There are different systems used for oligomer sampling and analysis. There can be problems in expressing the results, given different levels of access to data. Analytical laboratories are dependent on available data, which may involve bias. Accordingly IRSST is working to separate the oligomers, characterising their structures, determining retention times and response factors. Evaluation of results from different laboratories is difficult, but an improved way forward is possible.

Activities of the German Committee for Hazardous Substances on Isocyanates

Valerie Wilms described the committee which is the advisory council for the German Minister of Labour, determining the state of the art relating to the use of hazardous substances in the workplace, not undertaking research, but evaluating international research. The investigation of workplaces where isocyanates are used shows sensitisation of respiratory organs, even if airborne concentrations do not exceed legal limits. This can cause occupational diseases, especially in construction and machine industries, using adhesives, foams and coatings. German occupational limit values apply to monomers only. There are no occupational limit values or measuring procedures for NCO-groups for daily practice in Germany. A list of typical workplaces is being established, helping occupational health specialists. There is little information on dermal exposure. A new isocyanates project group has been established, chaired by **Valerie Wilms**, to coordinate the work of sub-committees and suggest tasks and suggestions for a safe working environment. Tasks have been identified, for discussion at the next meeting on 4 May 1999. Subcommittees are to work on Carcinogenic-Mutagenic-Reproductive classification of aromatic isocyanates MDI and TDI, classification of other isocyanates, evaluation of measuring procedures, proposals for occupational limit values, and proposals for biological limit values. The project group will investigate typical workplaces, including those where isocyanates were not in use, but present. The work will take particular account of UK measures and experience. Limits could vary according to industrial sector. There is a legal framework within which German industry is obliged to operate.

Examples of MDI-Workplace Monitoring; Data from Different Production Activities; Personal vs Impinger Train Sampling

Karl Brenner noted that government demanded proof that isocyanate production was safe, based on studies of workplaces using the best available technology. Personal sampling was done with filters and midget impingers, together with area sampling using a train of large (multi-orifice) impingers. He presented data collected by the two different methods, in two drum-filling operations showing detection of both MDI monomer and polymer, but well below the exposure limits.

Field Comparisons of Isocyanate Measurement Methods

Anders Östin described how in Sweden NBOSH is organising comparative tests with field sampling of isocyanates with the 2MP, DBA and MAMA-methods as presented by **Jan-Olof Norén** above. In this work NIWL has participated performing the analysis of the 2MP impregnate according to the British method MDHS 25/3. The analyses of field samples were performed both with UV and mass spectrometric detection. Mass spectrometric detection gives superior selectivity and sensitivity, and NIWL now uses this for routine analysis of isocyanates.

Isocyanate monomers in the personal field samples using the 2MP filter method were analysed at NIWL and DBA impinger samples were analysed at Lund University Hospital by **Gunnar Skarping**. The comparisons of the personal samples gave ambiguous results. In some cases correlations were good, in other correlations were varying, depending on industrial setting, with cases where the 2MP method gave higher values and vice versa. The data indicated that well defined stationary side-by-side comparisons were needed. These experiments are now being conducted, and the results will be evaluated when available.

Recent Developments on the DBA Method for Isocyanate Measurement

Gunnar Skarping discussed exposure. Workers can be sensitized, not only to the monomers, but also to prepolymerized, biuret, alofanate or isocyanurate adducts and isocyanate degradation products. The variation of exposure with time during the production of flexible toluenediisocyanate (TDI)-PUR, was great and concentration peaks were frequently observed. A worker is exposed to isocyanates in the gas phase and to particles that, in addition to monomers, may contain other isocyanate compounds, such as dimers, adducts, polymers and intermediates.

Thermal degradation of TDI-based PUR foams releases, in addition to TDI, toluenediamine (TDA), aminoisocyanates and oligomers with 2 and 3 aromatic rings in the atmosphere. When MDI-PUR is thermally degraded, methylenedianiline (MDA), aminoisocyanates, phenylisocyanate and oligomers are released in addition to MDI.

The thermal degradation of phenol-formaldehyde-urea resins results in the formation of methylisocyanate (MIC) and isocyanic acid (HNCO, ICA). Of the total weight of mineral wool about 0.1% is released as MIC. ICA is released at the same level. Polymers such as bakelit also release the same compounds. Isocyanates are now to be observed in new areas in the industry.

A method based on the derivatisation of aromatic and aliphatic isocyanates using di-n-butylamine (DBA) followed by the derivatisation of aromatic and aliphatic amines with ethylchloroformate was presented. The determination of isocyanates, aminoisocyanates and aromatic amines are made possible. The DBA-method has been demonstrated for isocyanate-adducts, -monomers and thermal degradation products of PUR, for example when welding buses. Fast reaction rates between isocyanates and DBA were observed and the method was found to be robust, with no influence of interfering compounds. For a 0.01 mol l^{-1} DBA concentration, the reaction rate was very fast and it was not possible to study the time dependence of the reactions. The removal of the reagent during the work-up procedure greatly facilitates the subsequent chromatographic determination and allows the use of DBA at high concentrations.

The formation of atypical ions such as the m/z = 130, m/z = 156 and the $[M+I]^+$ ions greatly facilitates interpretation of the MS-spectra. Three kinds of components dominated in air samples from the thermal degradation of PUR: isocyanates, aminoisocyanates and amines. Quantification was made by monitoring the molecular ions $[MH]^+$. The use of deuterium labelled internal standards

improved the quantification. When injecting 4 μl of the 0.5 ml sample, linear calibration graphs were obtained in the range of 50–500 nmol l^{-1} with correlation coefficients >0.9965. The precision of samples spiked at a concentration of 1 nmol l^{-1} were 1.2% for HDI-DBA and 1.7 and 2.9% for the two IPDI-DBA isomers and (n=8). The precision for MIC, ethyl-propyl- and butylisocyanate were <2%. The precision of 2,4-, 2,6-TDI-DBA and MDI-DBA samples spiked at a concentration of 500 nmol l^{-1} was 0.48, 0.85 and 1.42%. The instrumental detection limit for aliphatic isocyanates was about 20 nmol l^{-1} (0.1 μg m^{-3}, 15 1), for aromatic isocyanates it was about 1 nmol l^{-1} (0.01 μg m^{-3}, 15 1). Micro-LC was demonstrated to enhance the chromatography and improve the detection limits. Efficient collection of air samples, selective derivatisations and LC-MS are necessary for the assay of isocyanates in work places.

During the production of flexible toluene di-isocyanate (TDI) foam, the relative concentration of 2,6-TDI is increased in air as compared to that in the starting material due to the higher reactivity of the 2,4-TDI isomer. Thermal degradation of TDI-based PUR foams releases, in addition to TDI, toluenediamine (TDA), aminoisocyanates and oligomers with 2 and 3 aromatic rings in the atmosphere. When MDI-PUR is thermally degraded, methylenedianiline (MDA), aminoisocyanates, phenylisocyanate and oligomers are released in addition to MDI.

Preventive and protective measures are highly important to reduce isocyanate related respiratory disorder in the industry. Better information regarding the exposure and the health hazards of different kinds of isocyanates, more and better quality of exposure data is needed. Knowledge varies on the different isocyanates, and different approaches to measurement.

Field Evaluation of Iso-Chek Isocyanate Measurement System in an Automobile Assembly Plant Spray-painting Operation

V. Dharmarahan introduced Iso-Chek^{TM}, a patented dual-filter cassette recommended for sampling the aerosol and vapour fractions of airborne isocyanates. The IsoChek^{TM} consists of a Teflon filter followed by a 9-(*N*-methylaminomethyl)-anthracene (MAMA) reagent-coated glass-fibre filter, loaded in a 37-mm polystyrene cassette. In theory, the Teflon filter collects the isocyanate aerosols and the MAMA filter collects the monmeric-isocyanate vapours passing through the Teflon filter. The Teflon filter is field-desorbed with toluene containing 1-(2-methoxyphenyl) piperazine (MOPIP) to derivatise and stabilise the polymeric isocyanates. The MAM-filter and the MOPIP-desorbate are analysed by high-performance liquid chromatography (HPLC). In this study the Iso-Chek^{TM} was compared to the nitro-reagent impinger method (OSHA method 18) in an automobile assembly plant. In this operation robotic-spray guns and turbo-bells pained automobiles moving on a conveyor in an enclosed down-draft-wet booth. The paint system was based on polymeric hexamethylene- and isophorone-diisocyanates (HDI and IPDI). Concurrent sets of Iso-Chek^{TM} and impinger area samples were collected inside the spray booth. One of the objectives of the study was to evaluate the Iso-Chek^{TM} for longer-term sampling.

To obtain statistically comparable sample sets, the paint-spray atmosphere was directed uniformly into a draught-free chamber where the side-by-side sampling was conducted. The chamber consisted of a round 2-gallon plastic bottle with a 1.5-id opening and a 7.5-id body. The bottom of the bottle was cut out and mounted upright on a specially made wooden base. Four Iso-Chek™s and four impingers were symmetrically mounted inside the bottle with their inlets facing up at the same height. The samplers were connected to battery-operated pumps outside the bottle via 0.25-id tubing through holes in the base. Five 0.5-od holes were drilled in the base (one in the centre and four at the periphery at right angles) and connected to a vacuum/pressure pump via a manifold. The total airflow into the bottle was maintained at isokinetic flow by the vacuum/pressure and the eight sample pumps. Four isokinetic-sampling-bottle kits were constructed and used for the study. Seventeen side-by-side sample sets (four Iso-Chek™s and four impingers per set) were collected in the spray booth for comparison. Sampling times were 15-, 30- and 60-mins. The 15-min samples were collected in high-concentration areas; the 30-min samples were in high- and low-concentrations and the 60-min samples were in low concentration areas. The impingers were wrapped in disposable Kwik-cold ice packs to minimise solvent evaporation. Immediately after a sampling session, the Teflon filters were desorbed with 2 ml of toluene with MOPIP reagent. The MAMA-coated filters were *not* desorbed in the field. The Iso-Chek™ samples were sent to a certified laboratory for analysis. The impinger solutions were transferred to amber bottles and sent to Bayer laboratory for analysis.

Previous studies have reported underestimation of polymeric isocyanate concentrations in paint spray environments by the coated-filter methods compared to the impinger methods. However, in these studies the coated filters were not field desorbed. A 1998 NIOSH study showed acceptable correlation between Iso-Chek™ and the impingers; however, the study did not rigorously control the sampler-inlet orientations and the atmosphere uniformity for side-by-side comparison.

The two methods were compared. The Iso-Chek™ consistently underestimated both the monomer and polymer concentrations, by comparison with the impinger. The difference was particularly marked for HDIs. However, because of the poor quality-control recovery of the Iso-Check™ analyses, no definite conclusions can be drawn about the performance of the Iso-Chek™ for monomers.

Future Directions for Quality Assurance of Isocyanate Measurement

Eddy Goelen's presentation addressed quality assurance issues in a European context, reviewing the current scene and considering future options. He referred to a 1991 European Commission workshop on the Standards, Measurement and Testing Programme. He was surprised that in the earlier parts of the current workshop there had been no discussion of reference materials and certification. In 1991 the European Commission had decided that reference materials should be prepared for isocyanates. Certification of new methods would then be through inter-comparison. The specified stability studies have been undertaken, and Certified Reference Materials have been prepared, and can be obtained from the Community Bureau of Reference (BCR). The Dutch NMI, who undertook the work

for the European Commission, produced a set of reference materials, certified against the CRMs, and these are now available. There is in addition the COMAR database of reference materials from all over the world, with 13 providers. However, searching this database, the Laboratory of the Government Chemist in the UK were unable to find reference materials for isocyanates.

There are independent comparison schemes. The revised focus tends to be on laboratory methods, with specified standards for items of equipment. There are means of establishing comparisons, for example with vapour atmospheres. **Eddy Goelen** had explored appropriate target values, and identified commercially available methods and technologies for generating such atmospheres, such as permeation tubes, diffusion tubes and direct injection techniques. The challenge is immense, and more continuous comparison schemes are required. A Quality Assurance scheme is needed with assesses workplace air methods, validates methods, evaluates performance characteristics of direct reading instrumentation, and allows an assessment of the effects of interfering compounds on currently applied measurement methods. More research is needed on research on methods and techniques for production of realistic synthetic vapour phase mixtures of isocyanates, and the same for aerosols.

The Unions' View on the Isocyanate Problem

Lars-Erik Folkesson works with the metalworkers concerning health and safety, but with interests in products used in the car industry. There had been a problem in a factory in Southern Sweden, making safety seats for children, where women developed asthma. The risk became apparent. It was thought that the problem had been solved, but new problems have arisen, resulting in media coverage of problems with heating isocyanates. This can be a problem with vehicle repairs, where heat is involved. Contracting an occupational illness can mean that the worker is obliged to move to a new job. Some current ventilation systems are clearly inadequate, and smoke reaches the lungs, throat, nose and eyes. Actual work practices are somewhat different to laboratory conditions, and official laboratory-based recommendations are not always observed. Conditions have been improved, but problems remain. Heating paints leads to isocyanate emissions.

Most factories and garages are very small, and engage in dangerous practices. The most problem is the poor quality and use of data sheets concerning particular products. It may be falsely claimed that products do not contain isocyanates. There needs to be work with substitutes, and research on developing more substitutes. Isocyanates have considerable advantages when used as adhesives, and faster setting means more money for garages. Education is vital, for all workers with isocyanates. This is starting, with Volvo using their own handbook and courses. Small garages and repair firms can be missed. Measurement must increase, and the equipment easy to use, if risk is to be assessed. Medical examinations must be available. There needs to be better health and safety equipment, coping with the fact that isocyanates can be produced in the factory, for example through heating. There must be more research.

Nordic trade unions have produced publications concerning isocyanates. Metalworkers should not in future be obliged to retire early due to ill health.

Conclusions and Recommendations

Richard Brown had prepared a set of conclusions and recommendations, some political, some technical. The conclusions and recommendations were discussed in the group and revised, and the following text was accepted by all participants.

Isocyanates result in more reported cases of occupational asthma and similar respiratory disorders, than any other group of chemicals, other than asbestos. Industrial uses of isocyanates include manufacture of polyurethane foam, surface coatings, adhesives and textiles, and occupational exposure can occur, particularly in processes involving heating and spraying isocyanates. Most countries have adopted occupational limit values based on monomeric isocyanates (such as TDI). However, polyisocyanates (diisocyanate polymers or prepolymer adducts with polyamines) and low molecular weight isocyanates (such as MIC) are also used or can occur industrially. Toxicological evidence suggests that they should also be included in setting appropriate harmonised limit values.

Methods exist for the determination of airborne isocyanates. These are mostly complicated, expensive, and require a high degree of technical competence. There is a need for simpler, more cost-effective methods. This would facilitate monitoring by Small and Medium Sized Enterprises (SMEs).

There is a need for the further development of sampling and analytical methods for isocyanates, particularly airborne, but also for dermal exposure and biological monitoring. Where possible, such methods should be simple and cost effective, and distinguish between vapour and particulate isocyanates. Sampling and analysis methods should be supported by validation (such as according to EN 482), quality control, quality assurance and certified reference materials. The relative toxicity and metabolism associated with health effects of different isocyanate species should be further investigated in particular connection with setting limit values and improving biological monitoring.

Cases of occupational asthma have been observed where no measurable isocyanate in air were identified, implying a deficiency in the sampling and analytical methods used and/or an incorrect limit value and/or exposure via routes other than inhalation. For this reason, air measurements should be seen as part of an occupational hygiene assessment that might also include estimates of surface contamination, skin absorption and/or biological monitoring and health surveillance. In cases where isocyanate exposure cannot be prevented by substitution or minimised by engineering controls, and is controlled by the use of personal protective equipment, particular attention should be paid to the correct selection, maintenance and use of such personal protective equipment.

Workshop Participants

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Reflections on the Workshop

This was a technical workshop, with experts prepared to admit to gaps in their knowledge. The field is defined in scientific terms, but practitioners operate in different contexts and legislative environments. The science is far from simple, different technologies are in contention, with the shared objectives of detecting isocyanates, and reducing the threat to health at work. Tens of thousands of workers face exposure in each member state. Science reflects national cultures and political priorities. There are issues regarding manufacturing and use in different countries, and the approaches of multinational corporations to local standards. It is not enough just to check standards of laboratory procedures. There are particular problems for SMEs, where health and safety procedures may be more limited, trade union representatives lacking, and specialist knowledge absent. If there are to be effective and consistent regulations, there need to be appropriately equipped laboratories, flows of necessary information, effective inspection systems and commitment by the social partners.

4. Prevention of Work Related Contact Allergy

The workshop was held at Krägga Herrgärd, near Stockholm, 27–29 August 1999, and led by Torkel Fischer.

Trends in the European Labour Market: Expected Changes in Work Structure and Employment

Torkel Fischer focussed on human resources within employment. He highlighted the agriculture, manufacturing and service industry sectors. The balance of employment varies between the 15 member countries, with a general decline in agriculture and manufacturing industry, and an increase in services over the past 25 years. Agriculture in the future is likely to employ 2–3%, with 12% in manufacturing, and the rest in services. He divided services into routine production service, intellectual and personal services. The highest growth is in hotels, catering, education, personal and business services, health and leisure. He addressed population issues, and other factors affecting health. He set out a paradigm shift, with new patterns of work and the emergence of a post-industrial service society, with a moral dimension.

The EU population will grow, by expansion of membership rather than a growing birth rate. Birth rates are falling. The population is ageing. By 2025, almost 30% will be aged over 65, and half of the world's population will be aged less than 18. The costs of services will be considerable. Lifetime employment patterns are changing: we can see shorter working hours, flexibility, earlier retirement, shifts in employment patterns and social dumping, where European jobs are lost to cheaper markets overseas. Urbanisation will continue, with migration to attractive areas. Automation and computerisation continue, affecting manufacturing, transport and services. The gender balance of work activities is changing, with the imbalance in employment reducing. Education is involving more students, and on a lifelong basis, presenting problems for those with little education. Internationalisation will continue.

The political and regulatory framework is hard to predict, involving changes in bureaucracy and social welfare. Market forces may become more dominant, while some will argue for a return to a planned economy. This poses demands for products, services and safety, and challenges our use of time. Better logistics should reduce the use of transport. Energy developments are not clear, in the areas of nuclear power and carbon fuels. War and defence issues will present further challenges.

Incidence of Work Related Contact Dermatitis

Thomas Diepgen dealt with methodological issues. Occupational Skin Diseases account for the majority of notified cases of occupational illness; most are contact dermatitis, of which most are irritant dermatitis, and the balance allergic. Overall about 0.7% per 1000 workers have occupational contact dermatitis. He concentrated on hand eczema, comparing point prevalence with one year

prevalence, showing a much higher level of reported problems. Different data sources within the same country show disparate levels, including much lower levels where compensation is concerned. There is no standard accepted definition of hand dermatitis, though there is common experience of disease progression. Much data comes from patch tests, which suffer from bias, from worker reports and compensation decisions. Treatment is by diverse professionals, working on varying scales in different countries. It is hard to undertake formal studies of such cases. Concerning work related hand eczema, looking at improvements after cessation of work, confirmed the link with work. However, about a third of the cases involved medical treatment, less by specialists. In less than 10% of cases was sick leave involved. He concluded that 10% of the population risk hand dermatitis each year.

Research in Bavaria showed half of the employees as women, who suffered more dermatitis. Hairdressers and metal workers were particularly affected. Almost 6% of hairdressers had occupational contact dermatitis. Age patterns vary, with 19-year old hairdressers and 33 year-old metal workers as the medians. 10% of hairdressers under the age of 25 faced the problem. Prevalence is higher among women than men, among bakers and confectioners. Risks between specialist groups were compared, among metal workers and construction workers.

He reviewed international findings, having explained the difficulties of comparison. The answer was to use incidence-based data. There is no standard definition of cases. Exposures vary, and change with time. Subjects with severe skin problems leave the workforce. Comparison is fundamental to epidemiology. Work in Finland on dentists and nurses compared incidence rates in 1982–1984 and 1992–1994, taking into account the numbers of professional workers in those categories. The nature of the work, and the inherent level of risk, may have changed over the period. The key is not so much absolute risk, as incidence rates for those exposed and due to exposure. There are techniques for determining association with particular exposures, offering the use of relative risk, associated with particular exposures, and attributable risk, which can be attributed to particular exposures. The attributable fraction is then derived from a study of the population concerned. He cited the work of Doll and Peto on smoking, which demonstrated the case for stopping smoking, in terms of reducing attributable risks of heart disease. He took a similar approach to wet work and the use of cutting fluids with chromate exposure. Exposure to wet work is much greater, and more cases could be avoided by focussing a prevention programme on wet work, rather than chromates. A final comparison was between 5000 bakery workers and 88,000 health service staff in North Bavaria. The relative risk was higher for bakers, but the attributable risk was higher for health service staff. The figures were on a national basis: what would be the impact on policies of transnational firms, using this kind of analysis? In the case of hairdressers, relevant products have been withdrawn.

Non-occupational and Constitutional Factors Modifying Work Related Skin Disease

Kirsti Kalimo noted that changes in working life mean more workers going into service occupations. Hand eczema rates have increased, and there is scope for improving the situation, taking into account non-occupational factors, including gender, age, history of skin diseases and allergies. Despite well-known risks of

nickel allergy, ear piercing continues to increase, so more general measures are needed to improve the situation. There are factors from family life (including children and hobbies), socio-economic background, educational capacity and employment possibilities. These factors impact on dermatitis, including ownership of a dishwashing machine, and involvement in wet work. Numerous forms of activity can affect the skin, including exposure to wet work, friction, food, animals and climate change. There are many risk factors, and with a diseased skin, dermatitis is made more likely, due to the reduced barrier function, increased irritability and mental strain. Studies show the links of atopic dermatitis with particular occupations. Hand dermatitis and chronic widespread dermatitis before the age of 15 increases risk of later disease.

Atopic skin diathesis is a risk factor for hand dermatitis, and there are links with mental strain. Previous mental problems enhance the likelihood of incidence. Considering sick leave across patients, in total frequencies were similar but out of their sick leave, atopic dermatitis patients had more due to dermatitis. 30% had some level of employment difficulties linked with dermatitis. There is variation between individuals, and it is hard to generalise about atopic dermatitis. The prognosis is worse when it is widespread. Wet work with chemical exposure increases risks. Work changes tend to take place early in employment careers, with later changes uncommon. Occupational guidance should take into account histories of hand dermatitis, atopic dermatitis and allergies.

Construction: Glazing, Painting, Lumbering, Carpentry, Cement Work, Ceramic and Glass Industry

Pieter-Jan Coenraads had written a thesis on the construction industry, which involves numerous occupations. Allergens are associated with particular specialist occupations. The level of the problem is hard to assess, as published figures are the tip of the iceberg. Generalisations are often meaningless. He discussed reducing the chromate content of cement, implemented in some countries, and not in others. Figures from Denmark illustrated different interpretations of statistics. Considering incidence rates, improvements due to chromate reduction by ferrosulfate are shown to have been minor, both in hand eczema and chromate allergy, without addition of ferrosulfate. In the Netherlands there had been a fall in chromate allergy. He considered sensitization rates for common allergies, concentrating on chromates in men, and showing reductions over time. There are opportunities to study country variations.

Considering paint, he listed miscellaneous compounds, many of which are potentially allergenic. This is a consequence of replacing solvent-based paints by water-emulsion paints. Developing comprehensive prevention programmes would be complex. Epoxy and concrete work presents different problems; potential contents of epoxy resins are diverse, used in different concentrations and applications across Europe. Roofing work is different again, with new surface treatments, but problems of reactions. Glass fibre dermatitis presents problems, with variations of impact in compounds concerned (diameter, length of individual fibres). Turning to wood, he discussed patch testing, the need for knowledge about what is going on, and the difficulty of transferring knowledge from specialists to the ordinary workplace.

He presented an approach to risk inventory. If there is wet work, are liquid substances involved and gloves used? Are hazardous chemicals used; is there soiling of the skin; are there physical agents? The next step checks duration and quantities, the extent of contact and contamination, and the nature of microtrauma, and then the frequency and intensity of the exposures. Information is needed on formulations and remedies. Cases over the past 12 months can be reviewed, using reliable registers.

At the European level, there are problems of specialisation in SMEs. This is compounded by migratory workers, who are hard to deal with. There is an expansion of Do It Yourself, with the re-emergence of chromate allergies: here a chromate reduction programme seems desirable. As an alternative to ferrosulfate, tin salts are currently being tested. There needs to be job specific workers' education and knowledge dissemination, coupled with information for the general public. A European wide approach is needed, including development of alternatives to harmful materials, and implementation projects.

Office Work

Carola Lidén indicated that office work is not a major source of contact allergies. The Swedish and European situations are different. In 1870 over 70% of Swedish workers worked in farming, now fallen to 4%, while office work has increased greatly. This provides a new context in which to consider occupational health.

There have been a series of "epidemics", many including dermatological complaints, including carbonless copy paper, "repetitive strain injury", sick building syndrome, visual display unit problems, office illness, sensitivity to electricity, multiple chemical sensitivity. In the coming years there may be new problems associated with new technology. Different groups have played roles: physicians, engineers, mass media, trade unions and occupational disease compensation schemes. There are contact allergens in offices, including nickel; rubber; colophony (in paper and floor polish); inks, dyes and resins; thiourea (old technologies for photocopying), plants and cosmetics. There are skin irritants, including low humidity, paper, paper dust, solvents, soaps and detergents, and glass fibres (exacerbated by problems with air conditioning).

As for the future, there will be new "epidemics", whether chemical, physical, psychological or concerning work organisation. Dermatologists need to be involved where skin is concerned. They need to be ready, offer examinations, make diagnoses, make workplace visits, undertake epidemiological studies and controlled provocation studies, and ensure reliable information is provided.

Manufacturing: Rubber, Plastics, Electronics

John English took up the theme of small manufacturing enterprises. The UK is the sweatshop of Europe, with workers getting a poorer deal and lower wages. Manufacturing processes have improved in the past 15 years. He recalled visiting a rubber company with appalling occupational hygiene. Automation has reduced exposure to allergenic additives. We need to improve awareness of other allergens. It is a question of determining which allergies are most significant.

Prevention can be improved through automation, education of the workforce, and improved personal protective equipment. Similar messages can be derived from plastics and electronics. Plastics products can be introduced without proper testing and labelling. Complex substances such as isocyanates require understanding and proper working conditions. The same chemicals can emerge as causing problems in different processes, and patch testing needs to be extended. Electronics is becoming cleaner, with limited exposure to allergens. There is general professional awareness of the technical hazards.

There is no case for complacency, but "education, education, education" for small businesses is the theme.

Manufacturing: Chemical and Drug Industry, Laboratory Work

Annick Barbaud was concerned with the pharmaceutical industry and health care workers. There are numerous allergens described in the literature, and plants and equipment have been studied. New products can exacerbate sensitization to d.limonene and epoxy. There can be strong allergic reactions to immersion oils, leading to formula changes. Cases tend to involve maintenance technicians and young chemists: preventive information is important. One third of laboratory workers working with furred animals develop allergies, typically after about a year. We can identify risk factors in terms of atopy and work-related previous symptoms. Exposure is an important question for those handling animals. There needs to be screening for atopy. Exposure reduction can be expensive, so prediction is better value. In chemical dermatosis, allergies can take years to develop, linked to dust in the working environment. A number of further diseases can be encountered, but the most significant is eczema. There are risks of systemic contact dermatitis, from antibiotics and propacetamol. Sensitization can derive from final or intermediate products of pharmaceutical manufacturing, or from their vectors. Many successful drugs have had allergenic consequences for the workers concerned.

She highlighted particular molecules, drugs based on amino-acid esters, sensitization to vectors, and drug extraction from plants. There is a higher risk in small companies with manual production. Risks are higher with chemists and laboratory workers than packagers and handlers. Personal protective equipment is available, and pre-employment screening has been proposed. In the workplace drug dust exposure should be reduced, using closed systems and less dusty granules. Foreseeable risks should be reduced, with improved information for health care workers, and reporting of problems at national and international level. Transfer systems should be improved.

Educational Material for the Prevention of Occupational Dermatitis

Daniel Perrenoud cited entions of the importance of education, and the need to transmit the necessary information to the wider population. He described a new educational programme, which is about to be launched on a national scale in

Switzerland, sponsored by a pharmaceutical company. Overhead projectors were preferred to slide projectors, and the standards of marketing professionals were adopted. The teacher has to set the example, incorporating the message of prevention within the teaching. He presented a videotape, concerning the hand, with strong visual impact, music and attention-grabbing messages, in French, German and Italian. The message is followed by a simple explanation from the teacher using 23 OHP slides. He gave a rapid presentation, using the English language version of the slides. Classical diagrams are given a less formal context. Covering, for example, cumulative irritation, a more complex picture is presented, taking different professions in turn. Irritation is then presented as opening the door to allergy, using personal case studies. The contrast is made between viruses and allergens, in terms of their relationship with immune systems.

Once an allergy is established, it may well mean that the person has to change professions, with all the economic and personal disruption that involves. The only cure is prevention: avoidance, taking care of hands, being careful with gloves, and using hand-creams. The presentation ends with the participants applying a sample of hand-cream which is included in each kit. This may be the first time that a hand-cream has been applied, so this physical activity is psychologically vital. There is scope for local adaptation in other countries. The materials are printed and bound for use by teachers, with video, slides and samples, together with more formal reference materials.

Manufacturing: Shoe, Tannery, Textile Industry

Patricia Podmore discussed *tanning*, considering different treatments of hides. Vegetable tannins are less common than chrome in developed countries. Synthetic methods are gaining popularity. All tanning systems have allergenic elements. Fat liquoring oils are not problems in themselves, but additives and dyes cause occupational health hazards for tanners and shoemakers. Leather finishing is becoming more complex, as leather is used to do different things, but problems largely derive from biocides, varying with the country of source of the leather. A major item of footwear today is the running shoe, with small proportions of chrome tanned leather content. Chrome dermatitis may therefore occur in manufacture.

The *shoe industry* is old fashioned and hands-on, with problems related to where the worker is employed in the factory, and the level of mechanisation. Adhesive contacts are common, and can cause contact dermatitis. Mechanisation removes some problems, but certain stages in the process must be manual, including shaping, inserting and cutting of heel and toe counters. The key allergens are mainly on the standard battery. Trimming and finishing can involve solvents and dyes. Gloves may not be easy to use in shoe manufacture because of adhesives. It is unsurprising that the shoe industry in the UK is in decline, with jobs moving overseas.

The *textile industry* has a largely female workforce. At the spinning stage it is highly automated, but hands on contacts present problems. Spinning oil is treated with biocides, and solvents are used to remove marks. Gloves slow down workers, and tend not to be used. Flax spinning continues, a traditional industry. Problems can come at the bleaching stage, with wet work and chemical additives. Spinning is

hands-on, and gloves are hard to wear. Additives, dyes and chemicals are required to meet current market demands. Dye use is hard to monitor. Pressing the fabric can lead to formaldehyde exposure. Flame retarders can be a source of exposure. Dyes are a problem, linked to dye fastness, and possibly accompanied by fixing agents. Dye mixes are hard to make simpler and specific. New materials such as lycra, requiring dyes and silicon coating, involve increased textile worker dye exposure. There are numerous allergens involved; it is useful to have a battery of tests for each company regularly dealt with.

Improvements can be made in working conditions, improving industrial hygiene, using appropriate emollients, changing work practices, and minimising the use of allergens. Workers can present a range of responses to dyes, including respiratory symptoms.

Service: Medical Care, Dental Care, Foot Care, Hairdressing and Cosmetic Work

Reinhart Jarisch runs his own clinic, after many years at the university in Vienna. Prevention of occupational contact dermatitis is the key, with irritant dermatitis much more significant than allergic dermatitis. There is a seasonal influence, particularly on irritant forms. There can be atopic influence on irritant dermatitis. In certain areas atopic dermatitis is unknown. The difference is made by sun and humidity. The use of a humidifier from October to April can be helpful. Seasonal changes in irritant dermatitis were plotted by month, showing lower frequency in summer months.

Atopy can be a risk factor. The literature has considered latex, glove powder, and disinfectants in medical care. In dental care formaldehyde is used, but is an allergen, and may produce serious delayed responses. Hairdressing, as with medical and dental care, involves irritant dermatitis. Particular allergens, if detected, may suggest that particular workers should not enter the profession. Shops should improve ventilation to remove the smells. He reviewed patch text reactions over three years, highlighting metals as the main causes. Considering age and gender, more young women are affected, and he recommended testing for fragrances. Irritant contact dermatitis tends to be overlooked, partly as the tests are time consuming. He argued the case for patch tests, suggesting when tests for metals should be accompanied by tests for fragrances. Artificial nails can cause contact allergies; patch tests were advised. Leather watch bands can produce contact sensitive reactions: the problem exists but the cause is unclear.

He analysed responses from reactions to nickel, identifying appropriate indicators. Illustrating unusual dermatological disorders, he looked at potential medical responses, including tetracyclin, when the use of latex gloves should be avoided. The key is to have tools and solutions which convince the patient.

Manipulation of Allergens

Jean-Pierre Lepoittevin asked if it is possible to prevent work related contact allergies by manipulating allergens. Why do industrial companies use chemicals

which cause these problems? It can only be because of their interesting properties: physico-chemical (solvents, surfactants and preservatives), biological (drugs, preservatives, biocides etc) and chemical (glues, monomers, dyes etc). Modifying these chemicals in practice means trying to keep the salient characteristics, while removing the sensitising factors. He presented a model of the reactions concerned, incorporating the dose, level of skin penetration, and reactions between proteins and haptens. Modelling takes into account time, affected by diffusion parameters. Often sensitising potential is closely related to the properties of the molecule. When trying to control sensitising, it is a matter of dose, chemical reactivity, physico-chemical parameters, and antigenicity.

These factors have been known for years; studies have been made of the consequences of changing molecular structures, tested with guinea pigs. Confirmation comes from tests with mice, and the correlations between parameter changes have become clearer. Sensitisation does not vary with dose lipophilicity and reactivity on a linear basis, suggesting considering of both. There are few examples where major biological changes have resulted from chemical changes to compounds. In these cases, sensitisation has been reduced. Reactivity continues, but with different amino acids. Reaction rates are similar, but with different levels of sensitisation. The nature of the amino acid is significant, but in a way we do not fully understand.

There are two methods of reducing sensitisation; by changing skin penetration or chemical activity; we should change parameters which control sensitising potential, while trying to keep the original properties. It is more difficult to modify a chemical that is on the market, rather than implementing preventive measures. Sensitisation must be considered at the development stage. This entails risk assessment: hazard (intrinsic toxic properties); potency: (strength of intrinsic toxicity); exposure and risk, but pharmaceutical companies care little about sensitisation.

Expert systems can be used to analyse properties of molecules, predicting sensitisation potential, from the earliest planning stage, in contrast with animal studies or in vitro tests. This depends on sound databases, with identification, allergological data, technical data, and evaluative information. Expert systems do not decide, but help decision making. They bring together literature, reactivity, structure and decision criteria. Systems can be multi-parameter empirical, or cognitive in basis.

1. In the first case the starting point is the molecule, split into fragments, listing hazard indicators, using a database with molecules whose data is known, and making statistical comparisons. Resulting hazard indicators have little to do directly with skin sensitisation, but involve quantification of measurable variables. The database includes molecules with known properties, described by the same indicators. Conclusions are statistical, indicating probabilities. The danger is that two molecules with the same indicators may have different sensitising characteristics.
2. The second approach is to use rules, applying knowledge that we have on skin sensitisation from the literature and the chemistry. Analysis extracts information which is matched against rules to determine risk. When a totally new molecule is involved, the system cannot be used. As knowledge develops, the accuracy increases. Sophisticated conclusions can be reached.

The next stage is to consider structure-activity relationships, drawing on the databases and expert systems, defining quantifiers, defining one or more steps in reducing sensitisation, and quantifying parameters. We reach a relative alkylation index, experimental conclusions linked to biological evidence.

Manipulation of the Immune System

David Basketter argued that manipulation of the immune system should be a last resort. There are better opportunities for prevention of allergic contact dermatitis via risk assessment and education. Chemicals and secondary signals can be manipulated, as can irritancy. The importance of danger signals is becoming understood. There are opportunities for changes to chemical allergens to reduce their allergenicity that do not affect the immune system, but they tend to reduce functionality of chemicals concerned.

He considered the induction process in stages: skin metabolism, antigen processing, Langerhans cell migration, Langerhans cell interaction with T-cells, and clonal expansion, and gave a brief overview of elicitation. We know very little about skin metabolism at present, such that its modulation would give rise to unpredictable effects on contact allergy. Antigen processing can be blocked, for example with chloroquine, but this may not affect allergens which do not require processing. Loss of peripheral immune surveillance would be a cause for concern. A number of methods can be described, but with worrying consequences. There are specific treatments.

Novel ideas are available from investigative dermatology research. The dendritic cell can be treated; various antigen processing functions can be inhibited, T-cell receptor assembly can be inhibited, non-immunosuppressive anti-inflammatories are attracting interest, and Langerhans cells can be immobilised. In general, disrupting normal cutaneous immune function is a cause for concern. At this stage of knowledge, it is better to work through prevention.

Risk Assessment and in the Future

Ann-Therese Karlberg argued that dermatologists should take part in European regulatory work, enhancing preventive work. She cited an article by **David Basketter** and others in *Contact Dermatitis*, developing a European classification. The criteria for classification of a skin sensitiser were set out, including guinea pig tests, local lymph node assays in mice, positive data from human experiments and positive patch test data from at least two sources. The substances must be labelled "may cause sensitisation by skin contact", and products containing 1% of the substance must be labelled, as a default value. This does not take account of the relative potency of, and risk arising from, different substances. WHO have classification criteria, linked to epidemiological studies, correlation with exposure, data from more than one patient, use of independent centres, and sensitisation data from animal tests. Quantitative estimation of relative potency is recommended, distinguishing strong and frequent sensitisers. Potency and exposure information are needed. Information should be based on actual risk to man.

A second article in *Contact Dermatitis*, by **Karlberg**, **Basketter**, **Goossens** and **Lepoittevin**, discussed problems of substance change during handling and storage.

One example is limonene, used in hand cleansers and as an industrial defatting agent, which is affected by air exposure and gains in sensitisation. The addition of anti-oxidant changes the sensitising characteristics. Should the same health warning be used? Analysis of oxidation of alcohol ethoxylates shows the consequences of decomposition, and raises questions of classification. What should be included in databases? Single classifications to cover substances and their oxidised forms are a matter of controversy. Susceptibility to oxidation needs to be taken into account, with a note indicating that the primary structure is not a sensitiser. Complex mixtures which inevitably contain sensitising oxidised materials should be classified.

The Nickel Directive

Carola Lidén presented the 1994 Nickel Directive, due to come into force in 2000. The context is nickel used in piercing and in skin contact, and CEN standards on the nickel release from products in direct and prolonged contact with skin. She was a member of the European committee determining the details; it is now a matter of implementation.

She addressed sensitisation, largely privately encountered, and the prospects for improving the situation. In Denmark there has been legislation since 1989 limiting nickel release, and sensitisation to nickel is falling. In Sweden there has been legislation limiting nickel content in ear piercing posts, with minimal impact. Recent survey work in Sweden has assembled data related to current products, and many manufacturers and retailers have policies in line with the Directive. The Directive is important, and needs to involve the work of dermatologists. In Sweden the authorities are being brought together to plan a campaign, including information and control.

Prevention Through Minimising and Elimination of Harmful Exposure

Enzo Berardesca discussed occupational categories with particular problems with contact dermatitis. The challenge is to reduce or eliminate exposure. No contact would mean no dermatitis; changes in the working environment can make a major difference. We thus consider *dermatological engineering*. It is vital to involve engineers, and to address skin management. The occupational health team are all concerned in policy and practice. Hazards need to be identified: the wrong substances in the wrong place at the wrong time. Risk assessment includes monitoring and measuring exposures, rating risks, and considering whether the level of risk is acceptable. If the risk is unacceptable, actions must be taken to remedy the situation, changing the environment and protecting the worker. Exposure needs to be controlled and reduced, eliminating dangerous substances, changing processes and replacing key substances. Next the person needs to be controlled, with skin care and hygiene, as a result limiting effects.

Personal hygiene is a key issue, with dermatologists playing a major role. Hand washing needs to be effective, removing particles which could penetrate the skin. Skin care is then addressed, involving, for example, barrier creams and the restructuring of the skin barrier.

A range of substances are involved in soap treatment, with different linoleic acid contents, and effects in improving skin protection. The right mixture of lipids can improve the recovery of barrier functions. Mechanisms can be immediate, intermediate and longer term, with different impacts on layers of the skin. Monitoring is important, visually and clinically, taking health surveillance to the state of the art, and supporting predictive testing.

Education is vital in the training of staff and instructors of young workers. Most young workers do not fear skin disorders, and lack reliable sources of information. The media and colleagues are more influential than advice from doctors. Personal protection equipment, including gloves, was considered. Gloves can be penetrated, and deteriorate with age. Protective equipment can constitute a hazard to the user, giving chemicals access to the skin. Most workers never use gloves. Increased awareness and better training are needed. Dermatologists and their expertise are needed by industry, with a dermatology engineering approach. We are all two microns from death.

Laws and Regulations to Reduce Occupational Skin Disease: A Political Desiderata List

Jose Camarasa commended work on prevention of skin disease, being undertaken in Spain under recent legislation. He presented an account of professional illnesses, covering the situation in Spain before 1995, with chemical agents as the leading cause, then cutaneous dermatoses, substance inhalation, infection of parasites, physical agents or systemic agents, covering all disorders linked with the working environment. Occupational dermatoses represent 48% of all professional illnesses. Previous criteria for personnel selection were in terms of designated illnesses, including diabetes and backgrounds of cutaneous allergies. Rules covered medical checks, diagnosis and qualification for disability. Workers were to be provided a new job, or declared totally disabled. Workers had rights, and costs needed to be met. From 1995 there has been a new law, concerning prevention of labour risks, deriving from the European Framework Directive. Every industry must have a prevention service or prevention department, following the guidelines of scientific societies, who have to establish information systems concerning risk, epidemiology and training.

In general, worker health is to be promoted, preventing risks, studying labour microclimates, monitoring health, providing information, and furthering prevention. Principles of preventive action have been set out, with a National Institute of Security and Health and associated services. Duties are assigned to businesses and workers, including cooperation with businesses. However, there is only one national centre, no university hospital has a department of occupational dermatosis, and only a few have good units. Most specialists in work medicine know nothing of work dermatology, and dermatologists in social security and insurance are not trained in work dermatology. Companies do not consult

dermatologists in staff selection. Relations between company doctors, senior technicians and expert dermatologists are poor, and economic factors are given precedence over health. Dermatologists tend not to visit the workplace. Improving prevention means improving overall action, and changing the culture. He argued the case for an international commission of dermatologists, experts in occupational dermatosis and contact dermatitis, with an influence on decisions to improve prevention in all countries of Europe.

Occupational Guidance, Education and Ethical Aspects in the Prevention of Occupational Skin Disease

Birgitta Meding described occupational skin disease as common, affecting about 10% of the population of working age each year. If we can prevent some of that, it will benefit many individuals. The consequences of the disease mean considerable social costs. She drew on research in Gothenburg in the 1980s, noting medical costs, sick leave and job changes. Insurance for occupational diseases was expensive in Sweden, and the rules were changed in 1993, reducing benefits. Many face unemployment with little assistance. Prevention is therefore very important. Women face greater problems with hand eczema, especially young women, even more so where there had been childhood eczema and or nickel allergy. Dentists, bakers, hairdressers and cooks are also vulnerable. The main adverse exposure is to water and detergents, with a correlation between hand-washing frequency and eczema. The increase in the service sector involves occupations at high risk of occupational skin disease. The work is largely manual, unlikely to be automated.

It is possible for many affected people to work without problems. There has been a lack of information and guidance following earlier illnesses. A large proportion of sufferers from eczema in their youth will suffer problems in adulthood, and wet work increases the risk. Pre-employment screening is intended for prevention, and the interest of the employer is to reduce the risk of illness among employees. This can mean selecting out those with atopic dermatitis and those with nickel allergy, raising ethical problems. New workers should have proper information, it is for them to choose. A number of videotapes have been produced for educational use, intended for school students aged 14–15. This has involved a professional production company and a reference group of young people. It would be possible to make versions in other languages, using separate soundtracks.

Round Table Discussion: Strategies and Future Management of Work Related Skin Disease

Torkel Fischer gave an overview of other employment sectors, such as metal manufacturing, the paper industry, food industry, communication, trade and transport, and health care and home help services. There was discussion of the means of raising the profile of these issues at a European level. How can resources be secured to investigate exposure? Few researchers are currently engaged. It would be useful to analyse quantities of nickel on the skin. There is insufficient

understanding of the wider context, including characteristics of possible substitutes for nickel. There should be an ESCD working party on Education. There must be evaluation of measures taken, reviewing the effectiveness of campaigns. There is a need for multi-centre studies, and small group research. Companies could welcome involvement in the proposed studies, demonstrating the efficacy of their products. How do we interest dermatologists in preventive work? The role of the skin in the immune system needs to be developed, and emphasised in communications with the media. A proactive approach is required.

Workshop Participants

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David Basketter, Environmental Safety Laboratory, Unilever Research, UK
Enzo Berardesca, Department of Dermatology, University of Pavia, Italy
Rosemary Braun, Regional Hospital, Tromsö, Norway
Jose Camarasa, Dermatology Service, Barcelona, Spain
Pieter-Jan Coenraads, University Hospital, Groningen, Netherlands
Thomas Diepgen, University of Heidelberg, Germany
John English, Nottingham University Hospital, UK
Richard Ennals, Kingston University, UK
Torkel Fischer, NIWL, Sweden
Reinhart Jarisch, Floridsdorfer Allergie-Zentrum, Vienna, Austria
Kirsti Kalimo, Turku University, Finland
Ann-Therese Karlberg, NIWL, Sweden
Jean-Pierre Lepoittevin, Laboratoire de Dermatochimie, Strasbourg, France
Carola Lidén, Karolinska Hospital, Sweden
Birgitta Meding, NIWL, Sweden
Daniel Perrenoud, Dermatology Service, Lausanne, Switzerland
Patricia Podmore, Altnagelvin Hospital, Londonderry, Northern Ireland, UK
Bengt Rolfer, Journalist, Sweden
Carola Sundberg, NIWL, Sweden

Reflections on the Workshop

The workshop participants were all representatives of their countries on the European Society for Contact Dermatology. Although familiar with each other's published work, the group had rarely met physically, and the opportunity was welcomed. The setting of Krägga Herrgärd contributed to the success of the workshop. Given the eminence and mutual respect of the participants, the presentations were relaxed in style, and not dependent on extended use of complex terminology.

5. Rehabilitation: Prevention and Treatment for Musculoskeletal Disorders

The workshop was led by Åke Nygren, and held on 13–14 September 1999 at the office of the Swedish Trade Unions in Brussels.

Introduction

Åke Nygren outlined the work of his unit, assembling data on traffic accidents and occupational health. Is it necessary to conduct work in this area? Health care costs continue to rise. Neck and back injuries, reported and compensated, have been increasing. Sickleave has increased in Sweden, as has the total of people on disability pensions. Long term sickleave fell in Sweden, but has since increased again, presenting management problems with respect to working capacity. There are political issues, and concerns for public health policy. The impact of work organisation is now apparent.

Need for a Change

Alf Nachemson argued that the next decade has been designated by the WHO and UN the Bone and Joint Decade for prevention and treatment of musculoskeletal disorders. Interest and funding will increase: now is a time to make clear statements. Reported prevalence of back pain in the previous month is high. Back and neck pain is part of life: the question is what you do with it. Visits to doctors vary in frequency, with more visits in the UK than in Netherlands, Sweden and USA, but more in-patient days in Netherlands. The prevention of long-term sickness is economically important: the welfare state is threatened by chronic pain. Healthcare spending varies across developed countries, with Germany and France leading Sweden, Britain and Italy. Long term permanent disability is dangerous for the health, and costly for society, thus rehabilitation is important. X-rays tell us little, but are used as the basis of diagnosis. Follow-up studies suggest that the over-interpretation of X-rays must be addressed. None of the common labels have any proven value. The Journal of Hand Surgery has addressed repetitive strain injury, and made links with back injury.

We do not know what causes pain in the neck and the lower back. The association with various working conditions is weak at best. In recent decades, several studies have shown equal or better associations with various psychosocial disturbances. In particular, these seem to predict vulnerability for long term disability. Social and socio-economic factors have also been found to be associated with sickness absence. All of these problems must be addressed in rehabilitation. It is not surprising that attempts at prevention have failed. Volvo developed new workplace conditions, designed to be healthier, but not cost effective. Absence from work due to musculoskeletal pain did not fall. In the USA NIOSH recommend changes in the workplace to reduce musculoskeletal disorders, posing potential threats to the economy. The Michigan Disability Prevention Study was reviewed. Ergonomic

solutions and a "wellness" programme had negative impacts. The Daltroy Study of an Educational Programme with postal workers in the Boston area showed that recipients of the programme suffered more sickness than the control group, partly due to raised awareness of occupational problems.

Work in the UK has addressed personality issues, highlighting health beliefs and fear of pain. We need to calm early fears. Structured programmes produce results. Moving is beneficial, not dangerous, and should not be avoided. Rest and inactivity prolong healing, and inhibit recovery. Attention must be given to psychosocial factors, using evidence-based medicine. He described the work of the Cochrane Collaboration, reviewing healthcare interventions in a voluntary collaboration. A number of studies have addressed low back pain. We do not live in a perfect world, where research answers all our questions, and health care provision is driven by research evidence. Each specialist looks for his own favoured data. There have been numerous large-scale studies and reviews, and work on how to change physician behaviour. Economic policy changes can have medical impacts (for example, changing the finances of drug sales). Governments discuss physician reimbursement based on evidence. Clinical freedom may be a disguise for ignorance and an excuse for quackery. Studies in Canada considered spontaneous onset of back pain, linked with job perception. Financial aspects affect descriptions of pain origin. In Sweden, reports on back pain led to action in terms of payment for back pain, withdrawing payment for the first day of absence. Work-relatedness of injuries caused severe economic burdens, so medical criteria were tightened. Should back pain be treated by physicians or politicians? Politicians are more effective.

New solutions for back pain offer prospects of wealth, so high results are claimed, but later work tends to produce poorer outcomes. Industry will press to avoid legislation. Professionals should argue for proper testing. He dismissed a series of myths, concerning the role of rest, the diagnostic value of X-rays, and links with work disability. The need is to get the players onside: patients, primary care physicians, associated specialists and epidemiologists, employers, union leaders, media, insurance companies, and politicians. We need to distinguish constructive and negative interventions. We should meet decreasing spinal flexibility with increasing job market flexibility. There are biological differences to be addressed. People should be helped to work where they are capable of doing so, combining workplace and physical flexibility.

Clinical examination to rule out serious disease, followed by early activation and a rapid return to work, constitutes proven treatment. For those with longer term problems, psychologically based activation programmes can help minimise disability. For chronic patients, multi-disciplinary programmes including cognitive behavioural treatment can be useful. More research is needed on organic causes, requiring more funding. We lack clear evidence that work causes back pain. Money matters when we feel pain.

State of the Art on the Major Classification of Lower Back Pain

Jean Paolaggi described a systematic review of relevant articles, analysing their qualities and appropriateness for research and practice. Keywords were traced in

selected articles, classifying according to expert opinions. The most commonly used system is from the Quebec Task Force, concerned with activity related spinal disorders. Many others have been developed to work with particular diagnostic approaches or forms of treatment. Low back pain is no more than a symptom, and thus needs to be integrated in a reasoning process and to be placed in a satisfactory classification. There are weaknesses in alternative classifications, depending on their intended use. An overall taxonomy is needed, based on evidence. As medical understanding has increased, greater sophistication has been introduced in accounts of causation and presentation. We need to use qualitative and quantitative approaches. Levels of accuracy vary. Tests and treatments are expensive. More emphasis should be given to the psychosocial dimension.

Is Low Back Pain Always a Chronic Disease?

Peter Croft sees epidemiologists as in trouble. NIOSH have concluded that everything is dangerous. Even the contents of hotel minibars might cause cancer, according to the State of California. He started from the clinical assumption that most low back pain gets better within a month, which clashes with findings on recent back pain, and recurrences of back pain. The figures do not add up. The figures were based in general practice, and on assuming that patients who did not return had got better. Most people visit the GP only once, but within three months many will return, leaving only 10% still undergoing treatment after three months. Does this mean that the pain is better?

Jean Paolaggi and his group asked the patients, and concluded that 90% then had no pain after 2 weeks. The group concerned had been seen soon after acute pain. Other cohorts have had a wider perspective, and more ongoing pain. Outcome is dependent on the duration of the problem at the time of chosen consultation. Only a minority are seen as wholly free of symptoms. The longer the duration of pain at the time of initial presentation, the longer the problems lasted. A study in the USA worked with a wide range of initial presentation, and showed 70% recovered within a month. Following up later, the problems recurred. Low back pain must be seen as chronic. If attendance at a GP produces a picture of continued pain, predicted at presentation time, then health care can do little about long term back pain. If there was success in treating it, the problem would be manageable, but it continues. He presented outcomes of tennis elbow in primary care, and showed the impact of injections compared with a placebo. Some studies suggest that health care can help with back pain, but only in the short term. The more effective the treatment, the more recurrence can be prevented. We may seek to lower the density of pain and disability, and choose different targets, such as return to work.

Primary Care

Maurits van Tulder provided a systematic review of randomised controlled trials, with the objective of assessing the effectiveness of common conservative types of treatment for patients with acute and chronic non-specific low back pain. Little has been known about optimal treatment strategies, and overall effectiveness is

unclear. The literature is increasing exponentially. An assessment was made of methodological quality, taking clear criteria. Flaws were identified in many trials. Data were not homogeneous, and qualitative methods of analysis were used. Evidence was found to support muscle relaxants, NSAIDs and advice to stay active, and for the ineffectiveness of bed rest and exercise therapy with acute cases. There was strong evidence for the effectiveness of manipulation, back schools and exercise therapy with chronic cases, with short-term effects. Various countries have produced guidelines for managing low back pain, with different target audiences, all directed to an active approach in which patients are encouraged to continue ordinary daily activities and to remain physically active. Exercise therapy guidance varies, and there are conflicting views on spinal manipulation. Prevention of recurrence and chronicity is the priority.

Fear of Injury

Johan Vlaeyen discussed treatments for low back pain, most of them short lived in effect. Having worked in behaviour therapy interventions, he was in search of knowledge about mechanisms, predicting disability, rather than pain. *Why are people fearful?* Once you have been bitten by a black dog, your ideas about them change. Catastrophising involves an exaggerated negative orientation to noxious stimuli. With novel experiences, there can be a tendency to give them meaning; pain can be equated with injury. Etiological models can be developed to explain the behaviour of particular patients, where catastrophising increases the likelihood of fear and avoidance. This has generalisable cognitive and behavioural aspects. *Why do people catastrophise*? Anecdotal evidence leads the patient to fearful conclusions, building on a level of uncertainty. If fear is a predictor of disability, it can be dealt with, with interesting clinical consequences.

Does the Bio-psycho-social Perspective Work? Is It a Matter of Inconsistent Consistency or Consistent Inconsistency?

Charlotte Leboeuf-Yde maintains that methodological rigour is important when judging the quality of the evidence in the literature, but it is hard to obtain a good overview. Analysis of consistency of findings might be helpful. The objective was to investigate study results in relation to back pain, to see if some potential life-style related risk factors remain constant, when study populations and definition of low back pain vary. Smoking, obesity and alcohol consumption were considered. Three hypothetical Danish study populations were selected from a large database, and studied in terms of different definitions of back pain. Study results differed in relation to study sample and definition of "low back pain". The hardworking male study sample had lower odds ratios. Being overweight and smoking had consistent findings, while drinking had a different pattern. In conclusion, the results do depend on the choice of study population and definition of low back pain. Decision making in future should take account of these factors.

Efficiency and Costs of Varieties of Physiotherapy in Patients with Chronic Low Back Pain

Elisabeth Ljunggren noted that as health service budgets grow, there is pressure to spend wisely. Evaluations of treatment varieties depend on sensible evaluation systems and categorisations, as well as interpretation of common concepts. Medical exercise therapy is seen as saving considerable sums, while traditional physiotherapy also leads to savings. The Norwegian social security system provides support for a year. Research suggests that correlation with the back to work variable is hard to establish with treatment regimes. Physiotherapy for patients with chronic low back pain shifts focus from individual to group treatment, in a cognitive multidisciplinary setting. Studies have not used consistent criteria, or described treatment interventions in detail. Physiotherapy is the gateway to the human body, and deserves more attention. New treatments can be expensive. Should we exclude problematic patients? A Bergen back to work study screened 195 patients on physiotherapeutic lines, and then applied randomised treatment in three separate regimes, testing the validity of the screening. The conclusion was that it is a matter of individualising treatment, not applying general solutions. We need a wider perspective on treatment. Treatment should be in parallel with prevention, and is often not early enough. Variability should be used, rather than hidden.

Multidisciplinary Rehabilitation

Compensation at Sick Leave and Health-related Quality of Life

Åke Nygren provided an overview of the Swedish AGS system of sickness insurance, with a large database. The largest diagnosis is for musculoskeletal disorders. He followed progress over time, showing a large proportion of long-term sick leave for musculoskeletal disorders. Occupational differences are seen in the incidence of different causes of sick leave. There is then detailed study of particular workplaces.

Irene Jensen used the same data, concentrating on quality of life and rehabilitation. Rehabilitation has declined in significance, despite the emphasis placed on it by government in recent years. Why do so few now receive rehabilitation? Is it because they do not need it? Views of doctors on need and potential for rehabilitation were checked. There was no agreement, which means that patients in effect face random judgements with respect to needs and judgement. The study design, using the AGS database, was a randomised prospective outcome study with long-term follow-up. The objective was to assess the cost-effectiveness of the main components of multidisciplinary cognitive behavioural based intervention. There is growing evidence for effective multimodal behaviour oriented interventions; it is resource demanding, and not all patients benefit.

The study covered new cases of musculoskeletal disorder. Four different treatment regimes were used, in four different clinics. Patient motivations were assessed before treatment, and compliance during treatment. A checklist was applied to therapists, together with random observations. At rehabilitation stage, adherence was monitored. Inclusion criteria were non-specific spinal pain, sicklisted for a month, and fluent in Swedish. Searches were made for new cases each month, and those included were interviewed by telephone and examined. During the eight weeks specified, the majority left the sick list. The database covered only blue collar workers. Health related quality of life varied, and this survey showed diversity across the different clinics. Those who dropped out of the study suffered more from depression and alcohol problems. Those who rejected rehabilitation were more likely to have been refused compensation.

Intervention assisted in reducing sick listing, and there was an interaction between gender and treatment. The recommendation for women was part-time cognitive behavioural therapy. For women, all programmes increased their level of sick leave, but a reduction in disability pension. The explanation might be in terms of life style changes. The best results for men came from full-time multidisciplinary intervention, with cognitive therapy counterproductive. Men prefer an active role.

Need for Ergonomic Interventions for Workers with Severe Physical Disabilities

Hannu Alaranta emphasised the importance of skill and collaboration in vocational rehabilitation. He analysed previous papers in terms of comprehensive coverage, intervention, therapy on functional capacity, and rehabilitation. Unemployment rates vary between countries, affecting outcomes of rehabilitation work. The practical challenge is to develop a method to evaluate the ergonomics of workplaces for employees with physical disabilities. This means checking the need for ergonomic interventions among people with severe physical disabilities, using structured interviews. Could we learn something about these people? What kind of work can the people find? What hope is there of improving the work environment? The focus was on those working in SMEs.

ERGODIS analysis, a locally developed method, includes background factors, capacities, use of mobility aids, physical workload factors, architectural barriers and general accessibility conditions, need of help, adaptive measures made, physical activities, rehabilitation, and perceived work ability. The assumption was that the employee with physical disabilities knows his work demands and capacities, and the interviewer considers these views. Part of the interview is validated by other means, including sets of measurements. As a result, there has been increased awareness of the need to improve workplace layout, electrically operated work tables, the height of shelves, need for earphones, adjustable ventilation, remote control units, accessible toilets, and reasonable parking spaces for adapted cars, etc. The method can be part of occupational health and rehabilitation services. Motivation can compensate for impairments in the ability to work.

Cost-effectiveness Analysis of Multidisciplinary Rehabilitation for Chronic Musculoskeletal Pain

Marielle Goossens discussed how economic evaluation is giving increased attention to musculoskeletal disorders; we need to assess economic as well as medical consequences of new treatments. This does not mean that such data is used in decision making. The literature was reviewed, concerning preventive work in back pain, but few studies addressed chronic low back pain. There was no consensus on how to perform economic evaluation. Costs were considered, from an individual, family and social perspective. It is important to measure direct medical costs, direct non medical costs, and indirect costs, as well as quality of life incorporating health state valuations. Patient and family non-medical costs exceed medical costs, for chronic patients, yet this was neglected in earlier studies. How should the costs be measured? Patient cost diaries were kept during the follow-up period of a year, with 68% returned. The validity was checked. Effects were considered in terms of generic quality of life, for potential use in decision making. However, standard instruments proved inadequate. More cost effectiveness studies are needed, taking a broad view of direct and indirect costs. The cost diary is proving useful. Generic and specific valuation of quality of life is needed, with cooperation between payers and researchers.

Biomechanics, Ergonomics and Rehabilitation

Tom Bendix noted that traditionally ergonomics and rehabilitation have been based on biomechanics, but something has gone wrong: psychological factors are also relevant. Lack of success in ergonomics may be because improvements in posture have meant longer single periods of working between breaks. Ergonomics has improved work efficiency, for example by replacing poorly designed chairs, rather than optimising musculo-skeletal loading. Much degeneration could be explained by genetic factors, rather than the workplace. In rehabilitation, biomechanical issues dominated while problems increased. Indahl's work concerned the removal of fear of pain. He offered treatment and discussion, and found less patients still out of work after a year, compared with those he had not worked with. In the USA, functional restoration training was used to great effect. A study in Denmark showed effects lasting over five years, with different results in three studies. There have been further studies in Finland and Canada. Learning correct movements in working life disturbs long patterns of natural coordination. Workers' understanding of psycho-socio-economic issues interfering with musculoskeletal disorders seems relevant to reducing time off work. This does not mean that classic ergonomics is not relevant.

Psycho-social Influence

Gordon Waddell saw low back pain and disability as an example of a subjective symptom which is largely dependent on self-report, is often influenced by psychological and social factors, and typifies social security problems in EU and other developed countries. There has been an exponential increase in disability,

benefits payments and early retirement due to back pain, in the absence of any significant change in the physical pathology or prevalence of back pain. Low back pain, disability and incapacity for work are only related weakly to each other. Many studies show that psychosocial factors are more important than biomedical factors in the development of chronic low back pain and disability. He was concerned with social influences, rather than psychological issues. He argued that figures on back pain and invalidity are social phenomena, not medical, varying with social factors rather than biological or psychological. He had analysed the literature, studying social factors influencing clinical aspects of low back pain and disability. Clinical presentation, pain, disability and incapacity are influenced both by the underlying physical disorder and by illness behaviour. Illness behaviour is defined as "observable and potentially measurable actions and conduct which express and communicate the individual's own perception of disturbed health". Further research looked at the literature of social security, to see the impact of arrangements on back pain and disability, using a diffuse set of sources of varying accuracy.

He drew tentative conclusions. Neck and back pain are not discrete clinical problems, to be treated in isolation. Social security systems influence behaviour, including sickness absence and benefits payment. The structure and controls seem more important than the level of benefits. The biggest problem is the increase in early retirement on health grounds. Social security benefits for back pain are linked to social exclusion and disadvantage. Relative poverty, even within Europe, is of central importance. This is not restricted to back pain. Sickness and invalidity benefits are part of a broader social framework. In general, we are dealing with illness behaviour.

Sociocultural Determinants of Complaints

Marek Szpalski described a survey in Belgium, exploring the relationships of socio-cultural and employment factors to the reported experience of low back pain, and tried to explain the impact on health care utilisation and the impact of sociocultural factors, demographic factors and beliefs. Culture affected reports of back pain, but this is complicated by the inequality of access to health care. Combining diversity with access to health care is difficult; Belgium meets this criterion, with two cultures and a single health care system. A sample of 5125 Belgians was taken, representing the population, and stratified by gender, age and habitat. 34 questions were asked, catering for language diversity. Three groups were identified, in terms of back pain history. In general, women and French language speakers reported more back pain. Social class is significant, but cultural differences impact on movement and on communication patterns. It is a question of considering antecedent and consequent issues. Poor work satisfaction is not associated with the first onset of back pain, but only with subsequent episodes. True chronicity of reports is work-related, rather than culturally-related. Some cultural differences in treatment appear to be related to the attitudes of doctors, to their profession and patients.

Bio-psycho-social Risk Factors of Pain Chronicity

Monika Hasenbring analysed results by medical, psychological and demographic

variables, and saw combinations of variables as enhancing correct prediction of pain levels. She concentrated on psychological risk factors, deriving four main risk models, based on stress muscle spasm pain, fear avoidance, avoidance endurance, and the operant model. Considering prediction of early retirement, back depression inventory and stress at work were analysed and seen as predictors. Stress at work linked to pain was distinguished from other stress, but other stress was the most effective predictor. Fear avoidance was linked with pain intensity, taking into account psychosocial risk factors. Pain related cognition before treatment was studied, including hopelessness, catastrophising, minimising, coping signals, and suppression. Patients with high risk factors were classified, with different coping behaviour. How can the diagnostic conclusions be integrated into practice? Experimental screening is being tried, with a simple keyboard for self-assessment. High risk patients need separate interventions.

Developing Competencies in Biopsychosocial Management

Chris Main addressed issues of competence and skill, and concentrated on assessment. Listening and observation are important, and need integration before decisions. The need is to match the therapeutic potential of the intervention with the needs of the patient. How do we decide what is a successful outcome? Resources are needed to improve accuracy of judgements, with concern for the diverse stakeholders, including funding agencies. Most of the time we have only hazy ideas of how we arrive at our decisions. We need better accounts of risk factors, targeting the needs of individuals, and taking into account recent perspectives on low back pain. Certain working conditions increase risk and vulnerability, and may impair performance, later delaying recovery. He considered a range of flags, indicating both risks and obstacles to recovery and a return to work. Prediction of the responses of individuals increases chances of getting them back to work and coping with pain. Clinical red flags and complemented by psychosocial yellow flag predictors can help with case management; he wanted to add blue flags of perceptions of work, and black flags of pain in the workplace. He argued for educational strategies centred on biopsychosocial management, using a competencies framework, and developing teaching and training packages, located within social policy initiatives.

How Back Pain Is Treated in Europe

Tommy Hansson described the outcomes of an international study, run in six countries (Sweden, Germany, Israel, Denmark, Netherlands and USA) by the International Social Security Association 1995–97. Work Incapacity and Reintegration was concerned with medical and social interventions, and their effectiveness. Inclusion required employment, sick listing for 90 days or more under a back diagnosis, and no recent back surgery. Identical questions and instruments were used across all participating countries. He reported on the medical side of the project, but suggested that vocational interventions made had little effect. The cohorts varied in the extent to which they were representative of

the overall population. Statistics were not directly comparable, with different factors taken into account when measuring back pain. Sick leave regulations had impacts on sick leave patterns, for example in the Netherlands. In each case, apart from the USA, the General Practitioner was the basis of primary care. The role of company doctors varies, with different roles in certification. A variety of treatments were investigated and tabulated. Medical and social security régimes vary, often based on reports from patients, and definitions are not always clear: for example "massage". In the USA, where the financial basis for healthcare is private, the questions were the same, but patterns of, for example, visits to physiotherapists, are more frequent. The power of the market could be seen in the use of braces. Those who returned to work were better than those who were still not working. Only one intervention helped with the return to work, and only one helped with health measures. Back surgery in Sweden improved work resumption, reduced pain, increased function and quality of life. Socio-economic incentives and disincentives had effects on work resumption.

Neuroflexotherapy for Chronic Low Back Pain

Francisco Kovas reported that in low back pain, 10% of cases cause 80% of costs. His focus was on neuromechanisms which may explain the problems. Maybe not all patients are claiming for benefit, and may just have low back pain. He presented studies on treatments based on this approach. For most patients with low back pain, it is hard to establish physical causes. He illustrated the neurological approach, activating nerves with an ongoing impact, continuing after the removal of the cause. Physical stimulation of nerve endings can inhibit these mechanisms. Neural interventions mean the use of skin staples, left in place for 90 days. This is not the same as acupuncture. Does it work? There have been major studies since 1991, in primary care and out patient clinics, dealing with chronic sufferers over prolonged periods. The studies give consistent results, showing that patients improved, following simple and effective neuroflexotherapy treatment. Cost effectiveness and cost utility are currently being evaluated. It is not claimed that the treatment is preventive. How could the evaluation be double blind? He gave an exhaustive account of the approach taken. He ended with reflections on cultural differences, involving religion, attitudes to pain, and the role of professionals.

The Effect of Information and Advice

Kim Burton addressed the issue of patient education, evidence based as far as possible. The focus has switched from biomedical to include psychosocial factors. He considered recent materials, some of which are long and unreadable. Some have been tested, such as "The Back Book", which reduced patient referrals and problems. Roland and Dixon, Symonds and Cherkin have evaluated the effectiveness of these publications, which does not always exceed that of consultations with nurses. He gave an account of the work of Symonds et al with materials used in industry, based on fear avoidance and developing a positive attitude. The pilot was in a biscuit factory, with two control companies, measuring beliefs and absence rates. Absences were measured, based on prescribed periods of

absence and then extensions. An improvement in back beliefs was found, while the control, with good posture leaflets, deteriorated. Extended absences were reduced. The Royal College of Physicians guidelines were produced in 1996, and emphasised positive messages, reinforced by a booklet written by Roland, Waddell, Moffett, Burton, Main and Cantrell. It was designed to be different and uncompromising, arguing that the spine is strong, exercise is good, and, subliminally, that it is best to stay away from doctors. This has been subjected to randomised control trials, with control groups using other booklets. The hypothesis was that the booklet would produce clear shifts in belief and outcomes. Outcomes of the experimental and control groups were compared. The experimental book reduced fear avoidance, while the control booklet increased fear avoidance for a period. There was little difference on disability scores. Clinically important improvements were identified. The intervention was weak, but showed improvements. The approach was supported by the evidence. Further analysis could focus on particular sub-groups. It was explained that the doctors in the trial had taken no particular cognisance of the Royal College of Physicians guidelines. There was debate about the testing procedures for the booklet, which is a different kind of intervention from surgery or the use of staples. There is no reason to believe that the booklet could cause anybody any harm. The trials followed earlier pilot studies and review responses. The control book was well-regarded by other professionals, but seen as raising fears.

Summary

Alf Nachemson reflected that the workshop had been a positive experience, addressing the common concern for back pain in Europe. There is evidence from the Cochrane studies on how better treatment can be provided for workers in the workplace, and guidelines have been developed. He observed that it is difficult to apply common solutions across several countries.

Workshop Participants

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Tom Bendix, Odense University, Denmark
Kim Burton, University of Huddersfield, England
Peter Croft, University of Keele, England
Richard Ennals, Kingston University, England
Marielle Goossens, Rehabilitation Laboratory, Netherlands
Tommy Hansson, Orthopedic Institute, Goteborg, Sweden
Monika Hasenbring, Institute for Rehabilitation Research, Hoensbroek, Holland
Irene Jensen, Karolinska Institute, Sweden
Francisco Kovacs, Kovacs Foundation, Spain
Charlotte Leboeuf-Yde, Medicinska Forskningenheten, Denmark
Elisabeth Ljunggren, University of Bergen, Norway
Chris Main, Hope Hospital, Manchester, England
Alf Nachemson, Sahlgrenska Sjukhuset, Goteborg, Sweden
Åke Nygren, NIWL, Sweden
Jean Paolaggi, Hospital Ambroise, Boulogne, France

Marek Szpalski, Free University of Brussels
Maurits van Tulder, Inst for Research in Extramural Medicine, Amsterdam, Holland
Johan Vlaeyen, Institute for Rehabilitation Research, Hoensbroek, Holland
Gordon Waddell, Glasgow Nuffield Hospital, Scotland

Reflections on the Workshop

We are concerned with the pain of others, which we understand by reference to our own experiences of pain, but to which we can have no direct access. This raises questions of ethical ergonomics. In communications with politicians, who like simple messages, and have a preoccupation with short term economic costs, there would be dangers in suggesting that physical ergonomics could be disregarded. This could challenge practical measures, which reflect concern for the well-being of fellow humans, and associated social programmes. Human pain can be seen as at the heart of both politics and medicine. Simple prescriptions are attractive, but rarely work. At the workshop it has been paradoxically reassuring to find an open absence of certainty among leading professionals. The atmosphere of dialogue and interaction is itself, I am told, an effective means of reducing back pain.

6. Aetiology and Prevention of Musculoskeletal Disorders

The workshop was led by Ulf Lundberg and Eva Vingård, and held at the Office of the Swedish Trade Unions in Brussels, 29 November to 1 December 1999.

Mechanisms Behind Musculoskeletal Disorders

Mats Djupsjöbacka concentrated on muscle pain related to physical work loads. Well-established risk factors for development of work-related muscle pain are work tasks involving static and repetitive muscle contractions, as well as psychosocial factors such as stress. He considered patient findings. At the *muscle fibre* level, there is hypertrophy and damage to cell membranes. This suggests overuse of the muscles. The metabolism appears to have been disturbed. It is also important to consider *motor control*, and the nature of muscle activity, reduced when acting as agonist or increased when acting as antagonist. We find disturbed balance control and reduced control of head repositioning.

When considering *peripheral mechanisms*, we would like to know the sources of pain. Algesic agents are released in response to static contractions. There can be sensitisation through interactions with tissue-damaging stimuli. Sensitisation may precede excitation, sensitising pain receptors in advance of pain itself. There can also be chronic sensitisation through a vicious circle process, involving the release of substance P, giving rise to edema and hypoxia. There can also be fibre damage due to hypoxia-induced increases in intracellular calcium.

As for *central mechanisms*, animal studies have cast light on wind up phenomena, transmitting information via the spinal cord. This can widen the receptive field of interneurons, resulting in the referral of pain from one tissue to another. With time, these changes may become permanent. He then considered *motor abnormalities*, concerning balance control and head repositioning. This might be explained through a model of the muscle spindle system, based on the work of Johansson and Sojka. Muscle spindles are important for motor control, and provide the basis for the stretch reflex. Long-term pain input to the spinal cord could affect muscle activation patterns. This is a vicious circle, with an additional spreading effect. Further research highlights potential links with psychosocial factors. The model predicts that increased muscle load may lead to stiffness, which can spread. Animal model research has shown an increase on the stretch reflex during experimental muscle pain. This was supported by analysis of experimental data. Human studies give similar results, with experimental muscle pain. There is an alteration of muscle activation in patients with pain.

He considered the impact of tiredness, which decreases the ability to discriminate movement velocities and a reduction in position sense. Research has measured the effects of tiredness on proprioception, and the impact of repetitive work on position sense. The study involved men and women, all right-handed, and showed increases in errors after repetitive work, with a lower level of errors from men. The

consequences for motor control are hard to assess. It is concluded that deficits in proprioception decrease precision in movements and increase co-activation of muscles, increasing risks of developing problems.

Psycho-social Mechanisms Behind Musculoskeletal Disorders

Töres Theorell considered approaches to coping with pain. It would be disastrous to have full understanding of one's own physiology, but often we know too little. Three different kinds of mechanism may link psychosocial factors at work to the onset of musculoskeletal symptoms or disorder:

1. A *pathopsychological* mechanism (long-lasting adverse conditions inducing energy mobilisation and inhibiting anabolism) linking the psychosocial job environment to increased vulnerability in tissues. He outlined case studies with white collar workers and police officers.
2. A *pain* mechanism. Psychosocial adverse conditions may increase or decrease pain sensitivity in workers, depending on circumstances. This may have importance for the perception of tissue changes. There have been studies of pain thresholds.
3. A *social* mechanism. Pain or pathological tissue changes may influence the possibility for employees to do their work differently, depending on the psychosocial characteristics of the work situation.

Epidemiological findings regarding psychosocial factors have been partly contradictory. Time pressure has different predictive outcomes for men and women. There is indication that male employees with boring work tasks have an elevated risk of developing acute low back pain or neck shoulder conditions. In women, combinations of psychosocial and ergonomic factors may have strong predictive power. Men and women have different kinds of jobs, and there are relevant external factors to help explain differences, such as the extent of unpaid work and having small children.

He discussed physiological analysis, drawing on current ideas to differentiate cases, and to explore relations between physiological and psychosocial states. There is debate about hypothalamus and pituitary disorders, affecting cortisol, including the effects of psychiatric depression. He then considered chronic fatigue syndrome, with low levels of cortisol. Research involves the analysis of saliva. In this area there were no great differences between men and women.

In the recent MUSIC-Norrtälje study, of those in the geographical area consulting diverse caregivers for help with low back pain, we can analyse cross-sectional physiological data. We compare cases of low back pain and neck shoulder pain and referents, with regard to morning-midday plasma cortisol differences, immunological parameters (IgE and IL-6), an indicator of anabolism (DHEA-s) as well as one indicator of adrenomedullary activity (MHPG). The findings support the idea that acute musculoskeletal conditions may arise more frequently than expected in subjects who live under long-lasting psychosocial stress and that this is mirrored both in cortisol regulation and immunological findings.

In the follow-up of cases, there was indication that low DHEA-s during the acute phase predicts long-lasting pain and incapacity. He described informal reports that consumption of DHEA-s could improve love life, which is of relevance since there is a biological link between reproduction and anabolism. The overall picture is not clear regarding the prediction of disability, but in general the sympathetic nervous system is involved in some way in these conditions. Some of the psychosocial conditions may induce physiological changes that merit concern.

Gisela Sjögaard suggested a sequence of external exposure; dose and response; and outcome, corresponding to prevention, plausible accounts of mechanisms, and diagnosis. We would like to document causal relations, and see the implications of work organisation. Exposure is multi-factorial: physical, psychological, and social. It may be passive, through a fall. We are also concerned with the activity of the worker, expressed in terms of the nervous system, whether via motor or other nerves. This is physiology.

We can do little about the way we recruit our muscles, with regard to mechanical performance. If we just perform mental activities to solve problems, then there need to be effects via the nervous system to activate the muscles. Reflex control is important, and the combination of hand and eye movements involves numerous uncontrolled reflexes. Although the metabolism of the muscle may not be damaged, there are issues of, for example, levels of calcium, where increased levels can cause ruptures in membranes. The symposium considered pain, and models of pain adaptation, which suggest that less work is performed, in order to avoid pain. This may mean that work is no longer possible in some cases. Patterns of muscle behaviour change with age.

Low Back

Classification of Low Back Disorders

Hilkka Riihimäki located diagnosis in the head of the doctor, defined as the process of determining the nature of disorder by considering the patient's symptoms, signs, medical background and the results of laboratory tests. Diagnostic terms may relate to the underlying pathologic process, or to a syndrome, thus referring both to the aetiology of the disease and to its description. Diagnosis is about the nature of a case of ill health. Diagnostic information is meant to make a difference: it may tell what is wrong (diagnosis), what will happen (prognosis), and it helps in deciding about further diagnostic testing and therapeutic interventions.

Referring to the WHO classification of musculoskeletal disorders, classification of diseases refers to the assignment of cases to predefined groups within a taxonomy of entities. Ideally each entity should show an identical clinical appearance, pathophysiology, course, prognosis and therapeutic response. The taxonomy should have an etiopathogenetic basis. It is rare that we can meet these criteria. The majority of low back pain cases do not fit into the classical biomedical model that links pathology and symptomatology; only in 10–20% of cases can an aetiological diagnosis with clear-cut criteria be determined. The rest is often called

non-specific low back pain; defined by exclusion. The situation is made complex because of the involvement of many psychosocial factors in the course of non-specific LBP and its social sequels. Different techniques are available. There is a lack of agreement on what constitutes the "back". Classification involves the type of disorder or symptom, staging implies a temporal concept of a developmental process, and grading involves levels of severity. There are additional patient-related factors modifying treatment outcomes, including physical, psychosocial, psychological and social environment. We need for an evidence-based classification system, but a tenable theoretical framework is missing.

Risk Factors for Work-related Back Disorders and Their Impact on Different Health Outcomes Depending on Prior Distributions

Lex Burdorf reviewed the scientific literature on work related back disorders, covering 254 articles. The aim was to identify those risk factors that are consistently shown to be associated with back disorders, and to determine the strength of association between those risk factors and different diagnoses of back disorders. Lifting or carrying of loads, whole-body vibration, and frequent bending and twisting, were the physical load risk factors consistently associated with back disorders. There have been comparatively less studies on work-related psychological risks. Job dissatisfaction and low job decision latitude were important, but the evidence was not entirely consistent. Strengths of associations were influenced by study design, population selection, and health outcome of interest. Smaller studies have higher risk factors. Cross-sectional studies may overestimate the impact. Defined health outcomes and risk assessments are rarely linked. There can be misclassifications of exposures, and the ways in which they are assessed.

He considered the consequences for the workforce, following workers over the years. Many people get better, moving between health states. Cohort behaviour can be simulated, taking hypothetical groups of workers. Probabilities need to be assigned. Once a worker has low back pain, we can calculate the probabilities of recovery over time, taking account of varying load levels.

Prevention of Work-related Low Back Pain

Hilkka Riihimäki asked whether ergonomic programmes over the last 50 years have failed. Low back pain continues to be a major occupational health problem in Western countries, causing high costs to society, and affecting the quality of life of many people. The primary prevention of back pain should have a high priority in occupational health, as well as in the public health agenda. Primary prevention is controversial, and it is hard to discern the practical effect of ergonomic programmes. We need to understand causal factors in the cases of diseases which are amenable to change, if prevention is to be successful, taking into account the results of ergonomic problems in the workplace. Causal links and preventive measures are controversial, and introducing major programmes without broader

understanding might be seen as misguided. It can be argued that preventive measures can be effective even without complete understanding, as in the case of heart disease. Analysis has been made of international peer-reviewed articles on interventions, and we would ideally like to deal with health outcomes. It is hard to assess the effectiveness of interventions: exercise has some effect, education is not effective, and opinion on lumbar support is divided. There is a mixture of patient studies and studies of healthy people.

Today, both physical and psychosocial factors can be taken into account in a single conceptual framework of contributory factors for musculoskeletal disorders, or in a balance model of work system misfit. She recommended a reconceptualisation of why interventions work. She tried to illustrate the central problem of overload, set in a context of related factors, such as knowledge, culture and behaviour, and external factors such as work organisation, work methods, engineering technology and lifestyle. Evidence on workplace and organisational interventions is inconsistent, and more randomised controlled trials are needed.

Tommy Hansson is a therapist. The diagnosis is more helpful to the therapist than to the patient, applying a label. Does it matter whether we know the diagnosis, and at what times does it matter? Once we know how to treat back pain better than nature itself, then it is worth knowing the diagnosis. Otherwise, where our recommendation is normal activity as far as possible, diagnosis is not needed other than for research purposes. Our objectives include the end of pain and the return to work. What is the normal pattern of symptoms and healing? Should a return to work be seen as a medical outcome? Patterns are affected by different social security systems. Once we have the diagnosis, what else is there to research? He discussed the idea of stages of back pain. He considered the occupational risks of back pain. The amount of back pain is the same today as in the 1950s, but with different consequences. Risks should be reduced, but costs must also be considered. Problems such as hip fractures and general bone fragility have increased. Low back pain has a better prognosis than most other illnesses.

Time Trends in Low Back Pain in Finland, 1985–1995

Päivi Leino-Arjas asked what is happening to back pain. It is a burning question for policy makers, given the drain on public resources. Our evidence is limited, other than social security data. Occupational exposures, the relative sizes of occupational groups, and lifestyles, are all changing. Manual work is being replaced by the use of computers. Obesity is increasing. It is possible that these changes affect the occurrence of back disorders. Evidence on such trends, other than those in the usage of health care or insurance benefits, is sparse. Annual surveys of the 15–64 population have been conducted in Finland since 1978, studying issues including back pain and employment consequences. Over the study period 1985–1995, farming and industrial employment has declined, while office employment has remained stable for men and increased for women. Unemployment has increased in the period to 1995, reaching 12%. The data was analysed for the 20–64 age group. Taking into account lifestyle factors such as smoking and body mass, mental symptoms and the general occupational structure and unemployment (13%), prevalence of back pain declined slightly. A more substantial decrease was seen in back pain diagnosed and treated by a physician.

What could explain this? Have work methods changed? Is this an effect of unemployment increases? In the early years of the time series there were increases in back pain, and increases in physician numbers. Joint pain shows a similar pattern over the period.

Low Back Pain: Results from the SMASH Study

Paulien Bongers outlined studies undertaken as part of the SMASH programme, addressing physical and psychosocial factors, reviewing previous clinical trials and deriving summary conclusions.

Physical: the aim was to determine whether flexion and rotation of the trunk and lifting at work are risk factors for low back pain and to explore the exposure-response relationship of these work-related physical factors with low back pain. The Study on Musculoskeletal disorders, Absenteeism, Stress and Health (SMASH) has addressed the issue.

Many studies have considered physical loads, but not considered exposure levels. The study population was 1800 people from 34 companies, in more or less fixed workplaces, with limited numbers of tasks. They had at least a year of employment, and worked 20 hours per week. The study concentrated on those without a record of reported LBP.

Measurements were made with video at the workplace, classifying workers into groups, extracting information on physical loading, and sampling worker groups. Trunk flexion was analysed, together with lifts and trunk rotation. In addition, there was a self-administered questionnaire, on individuals, psychosocial factors, driving etc. There was then a study of cumulative LBP over three years. Detailed statistical analysis was applied, assessing the confounding factors. There was further sub-group analysis of shorter-term employed workers, to test for the healthy worker effect. The response level was 87% overall, with 72% of those responding on follow-up. On trunk flexion, high flexion was linked to increased risk of LBP. With trunk rotation, the greater the time spent in rotation, the higher the risk of LBP. A longitudinal study of lifting showed little correlation, unless for high weights on a frequent basis. In the short-term sub-cohort there were higher risk factors, for flexion, rotation and lifting. It was concluded that flexion, rotation and lifting are risk factors for low back pain, especially at high levels of exposure. Trunk flexion and lifting are closely correlated.

Psychosocial: the aim was to investigate the relationship of the work-related psychosocial factors quantitative job demands, skill discretion, decision authority, supervisor support and co-worker support with low back pain and neck pain. Skill discretion, decision authority and supervisor support showed no relationship with LBP and NP. Quantitative job demands and co-worker support showed a similar positive relationship with LBP and NP, but the relative risks for NP were higher and statistically significant. There was contradictory evidence regarding high work pace and qualitative demands.

Neck/Shoulder

Diagnostic Criteria of Neck/Shoulder and Upper Limb Disorders: The SALTSA Project

Judith Sluiter described work of the SALTSA project on consensus criteria. There are problems in reconciling the different studies, making choices of data to study.

We seek to diagnose the right disorders, and establish links with work. Standards, guidelines and criteria are far from straightforward, across cultures, nations, languages and professions. We seek clear descriptions: evidence based, structures, repeatable and verifiable. Despite the number of studies on work-related upper extremity musculoskeletal disorders, there is still uncertainty about the extent and aetiology of these problems; the contribution of work and non-work risk factors to their development and resolution; the criteria used to diagnose them; outcomes of various treatment methods; and appropriate strategies for intervention and prevention. Progress in advancing our understanding has been hampered by the multifactorial nature of the disorders; uncertainty of pathophysiological mechanisms; and problems with epidemiological research. There is a choice of case definitions and diagnoses, a lack of golden standards, inherent biases in study designs, and the inability to control for confounders. It is hard to compare the results of different studies, and to assess the effectiveness of interventions.

A European SALTSA project to develop criteria for the evaluation of the work-relatedness of these disorders started in 1998. The SALTSA project involves the Coronel Institute (Amsterdam), the Robens Institute (Surrey), and National Institute for Working Life (Stockholm), and has the objective of developing evidence and consensus based definitions. The normal steps are minimal diagnosis, assessment of work-relatedness and determination of probability of work-relatedness of the disorder. The target populations are occupational physicians and the wider medical community, working in varying institutional contexts. Work has been devoted to development of case definitions, drawing on the scientific and grey literatures. Definitions can be descriptive, and need not to be implicitly causal. Criteria derived from different purposes, and guidelines have had different roles, depending on target audiences. Taking the example of Carpal Tunnel Syndrome, the occupational history could be presented as central. Harrington's approach was based on surveillance case definition. Harris presented guidelines that were less than clear. Consensus established which tests are most commonly used. The SALTSA case definition for CTS draws on past work and tests. It makes use of time rules based on symptoms, determining appropriateness of tests. In other cases, for example in Lateral and Medial Epicondylitis, there was less controversy. For non-specific upper extremity disorders, the normal steps should be followed. More information needs to be collected, including symptoms, regions, time, work-relatedness and occupation.

Criteria for Work Relatedness of Upper Extremity Musculoskeletal Disorders

Monique Frings-Dresen saw upper extremity musculoskeletal disorders are a

major cause of sickness absence, disability and health care expenditures, but the evidence of work-relatedness is not clear. The work environment and the performance of work appear significant. Work factors could be physical or non-physical. A traffic light model was developed, covering probably, possibly, or most likely not work related. There were conclusions regarding unsuitable (red) physical risk factors, including posture, movement and combined factors. Non-physical factors include work-rest ratio and work characteristics. Similarly accounts could be given of acceptable (green) factors. The difficulty was in the yellow area. Each region of the upper extremities was covered. The final establishment of work-relatedness of an upper extremity musculoskeletal disorder involves four steps:

1. Evaluate the general criterion on the relationship of the disorder to the present work
2. Examine the work factor criteria by body origin
3. Check non-occupational origins of the disorder
4. Decide on the level of work-relatedness and needed action

Based on the literature, work factors can be formulated by region and type of work factor, qualitative and quantitative, usable at different levels of health surveillance: micro, meso and macro.

Physiological Mechanisms in Work-related Shoulder and Neck Pain as a Basis for Prevention

Rolf Westergaard regards prevention as the primary focus in combating work-related musculoskeletal disorders. Knowledge of physiological mechanisms helps us direct prevention efforts in a more efficient manner. We would like to know if the pain is work-related. Do we have objective measures for risk and probability? We need to find physiological processes that are causally related to pain initiation, and can be influenced by intervention measures. Risk factors identified in epidemiological studies, e.g. sustained posture or repetitive work tasks, provide clues, but lack precision. Knowledge of pain-initiating processes that provide a basis for treatment, e.g. pain-relieving medication, is useful, but is a secondary focus in this context. Long time courses of pain development present problems. Changes in exposure variables over time may influence the outcome, and are hard to quantify. The disorders are multicausal, pointing to diverse physiological mechanisms. We seek to distinguish between mechanisms in the development of musculoskeletal complaints, and the assessment of risk from work-related exposures. The strong interaction between work and leisure time in determining the health status of workers is acknowledged.

He considered injury hypotheses, looking at metabolic effects in muscle (the European approach) and mechanical strain (the American approach). He discussed regional overload, and the effects of really low workload. He outlined work with surface EMG measurement in ergonomics, and described a current intervention study in shopping centres and health centres, summarising prevalence of pain. EMG recordings are made over the full working day. There is no clear difference between the conduct of those with and without pain.

Measurements continue during leisure and sleep, showing some differences over the day. He presented detailed readings of biceps muscles.

There has been a failure to demonstrate the Cinderella hypothesis, where metabolic effects are confined to a few muscle fibres undergoing excessive strain. There may be underlying undetected phenomena, which might be consistent with other observed data.

There was debate about the use that could be made of data from muscle measurement. Stress and psychosocial risk factors need to be measured subjectively. Theories to explain the work environment connections were tested, but failed to convince.

Neck/Shoulder Pain: Results from the SMASH Study

Paulien Bongers aimed to investigate the relationship between neck pain and three work-related physical risk factors: neck flexion, neck rotation and sitting posture. There was an extensive systematic review of the previous literature, covering physiological and psychosocial factors. The SMASH study concentrated on specific risk factors, using the same approach as was reported in the earlier talk by the same speaker. There is a weak positive relationship between the percentage of neck flexion and neck pain, however not significant. Further, sitting for more than 95% of work time is a risk factor for neck pain.

Stress and Neck/Shoulder Pain

Ulf Lundberg presented stress as a complicated concept, hard to define, seen as imbalance between environmental demands and the individual's resources. We recognise this with excessive demands, but the model also predicts stress when demands are too low. Another model is based on demand and control, with the addition of elements of social support. We can also consider the effort reward imbalance model. Each has been linked to somatic health problems in prospective studies. How can stress affect physical health? It can be through bodily functions, health-related functions, risks of accidents, or ignoring signals from the body, or lack of compliance with treatment. A new model, the allostatic load model, assumes a normal stress response, constituting activation of physiological systems, shutting off once the stress ends. In normal life we tend to be exposed to several stresses, requiring frequent activation and little time to rest and recover. High levels of arousal may continue, threatening health. The system can become exhausted, less able to respond, forcing compensating responses from other systems.

At the workplace there are many factors leading to stress: time pressure, machine-paced work, restrictions, isolations, lack of influence, etc. Studies measuring biomechanical loads of female assembly workers concluded that there were musculoskeletal problems, and that job satisfaction was low, physical loads were low, accompanied by high stress levels. A more flexible form of work organisation was introduced, based on the same underlying work, and stress levels were reduced, especially when measured after work.

Another study considered female supermarket checkout workers, who report neck and shoulder disorders. Workload was counted in terms of customers and items registered, and the weight of items lifted on the conveyor belt. Stress was highest among cashiers, compared with assembly line workers, clerical workers and managers. EMG activity was measured, monitoring muscle tension and rest. Women with symptoms had higher EMG activity, and higher blood pressure. After the study the work was reorganised and job rotation was introduced, and a follow up study is being undertaken. Can mental stress induce muscle tension? Others have argued YES, and his work confirms this. Different levels of mental stress can be seen as leading to corresponding tension levels, at least in the trapezius muscle. There is correlation of muscle tension with self-reported stress.

He introduced the Cinderella hypothesis, explaining myalgia problems in light physical work. Cinderella was first to rise, last to go to bed. The hypothesis is of overuse of low threshold motor units, with activation either physical or psychosocial. Analysis helps researchers identify single motor units. Experiments involve voluntary and involuntary activation, with intramuscular, surface and heart monitoring. Evidence suggests increased heart rate during stress provocations. The same motor units are involved in both voluntary and stress provocation. Physical and psychosocial factors both contribute to muscle tension and stress. There may be some interaction between them. Factors at work may contribute to slower unwinding, and conditions away from the workplace can also add to stress. Is lack of rest and recovery off work more important than intensive force at work, and is a dynamic stress response important for health?

Other Musculoskeletal Disorders

Osteoarthrosis

David Coggon argued that although osteoarthrosis affects the spine, it has wider impacts. The two most important sites of osteoarthritis, as regards disability and economic burden, are the hip and the knee. His concern was for prevention. We have better understanding of pathogenesis and more objective diagnostic methods than for back and neck pain.

Causes of hip osteoarthritis include developmental disorders such as congenital dislocation of the hip, Perthes disease and slipped femoral epiphysis, inflammatory arthritides such as rheumatoid arthritis and ankylosing spondylitis, and metabolic disorders such as ochronosis. These account for only a minority of cases. The disorder can result from a generalised tendency to osteoarthritis in multiple joints, but mechanisms underlying this predisposition have not yet been identified. He cited a number of studies of farmers, showing high levels of risk, raising questions about farming, with exposure to whole body vibration and heavy lifting as possible explanations. He presented evidence of progressive increases in risk with more prolonged and heavier exposure to lifting. The best scope for prevention lies in the control of obesity, and avoidance of extensive heavy lifting, particularly in the workplace.

Knee osteoarthritis can be caused by obesity, generalised tendency to osteoarthritis, and previous injury or surgery to the knee. He reported on a study of 518 surgical cases and 518 community controls. There was a progressive increase in risk with body mass index. This was a retrospective study, making analysis of causation harder, but obesity seems to be a cause rather than an effect of the disease. The effects of obesity appeared to be magnified in people with previous knee injuries. There were also risks incurred by soccer players. Kneeling and squatting at work, especially in obese people, can present risk, with associations with obesity. If occupational kneeling and squatting cannot be avoided, reduction of obesity may be helpful.

USA after the Yellow Book

Larry Fine gave an account of the Bhopal plant disaster in India, and the study of dangers in the USA. OSHA concentrated on record keeping, and broadened the scope of their studies. They went into meat packing plants, and encountered ergonomic problems combined with assembly line pressures. This led to charges against more companies, and work with companies to develop new policies, with a commitment to ergonomic standards. The government brought in academic expertise in 1994. A draft policy was published on the Internet, and NIOSH reviewed the scientific evidence, releasing the Yellow Book in 1997. It concluded that a substantial body of credible epidemiological evidence exists for the association between work factors and several musculoskeletal disorders. High levels of exposure to work factors, with exposure to more than one physical factor, provide the strongest evidence. Individual factors affect risk. All disorders can be caused by non-work exposures.

The assertion of links between work and musculoskeletal disorders was controversial, and further research is being undertaken by the National Academy of Sciences. Standards are being released at local and state level, not waiting for the completion of the work. In Washington State, "caution zone jobs" have been identified in terms of physical exposures, and advice issued, with requirements on employers. This process is likely to continue to lead national regulations, but is changing the environment in which these issues are discussed.

He addressed the scale of the problem, using the Bureau of Labor Survey, citing 580,000 cases in 1997 with lost time from work, with some time due to management of injuries. Since 1994 there has been a decline in injuries, possibly linked to legal changes in worker compensation to control costs. Reporting has had less attention, as the focus has shifted. He also drew on workers' compensation data from the State of Washington, emphasising the back and upper limbs, at great expense to public funds.

He outlined recent grants for universities by NIOSH and NIAMS, reflecting a biomechanical approach, with interest in animal models for upper extremities. There are also epidemiological studies, looking at new exposure methods. Work has dealt with computer operators and workstation design, and considered the impact of 5 minute rest breaks on tax data entry clerks. Other studies covered hospitals, an airline, engineering workers and office workers. With the lower back, there are less animal studies, but a major intervention study in Wal-Mart. Training

to prevent back injuries is supported. The National Occupational Research Agenda is based on consultative workshops with practitioners. The challenge of exposure response studies continues.

Causes of Socio-economic Differences in Musculoskeletal Morbidity in Finland

Päivi Leino-Arjas outlined factors related to work and lifestyle, producing differences in musculoskeletal morbidity by social class. This has been a popular theme in medical sociology, but detailed work on musculoskeletal disorders has been lacking. The Mini-Finland Survey covered the Finnish adult population, and adopted a complex sampling and stratification approach. Health Examination work was undertaken in phases, screening and then diagnostic. Participation rates were high. Standardised assessments were made, immediately after the examinations. Chronic low back syndrome, neck syndrome and osteoarthritis of hip and knee were combined into a single area of degenerative musculoskeletal disease. Education and occupations were classified using standard categories. Income included family income. Physical workload and mental workload were based on survey measures. The results show links with education and income, with greater incidence at low education and income levels, and variation across occupational groups. There was an association with smoking and body mass, and mental workload did not change the educational stratification. Once physical workload is taken into account, educational differences disappear. In the case of difference by occupational classes were significant, physical workload is again the dominant factor. Analysis of income quintiles produced a different conclusion, as income inequalities continued to be vital, and persisted after all adjustments. When similar analyses were made of effects of lifestyle variables, including leisure and commuting habits, using self-reports in the 1990s, similar results were obtained. The data may be criticised as old, reflecting older exposures.

Health Surveillance of Work Related Musculoskeletal Disorders

Mats Hagberg saw active health surveillance of work-related musculoskeletal disorders as an important tool to enhance worker health and productivity. He outlined the nature of surveillance, why and how it is done, and how information is used. It is used for planning and for evaluating interventions, both medical and ergonomic. Surveillance and screening are not the same: the objective is to identify risks from exposure. Surveillance and research are not the same: the objective is prevention, not seeking answers to hypotheses. He distinguished hazard (work system) and health surveillance (worker characteristics and outcomes). There is active surveillance (using new data) and passive surveillance (using old data), and different measurements will be made. Statistics Sweden undertake quarterly surveys of representative samples. He set out goals of surveillance: identifying problems, determining the scale of musculoskeletal disorders, identifying occupational groups, tracking trends over time, describing health and risk

factors, identifying potential control measures, prioritising preventive actions, evaluating progress of prevention, and generating hypotheses for research.

At national level, there are standard sets of statistics. His emphasis was on the organisational level. It is first vital to determine purposes, making the choices set out above. Is there existing information that can be used? What more is needed? How is the system to be managed? What measures will be used? How are health and productivity measures to be linked? What are the economic issues? How is feedback to be handled? How can feedback be used to promote ergonomic change? The delay between collection and feedback must be less than two weeks. It can be oral, visual or written. He located the account in the context of Internal Control systems that are well established in the Nordic countries. There was initial reluctance to enforce Internal Control requirements, but pressure is increasing on companies.

Prevention and Rehabilitation

Tom Cox emphasised prevention. Musculoskeletal disorders are among the most common causes of ill-health in Europe, a challenge to the health of individuals and organisations. In the UK at least, the other key challenge is stress and depression. The problems are not unrelated. With regard to musculoskeletal disorders an integrated prevention strategy is needed. His perspective is that of occupational health psychology, and an overall explanatory model forms the basis for intervention and research, as the basis of an integrated prevention strategy.

The framework for the model incorporates social and organisational environmental factors, as well as antecedent and trigger factors. Reports of musculoskeletal illness can be seen as illness behaviour, affected by organisational responses. Experience of disease and illness behaviour can be seen separately, but the results can distort our understanding of the epidemiology. Musculoskeletal disorders involve self-reporting, and there are varying cultures of reporting within organisations. He illustrated the levels within his model, linking individual psychological and physical factors, and the organisational context, affecting reports. In the background was STRESS. Taking the example of an international *news organisation*, cases and controls were compared, with upper torso or limb problems, and the circumstances were compared, noting ergonomic and psychosocial factors. In the London *voluntary sector organisation*, there was a history of work-related complaints, a tradition of attribution to work, a legitimating culture, and organisational reward for time out.

Experience of distress, fatigue and tension, which can lead to non-compliance with healthy work practices, increase in physiological arousal, change in cognition of pain, and change in sensitivity to social and organisational factors. Factors affecting experience and reporting are different. Which should be the focus of prevention? Developing a strategy is complicated by uncertainty over the prevalence of the disorders in given organisations, and the factors affecting reporting, so information needs interpretation and correction. Underestimation of the psychological and organisational dimension is common. Standard methods do not necessarily work. Health surveillance needs to be improved, normalising reporting. The problems should be reduced at source, through work redesign. Healthy work behaviour needs to be strengthened, with appropriate support,

targeting at risk individuals and groups. Occupational health support needs to be improved; in the UK there is no national occupational health service.

He considered interventions for different pain experiences and reports. This goes beyond biomechanics and ergonomics, integration is needed, looking at the culture of the organisation, in effect aiding organisational development. There are issues of personnel practice and occupational health, not just ergonomics. Work design and social engineering must be considered, with implications for employees and management development. There are process issues, linking with organisational functions and objectives, including health and safety, organisational development, job and equipment design, personnel practice, education and training. Active champions or task groups are needed, with visible senior management and trades union commitment, and integration with management appraisal. Musculoskeletal disorders are a symptom of unhealthy organisations, requiring a broad-based prevention strategy.

There had been limited onward evaluation of the organisations concerned, but observation continued. In the case of the *voluntary organisation*, the organisation's response was driven by personnel officers, worried about potential legal action. In response, the occupational health group were re-empowered. Focus groups explored the nature of the tasks undertaken in the organisation, dealing with a mass of appalling information, recognising that there was a rigid hierarchical structure which imposed pressures on individuals. The structure was changed towards more autonomy and delayering. Reported cases of musculoskeletal disorders declined.

The *news organisation* had control but not integration. Diverse specialists were used, and new focus was needed. The organisation was undergoing change, and could address organisational change issues. New issues of musculoskeletal disorders were added to agendas, and complaints declined. Perhaps they were fed up with making such reports. The organisation felt that something had happened due to the intervention. Many UK companies lack convincing records. Better systems would be a good start. He acknowledged that there are different surveillance approaches, and that an independent element can be useful. Is occupational health in isolation, or is there a wider strategy?

Prevention and Rehabilitation

Kerstin Ekberg spoke from a Swedish context of rehabilitation, aiming to eliminate symptoms, promote health, and to enable return to work. The aim determines which measures of outcome should be used, not all are concerned with return to work. There are different responsibilities. Factors associated with return to work include early rehabilitation, employment rates, employment status, size of the workplace, workplace attitudes. Age, sex, civil status and socio-economic position are relevant, as are level and duration of pain. The context is important. Many studies lack theoretical basis, lack control groups, do not randomise between conditions, focus on the individual, and few consider the role of the workplace and society. Rehabilitation is seen in a context of change processes, involving intervention in organisations, with learning, development, prevention and health promotion. In Scandinavia rehabilitation takes place away from the

workplace, before return. Responsibility lies with the employer, who may provide general solutions before identifying individual problems. Work organisations are changing, with new demands. It is harder to return to modern organisations. Lean organisations require more knowledge from less employees, with greater flexibility, no time buffers, fewer supervisors and less personal contacts. There is more emphasis on individual characteristics and skills. High performance is demanded, and improved self esteem for those who succeed. Lean organisations are linked with self-reported stress, greater risk of musculoskeletal disorders, and sick leave. Changing organisations need employees willing to change. Strategies must overcome fear of change, and involve participation, goal directed communication, clear leadership, and social support and arenas for interaction. This is particularly important with temporary staff.

She outlined the problem-based approach, where people lack the psychosocial resources to arrive at successful treatment without intervention and support. Problem based rehabilitation addresses both the work environment and treatment. Patients work in groups, with trained leaders, learning to see internal and external causes of symptoms, and finding ways of effecting changes in causes and symptoms. The group take responsibility for their work and its outcomes, brainstorming and illustrating perceived relationships, showing the nature of hindrances to their return. Various themes can be chosen for a period of months, taking control of the agenda and setting goals. After a while initiatives are taken, and changes are proposed. Parallel groups are now run with supervisors, launched from a joint meeting. The approach has been used in a number of different contexts, with controls and randomisation, showing a better prognosis. However, the supervisors cover both group members and controls. The entry point has been developmental, not rehabilitation. Sick leave has declined. People enjoy the groups. Each individual can apply their own priorities, taking an active role in learning, contributing to the competence of the group.

Tom Cox discussed removal of symptoms as opposed to work-based rehabilitation, working with the symptoms and getting back to work. In the UK rehabilitation systems are poor, and many employers are intolerant of returners below full health. Success is due to organisational flexibility about ways of working, and a strong social environment that transcends task and level, meshing naturally. In such settings, people work with pain without taking sick leave.

Sport and Musculoskeletal Disorder: Risk or Health Factor?

Eva Vingård presented low back pain as a recurrent disorder, experienced by almost everybody, thus the location in the pattern of prevention and rehabilitation is difficult.

Swedish citizens showed no differences with respect to low back pain in terms of physical exercise. A Finnish longitudinal study looked at the effect of physical activity on low back pain. In men, there was an inverse relationship between physical activity and back pain at the end of the ten year follow-up. This did not hold with women. Finnish élite athletes and controls were examined, showing that

athletes had less back pain in later adulthood, but participants in power sports and soccer had more degenerative changes and hospitalisation for low back disorders. A longitudinal study of Danish school children were investigated and x-rayed at the age of 14, then followed for 25 years. Those with active sports involvement had less low back pain in later life. However, there were a number of compounding factors. The MUSIC-Norrtälje study investigated men and women, taking cases and controls who had not sought care in the previous six months. For women, taking interview information on physical activity, limited exposure to high intensity training could be a risk factor. This tended to be combined with full-time working and domestic pressures, suggesting that lifestyle issues were significant.

Track and field athletes, including the "big boys", aiming for high achievement, generally benefited from training in terms of later low back pain, but factors such as income and occupational may have been relevant. Further studies show the effects of physical inactivity on low back pain. There have been a number of negative studies of osteoarthrosis of the hip among runners and swimmers, involving small numbers of cases and controls. However, more recently there have been studies of soccer players and osteroarthrosis of the hip, showing increased reports among soccer players and élite players. As for ordinary men and women, taken from population studies in Sweden of those with new limbs, knees or prostheses, the evidence suggested that women had engaged in little sport. Men were at greater risk, with track and field and racket sports leading to the greatest risks. With respect to the knee, and trying to exclude trauma cases, men incurred risks from soccer, track and field, skiing and ice hockey. She still recommends physical activity.

Gisela Sjögaard commented on shoulder pain among swimmers, and bicyclists in the Tour de France. There is an imbalance in the activity of muscle tissues. There can be knee problems and carpal tunnel syndrome. Runners have further problems, and marathon running means frequent repetitions. Cross-country runners and skiers seem to have reduced immune systems and lower temperatures. Tennis and golfers elbows all involve professional athletes. Teachers of physical education encounter additional physical problems, sometimes related to working conditions. Repeated exertions can cause problems. There are differences between élite and leisure activities. The level of activity should be such as to minimise risk. She presented an account of mechanical stress as needed for tissue growth and viability. The optimum would be different for different tissues, suggesting vulnerability at times of relative imbalance of strength of, for example, muscles and tensions. Bone tissue development requires impacts, such as with running, but this can lead to osteoarthritis. Time history is important. She referred to Hippocrates, who said some millennia ago: "Exercise should be mild at first, gradually increasing, gently warming, and not taking too much from the available strength". In practice, training is often recommenced before recovery from previous training bouts is complete. With regard to prevention, we could consider complementary leisure activities. Should we promote holistic lifestyles? Cycling can be an antidote to conferences. Roller skating can also be effective, and is recommended. There are fundamental questions about where responsibility lies for individual physical fitness.

Tom Cox noted the complexity of the physiological and psychological issues. He argued that population based studies of sports participation tend to neglect the subtleties of the problem. Patterns of activity vary greatly, including warming up and warming down. Élite players play with their heads, rather than their legs, and

impacts varied, comparing club and novice players. There was also a difference between winners and losers.

Results from the ISSA-study

Tommy Hansson summarised the International Social Security Association study from 1993–1994, looking at Work Incapacity and Reintegration. He concentrated on the results of medical interventions. Cases were 18–59, with back pain, employed, and sick listed for more than 90 days, with no recent back surgery. Each nation ran common questions and instruments. Retrospective information was sought on the first 90 days, on appointments and treatment, etc. Outcomes were in terms of working or not within one or two years. It was a question of systems, not of particular treatments. Cohort sizes varied 300–600, with varying gender balance. Overall, more women are sicklisted over 90 days, though there are more men in the workforce. Rates of return after one and two years varied greatly, probably affected by the social security systems concerned. The core was the visit to the General Practitioner, whether for treatment or referral. Company doctors have different roles in each country: in the Netherlands all sick workers have to see the company doctor, but this does not affect the number of visits to the GP. Physiotherapy, chiropractors and homeopaths had varying significance. There was also analysis of manipulation, traction and medical baths, the last of which delayed the resumption of work. Physical activities and back school had no clear effect. Heat and cold treatment, ultrasound and short wave treatment are prevalent, perhaps linked with payment per visit. Surgery rates varied greatly, low in Sweden, the only country where the surgical intervention affected return to work. None of the current treatments have any effects on the outcome measures. In Denmark physiotherapy led to deterioration of back function. When patients were asked their opinion of why they had not returned to work, most referred to current back problems.

Psychological Aspects of Early Detection and Intervention in the Prevention of Chronic Pain and Disability

Steven Linton discussed psychological risks, describing tests by a series of doctors, developing learned responses. He was concerned with psychosocial factors in doctors as well as patients. His focus was on chronic disability, with different roads to recovery for each patient. Back pain and neck pain are recurrent. Psychological factors are related to the transition from acute to chronic pain, the onset of pain, with larger impact than medical and biomedical factors. He considered fears, emotions, abuse, the psychosocial environment and poor perceived health. Fear avoidance and catastrophising, exacerbating problems in a cyclical manner, were illustrated. He considered attitudes of patients two months after primary care for back pain. Fear of disability is high, with worried of serious problems, dangers of movement or of exercise. Much depends on communication between patient and physician. Test results and communications can be interpreted differently, depending on psychological approaches.

He considered the problem of screening. Of 1000 workers, 100 might want help, and 5–10 might need serious help. Waiting to be asked is one approach. Screening

is another. There are difficulties in generalising from a group to an individual, and in defining factors. He described a screening questionnaire used in Örebro, concentrating on psychosocial factors, and indicating how it is used. He considered predictive validity.

How might the information be used? Particular interventions might be used. In Örebro they use psychologists with "pain coping" groups of patients. The groups are active, in a course of six sessions. He compared the outcomes in terms of pain intensity in three groups, treated differently, with reductions in each case. The risk of increased sick leave with the pain coping group was much lower. Treatment focused on psychological factors, used with the appropriate group, can be effective, engaging the individual.

Workshop Participants

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Reflections on the Workshop

Difficult and perhaps surprising questions are raised, when it comes to considering messages for policy makers. Honest leading scientists, at a series of workshops, have conceded that the scientific evidence to support their conviction that ergonomic improvements can, of themselves, make a substantive difference to occupational health and safety is, at best, incomplete. It is therefore hard to plan to present, in Malmö, the argument that investing more money in research will bring results that will necessarily withstand cost benefit analysis. There is an assumption that research results will be taken and disseminated by others, enhancing education.

7. Health Effects of Electromagnetic Fields

The workshop was led by Ulf Bergqvist and Kjell Hansson Mild, and held at the Swedish National Institute for Working Life, in Solna, on 10–11 December 1999.

Known Effects, Guidelines and Compliance Issues

ICNIRP Guidelines

Ulf Bergqvist set the objective as to establish guidelines for limiting EMF exposure that will provide protection against known adverse health effects. As a first step, risk identification was performed. For electric and magnetic fields below 10 MHz, causing induced current densities about some 100 mA/m^2 have been shown to cause transient changes in nervous system function, shown in volunteers, for example as visual phosphenes. Between 100 kHz and 10 GHz, whole body exposure resulting in a temperature increase above 1°C has been shown to be associated with various effects, including behavioural responses. This corresponds to a SAR (specific absorption rate) level of 4 W/kg. Local exposure to the head in excess of 100 W/kg has been shown to cause cataracts in the eyes of rabbits. These established effects form the basis for the 1998 ICNIRP guidelines.

Basic restrictions have been formulated, including safety factors based on uncertainty in the underlying biological data. Work continues on pulsed fields. For practical purposes, more easily measured variables such as external field levels have been introduced, based on worst case assumptions. Compliance with basic restrictions is assured if these external variables are below specified reference levels. Simultaneous exposure can be calculated summatively, again using worst case assumptions. Procedures for compliance testing are being developed by bodies such as CENELEC. The inclusion of social, economic and political considerations falls within the mandate of the competent national authorities.

European Council Recommendations and International Standards

Paolo Vecchia described increasing consensus world-wide on basic criteria for protection against electromagnetic fields. The same science forms the basis for a number of sets of regulations and guidelines, such as IEEE and NRPB. WHO and European Union recommendations are emerging. Convergence can be noted, in particular as regards dosimetric quantities and concentration on acute cases. The EU issued recommendations on exposure to EMF, with discussion of the arguments concerned, and the underlying scientific consensus. The intention is to increase confidence through common standards. The basis is from ICNIRP, but states may set more stringent standards. This means addressing established health effects, and citing scientific bases for precautionary measures, setting out criteria

for implementation of the precautionary principle. In general conservative approaches are applied to a number of factors concerned, providing a greater margin of overall safety. A number of extrapolation processes are involved in the calculations, which magnify this margin. Safety factors only apply reliably in cases where there are threshold elements in exposures. EU recommendations concern protection of the general public, not workers. There is a proposal for a further directive for workers, but this raises a number of questions. How should we distinguish workers from the general public? Reference levels are dealt with differently in the various standards, and the structure and purposes of the different standards must be understood. There is scope for confusion for the non-specialist. He noted the need to attend to multiple safety factors, with an inflating effect on safety margins. Awareness of the level of safety needs to be addressed. The EU cites the precautionary principle, calling for action in face of severe risk, without waiting for the results of scientific research.

Development of Standards

Georg Neubauer talked about development of standards and the work of CENELEC, and international comparative studies. Illustrating thresholds of magnetic field effects, he demarcated effects of different exposures at varying frequencies. There is usually a significant safety margin. There is current discussion of non-thermal effects of low level exposures. Illustrating specific absorption rates (SAR) for the whole body, for different frequencies, he distinguished the situation for adults and children, and by size. The curve describing the envelope of the different exposure curves in turn defines the standard from which limits are derived. He gave examples of legally binding regulations. An EU directive for workers was proposed in 1994, and a directive for the general public was agreed in 1999. Italy and Germany have specific regulations in place, and the USA has FCC codes dating from 1996. World-wide there are numerous standards, and countries tend to adapt ICNIRP guidelines. ANSI/IEEE (1992), NRPB (1993) and Swedish Precautionary Policy (1996) were cited. There are different approaches to workers and the general public. He considered the effects of different levels of EMF, and added discussion of wavelength-dependent resonance effects between body and incoming fields. The impact of the different international regulatory regime varies, with ICNIRP normally the strictest. He gave an overview of the work of CENELEC's TC211, and the issue of intended use positions of mobile telephony equipment. The orientation is now to issue product standards, developed by working groups, dealing with mobile phones, base stations and anti-theft devices. Other groups are dealing with high tension lines. For mobile phones, there is a European specification ES 59005, concerning simulation, measurement and uncertainty.

Workplace Evaluations – Different Methods

Kjell Hansson Mild addressed practical problems. Sweden has legally binding values, enabling labour inspectors to close factories. The situation varies across Europe. A number of different parameters have to be taken into account: frequency, contact current induced current, duty cycle, E and H fields at places

occupied by parts of the operator's body (without the operator present). The derived levels are an umbrella structure. How do we show compliance? What measurements should we use? He illustrated measurements of plastic welding operators in bare feet on a stone floor compared with a wooden stand. There are issues of calibration, including choices of instruments and confidence levels. The application of the precautionary principle can have major impacts. He discussed point welding, as used in the car industry, where ceiling values can easily be exceeded, and safety distances would make manual welding impossible. There was discussion of detailed practical problems of applying the values. There are gaps in the overall picture.

If limits are exceeded, workplaces should be closed. Cases such as welding were explored, and the use of instrumentation. Particular devices are likely to exceed limits for brief periods. Who will enforce the standards?

Stanislaw Szigielski asked whether ICNIRP and CENELEC cover the case of welding. If not, how should we proceed? The workshop needs to identify exceptional cases, which are not properly covered by the guidelines. Spot welders are exposed beyond the limits, even if they do not report particular effects. **Ulf Bergqvist** described anecdotal reports of problems in welding, and described the requirement in Sweden for authorities to consider social and economic contexts

Paolo Vecchia saw this as a matter for the European Commission. He distinguished the pragmatic approach of Anglo-Saxon countries from the Roman Law tradition of strict adherence with the letter of the law. Guidelines tend to be based on minor effects, and there is scope for confusion and varied interpretations. We could set out a gold standard, but there are complex issues involved in progress towards it. He discussed the levels between guidelines and legislation, and the status of reference levels. How does one prove compliance with basic restrictions? A simple model should be used. Proofs using advanced measures are difficult to check and validate. Legislation places new emphasis on reference values.

Low Frequency Field, Low Level Issues

Epidemiological Studies

Ulf Bergqvist reported a rather robust statistical association between residential exposure to extremely low frequency magnetic fields and childhood leukaemia, which has led to the classification of ELF MF as a possible carcinogen. There is limited need for further studies on childhood leukaemia, but studies on certain high exposure situations, such as use of electric blankets in late childhood and early puberty, could enhance our understanding. In the case of adults, we need to consider occupational exposure. Occupational studies have shown a weak statistical association with leukaemia and brain tumors. Research is needed on a wider range of cancers; there are also apparent links with neuro-degenerative and cardiovascular diseases. There are many factors which could modify effects at an individual and environmental level.

Kjell Hansson Mild discussed the Oxford Survey, and a study from New Zealand. Neither supports the link between power cables and childhood cancers. However, in the Oxford Survey, few subjects had high exposures. A final answer has not been provided.

Human Experimental Studies

Kjell Hansson Mild outlined research on chromosome aberration in engine drivers in Northern Sweden. There has been a significant increase in chromosome breaks, compared with the control group. The exposure is to consistent electromagnetic fields from old engines. These conclusions drew from analysis which also included smoking.

He discussed research on field perception, and studies of different occupational groups involved in exposure to electromagnetic fields. Studies have been undertaken into those who claimed to be electrical hypersensitive, but were found not to have significantly more pronounced responses to electromagnetic fields. Basic physiological parameters are different, but not in this particular set of responses.

Animal Studies

Jukka Juutilainen concentrated on carcinogenesis and developmental effects. Animal studies suggest that EMF alone does not cause cancer. Direct DNA damage is not plausible. There are questions about initiation and promotion, with most studies giving negative results. Analysis is needed of the differences between relevant studies, not just identification of positive and negative studies. Positive outcomes came from long-term exposures to both EMF and other factors. He considered effects on development, reporting on a recent review of past studies, including positive findings. Several studies report minor skeletal changes, which should be researched further. Different exposure levels were used. There is a lack of deformations, but there are possible weak effects on skeletons, resorption and postnatal effects of prenatal exposure. Research is needed on interaction with other exposures. He concluded with an account of immune response, neurobiology and behaviour, and melatonin.

Britt-Marie Svedenstål reported on recent work, now in press, the first on mice in the laboratory, and the second exposing mice outside to power lines, measuring numerous physical factors. Measurements were made of DNA fragments, showing longer tails in exposed cells, resulting from strand breaks. She illustrated changes to single brain cells. Aspects of the experimental data could not be fully explained.

In Vitro Studies

Mats-Olof Mattson explained that mechanistic studies are needed to give practical support for higher level explanations. Cell studies can be illuminating, but are not reliable predictors of health effects. Experiments are needed to enhance understanding. Cellular studies have focused on several biological end-points, such as cell growth, macromolecular synthesis, DNA damage, gene expression,

enzyme activities, cell death, signal transduction and intracellular messengers. This is helpful for the cell and molecular level, but extrapolation to organism and population levels is hard. However, it highlights interaction mechanisms, and suggests processes at higher levels which might be effected.

His recent research included a major review of cellular studies in the literature. He discussed genotoxic effects, effects on cell proliferation in sensitive systems, and disruption of signal transduction pathways. In vitro studies do not convincingly explain interaction mechanisms between ELF fields and cells. Maybe mutagenic outcomes are more significant than carcinogenic outcomes. We need to understand proliferation mechanisms, and signal transduction. There are a number of things we do not know about at cell level, including biophysical interaction mechanisms, dependence on physical parameters, clarification of dose metrics and dependence on biological systems. Biology is complex, and generalisation must be handled with care. With limited knowledge of what we are talking about, we find it hard to tell decision makers what they need to know. Independent laboratories have shown the impact of EMF exposure on breast cells. He described co-mutagenic effects, drawing on research in the USA and Japan. Effects can be protective, with less tumours following exposure, or involve programmed cell death. Alzheimer's disease involves scars in the brain through cell death.

Anthony Muc saw the debate as relevant to standards and government measures, but the practicalities of working life, such as in welding, have not been addressed. How should EMF guidelines be applied and implemented in working life? He compared the situation with chemical exposures, where the phenomena drive the study of mechanisms. In EMF, there is a groping for evidence that these things are bad. He sees it as an issue of implementation.

Mats-Olof Mattsson discussed non-homogenous populations, and the issue of diversity. There are likely to be sensitive individuals who trigger latent factors as an outcome of an external exposure. Responses will vary. We should respect diversity, and not seek single simple solutions. **Anthony Muc** saw this as a critical issue. Our environment incorporates mobile phones and spot welding. What is the best information? What are the implications for working life? Cellular phones are placing by the head the kind of source that formerly caused worry in the kitchen with microwave ovens. He considered meanings of "possible", which can mean "conceivable" or "worthy of exploration". It is the implementation of terminology in the wider world that is vital.

High Frequency Field, Low Level Issues

Exposure Assessment Issues

Dina Simunic reported that the use of sophisticated personal communications devices has been increasing exponentially over the past decade, with a corresponding public perception of the increase in the ambient background of radio frequency (RF) radiation in the environment. Sources of electromagnetic fields have continued to concern the public, and it is the responsibility of public

health authorities to measure these fields, in order to quantify the potential health risk to the general public as well as telecommunications workers. Basic characteristics of RF electromagnetic radiation sources, as well as the potential for interference to electronic devices and leakage were discussed. Because of the impossibility of reradiating surfaces, it is necessary to perform careful planning of measurement protocols, which should take into account both spatial and time averaging. The type of modulation of the RF source is also important when choosing the correct type of measurement instrument, whether it be diode or thermocouple based. The ambient electromagnetic environment is another source of error, if not completely analysed before measurement takes place. Effects of sensor size with respect to characteristics such as frequency of the RF source, as well as measurement distance, are also important. She considered the case of exposure to GSM mobile phones, measuring averaged and peak power, and issues to be addressed in measurement. Particular characteristics of measuring devices were explored. The task is challenging, but important because of potential non-thermal interactions with humans. Other metrics may be needed.

Epidemiological Studies

Stanislaw Szigielski noted that multi-year exposure of workers in RF/MW fields may result in appearance of a variety of non-specific health disorders (NSHD) reported during periodic medical examinations of Polish military career personnel. A variety of NSHD, including periodic headaches, weakness, dizziness, irritability, troubles with concentration and memory, are experienced by a considerable part of the RF/MW exposed personnel and linked by them to work conditions, including exposure in EM fields. He described a controlled multi-centre study, running since 1996, which concerns a range of measurable abnormalities in cardiac function. It is not easy to relate the abnormalities to exposure levels. Monitoring of workers is continuous through shifts, with analysis of abnormalities. Short peak exposures can approach danger levels, in experiments modelling exposure of workers using telephones. ECG abnormalities are increased among exposed workers, but not at a clinically significant level. Similarly heart-rate variability is increased, and there are correlations with shift dose. Research suggests that measurable abnormalities result from exposure, but clinical relevance is not confirmed.

Ulf Bergqvist observed that in a given situation measurements of fields are made, and explanations are sought. Often exposures are inferred, rather than measurements being made. He discussed experience of research with VDUs: there could be similar experience in the case of mobile telephones. A number of studies have examined the occurrence of cancer, or other disorders such as eye damage and neurasthenic symptoms, as well as reproductive outcomes in relation to exposure to radio-frequency fields. Exposure settings have been varied, with studies of occupational settings and exposures from use of radar, radio transmitters, short wave diathermy, plastic welding, and various sources associated with work with electricity and electronics. There have been epidemiological studies of mobile telephone users, considering use of phone, portable or mobile, analog or digital. One hypothesis was of attention disturbance when driving. Other interpretations, in terms of life style and heat, were

considered. Some research suggests that motor vehicle accidents have increased with the use of even hands-free mobile telephones. Further research concerns musculoskeletal disorders among mobile telephone and VDU users. Swedish research has considered headaches and feelings of warmth (but it is hard to find control groups of non-users of mobile telephones). There is little research evidence to link cancer to radio-frequency fields emitted from mobile telephones. The pace of change in technology outpaces the capacity of research. This poses challenges.

Human Experimental Studies

György Thuroczy saw human experimental studies as having close connections with both epidemiological studies and basic research in EMF research. Issues to be addressed include selection of subjects, exposure protocols, risk rating of work stations, selected protocols, possible side effects and confounding factors, and EMC considerations. Volunteer subjects are normally healthy, with known background. Exposures should be close to those encountered at work. Where companies provide mobile telephones, users are motivated or required to use them. Subjects need to be carefully chosen, as is dosimetry. What area is affected by the mobile telephone? Exposure should not be longer than 2 hours per day. Thermal levels, as set out in official guidelines, should not be exceeded. Classification of working sites with respect to EM exposure is important. There are ethical issues to be addressed. **Paolo Vecchia** asked what is the point of such studies, which can only deal with short term low level exposures.

Maila Hietanen argued that human exposure studies in the RF range have focused on effects of use of cellular phones on EEG, sleep disturbance, blood pressure and cognitive functions. No adverse effects on EEG were found in three studies, but minor effects on human brain activity have been found. Two studies on sleep disorders found increased REM latency and decreased REM sleep duration. Cognitive functions showed an increase in responsiveness in choice reaction time. Concerning RF radiation and blood pressure, there was statistically significant elevation in systolic and diastolic blood pressure after exposure to GSM phones. Slight decreases in cerebral blood flow and changes in blood pressure were found. Most studies have concerned healthy young adults. Future studies need to cover different ages, and those with electrical hypersensitivity.

Recommended parameters and end-points of human laboratory studies were acute exposure studies related to neurophysiology; provocation studies on hypersensitive people; sleep disturbances related to exposure during the day; effects of repeated exposure on sleep related parameters; studies on people of different ages; studies on people with different diseases, such as epilepsy; effects on physiological parameters related to stress; memory disturbances; headache in connection with use of mobile phones; effects on auditory and vestibular system; and changes of arterial blood pressure.

Animal Studies

Bernard Veyret outlined the history of research in the field, with an overall drive to reduce the number of animal studies in toxicology. Such studies are still needed

in investigations of the effects of both acute and chronic exposures. Research was formerly related to the use of radar and RF equipment, but is now mainly devoted to mobile telephones. There is a need for accurate dosimetry of laboratory exposure systems. Both systems and data have improved in recent years.

With regard to cancer, there is little evidence for tumour promotion in long-term exposure of non-sensitised rats and mice. With sensitised animals, there are some positive results in BP-induced mice. Ionising radiation did not accelerate promotion of tumours. There were negative results with grafted tumours. With transgenic mice, results were positive. Evidence is unclear regarding DNA fragmentation.

With non-cancers, there has been research into the permeability of the blood brain barrier, with largely negative results. The same applies to hormone levels and reproductive functions. Some minor alterations of EEG have been found. Working memory of rats is being investigated. Effects of mobile telephones on the inner ear of guinea pigs, and headache effects in rats, are being studied. Given the different characteristics of the heads of guinea pigs and rats, who seem to hear something, as compared with humans, we cannot generalise the results.

Animal models are used extensively. Most current studies deal with mobile telephones, but few address the workplace situation, other than base station maintenance workers.

In Vitro Studies

Luc Verscahave reported that most in vitro investigations on RF bioeffects have been devoted to genotoxicology, cancer-related effects, immune system studies, and to a lesser extent nervous system studies. Most results have been negative, certainly at low SAR levels, but there are some positive findings. Exposure dosimetry has improved, but is not good enough. There are complex issues of experimental method.

He reported sporadic positive responses, apparently not due to RF exposure, and apparent contradictions between in vitro and in vivo results. A compound can, he maintained, be genotoxic in vitro, and not in vivo, but not vice versa. Synergistic effects need further consideration. Cell investigations are producing diverse results. Finally, considering immune systems, more work is needed, particularly with reference to the skin.

Other Issues

Future Research Agenda

Antony Muc noted that the WHO EMF project research agenda has developed over recent years to address gaps in knowledge that remain to be filled before cancer and health risk assessments can be carried out by IARC and WHO/ICNIRP. The WHO EMF project deals separately with RF, ELF and static areas of concern. Working life EMF issues are seen as linked to the enforcement of current

legislation and regulations, or the practical application of standards and guidelines, including evaluation and compliance.

The RF agenda is relevant as regards epidemiological aspects of exposure to fields associated with emerging technologies. Studies on spatial and temporal characteristics of exposures are critical. There are large scale animal bioassays, concerned with cancer initiation, promotion, co-promotion and progression. There are large studies on transgenic mice. More work is needed on the reproducibility of reported changes in hormone levels, and effects on the eye, inner ear and cochlea. Epidemiological studies are needed of those with high level exposures. There need to be volunteer and in vitro studies.

ELF exposures are often first felt in working life. Surveys of transients are needed, with extended animal studies and improved exposure assessment. Large epidemiological studies are needed with highly exposed occupational groups. Volunteer studies are important.

Static electric fields are not seen as producing deleterious health effects. However, animal and epidemiological studies are needed, including studies of combined static and time-varying fields.

WHO has limited resources. He addressed problems of natural and scientific language barriers. "High exposure" for example, is less than clear. It is vital to work out what is to be measured. Many EMF issues, including the development of new standards, are not directly related to working life in itself. The challenge is to make the existing standards and guidelines work.

Other Actions (Precautionary Principle, Information)

Kjell Hansson Mild argued for a precautionary approach, taking exposures as low as reasonably achievable (ALARA), and where possible avoiding exposure altogether. The United Nations Rio Declaration on Environment and Development, 1992, set out the precautionary approach, as did the Maastricht Treaty. The case is made for taking simple, easily achievable low cost measures to reduce EMF exposure, even in the absence of a demonstrable risk. With EMF he argued that in some cases only minor changes can lead to major increases in exposure. Regarding mobile telephones, advice in the UK to the NRPB is urging low SAR designs, in support of consumer choice. There is, above all, a need for information.

Ulf Bergqvist endorsed the approach, but there can be problems of numbers. We are outside our area of verified knowledge. He advocated proceeding without numbers, working from a principle that practices should be justified. Unless there are advantages of exposures, they should not happen. We need to examine practices, and see if we have the knowledge necessary to challenge the practice. We need also to be able to address the detail, specific to each practice. Taking the example of engine drivers, advice could be different from that offered in an office. Levels could vary between practices. He argued for a shift from "dangerous" to "unnecessary" levels. Decisions fall on those who pay. Activities need to be understood, and must therefore be accompanied by information.

Paolo Vecchia discussed principles of radiation protection, and the problem of the absence of knowledge about links, between levels of doses and health problems. What is meant by justification? Where do we draw the line? Is all TV necessary? Is all hedonism to be opposed? Is electricity to be banned? He then addressed the idea of unjustified exposure, and drew attention to wide margins of safety. The same principles apply to all human activities. He advocated the EU formulation of the precautionary principle, which deals with objective evaluation of risk; maximum transparency in the evaluation of risk; proportional measures according to risks; measures based on cost-benefit analysis; assignment of responsibilities for providing scientific evidence; and the temporary character of measures. It is a question of scientists getting their hands dirty participating in health policy.

Even if something is safe, it should not be introduced unless it is necessary. New technologies require scientific answers, slow in coming. New technologies such as cellular phones could not be tested in advance, and the market drives development rapidly. Technology will continue to lead. Science takes time to undertake and publish. Society will continue to face these problems. We must be prudent, maintain sensibly low levels of exposure, and science will try to provide answers. The precautionary principle may be the only way forward, as other approaches require knowledge.

How to Handle Individuals with Claimed Special Sensitivity

Ulf Bergqvist summarised the work of an expert group at NIWL, concerning knowledge on risk indicators and causal factors for electromagnetic hypersensitivity. The underlying assumption is that the phenomenon exists, though we can argue about causal factors. These can include individual characteristics, seen in symptoms from the skin and other areas such as headache, tiredness, concentration difficulties, memory and dizziness. So far we are not convinced of a central role for EMF. In many cases, other medical factors emerge. The answer seems to be to work at an individual level, and to gain an impression of the scale of the problem at a national level.

Paolo Vecchia cited a set of nine cases of lethargy in Tuscany, popularly attributed to power lines or a base station. The scientists dismissed the arguments as not plausible. The issue was debated in court and in the press. The eventual answer was poison from local water. The number of cases and the public attention made a considerable difference.

Bernard Veyret asked: "If you cannot evaluate the risk, what do you do with the principle?" In EMF, objective evaluation is not possible.

Anthony Muc argued that in Sweden the precautionary principle means lowering exposures, but this is not always logically and financially justifiable. Terminology, such as "avoidance", needs to be understood. He discussed emerging technologies, where information tends to be available, and precedents can be helpful. Lessons from microwaves are helpful for mobile telephones.

Paolo Vecchia avoided an emphasis on the need for further research, which is obvious. There are many open questions, but a great deal of scientific knowledge. The weak point with respect to workplaces is not knowledge on the effects, but ability to test compliance with guidelines, beyond common sense, with actions implying costs. The conclusion could be the adoption of measures to reduce exposures.

Workshop Participants

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Richard Ennals, Kingston University, UK
Roger Falk, journalist, Sweden
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Bernard Veyret, University of Bordeaux, France
Arne Wennberg, NIWL, Stockholm, Sweden

Reflections on the Workshop

Why do decision makers in the workplace want or need to know about this research? There is a critical interface function to be performed, whether we call it technology transfer, dissemination, education and training, or quality certification. Scientific research in occupational health and safety produces outcomes of knowledge in codified forms. This tends to be obscure to the workplace user or non-specialist, whose interest in the field is more likely to be stimulated by an incident or question of immediate practical significance. When the question is raised, a route should be available through to an answer, a constructive dialogue, or a next developmental step. We need to understand the context (or contexts) in which knowledge may be applied, in order to know how it might be located and presented.

8. Psychosocial Work Assessment

The workshop was led by Töres Theorell, supported by the European Science Foundation, and held at the National Swedish Institute for Psychosocial Factors and Health in Stockholm on 15–16 December 1999.

Epidemiological Findings

Age and Strength of Associations Between Demand, Control, Effort and Reward on One Hand and Cardiovascular Risk on the Other Hand

Lars Alfredsson considered associations between exposures and cardiovascular risk. Exposures, and decision latitude, vary over life. Studies have considered the relationship of relative risk with age: the risk of stress-induced infarction is highest between 40 and 50. Methodological issues include selection of occupations and what to measure. Early retirement complicates studies, and may have been prompted by stress. It does not follow that job strain is more dangerous at an early age. Myocardial infarction rates increase with age, and rates for exposed subjects may be parallel in their rates of increase. Relative risks will seem greater at younger ages: if relative risks were constant, the absolute risk increase would be higher at greater ages. The power to detect increased risk for older subjects is less than for younger subjects. Many risk factors become more prevalent, suggesting no strong general interaction with the underlying risk factors.

Is There Interaction Between Demand and Control?

Johan Hallqvist saw a core issue in job strain as the relationship between demand and control. Considering empirical criteria, the two components might be added to give more than the sum of the two. He referred to the SHEEP study 1992–1994, adjusting for age and other variables such as smoking. He considered degrees of decision latitude, and in demand. He considered decision as a dichotomous exposure, with similar risks for the two genders. Similarly with demand, he found similar relative risks. He considered the interactions between demand and control for men of less than 65, highlighting significance. There are separate effects in control and demand, but increased risk from double exposure. Repeating the analysis with women, there were less women concerned, and evidence of separate pressures of demand and control, but less additional effect from the double exposure. How can this be explained? According to these results, men are more at risk in job strain, and women are more at risk for passive job situations.

Increasing Demands in Working Populations Using Materials from Sweden, Japan, US

Irene Houtman noted that in the *USA* the data suggest societal problems: not enough time, people working very hard and very fast; increasing in each case 1977–1992, then reducing 1992–1997. In the USA decision authority had increased, as had skill discretion; this means intensification of work. However, has discretion increased or has control been decentred? Costs related to stress are rising. Job stability has fallen, with an increase in outsourcing, temporary work and long hours. Flexibility of working is required.

In Japan patterns are different. Work related stress has risen 1982–1997, not related to a steady rise in job demands. Evidence suggests psychological stress, including drinking and depression, related to job control, skill use and work site support. Hypertension and myocardial infarction are linked to long hours, demands and new technology use. Immune problems are linked to economic factors.

In Europe the key increase has been in high speed work 1991–1996. There are similar patterns with other quantitative demand changes. Changes in ability to choose speed or rate of work are similar to the USA. There have been increases in computer use, suggesting association with intensification of work. Overall, quantitative demands are increasing, with decision authority and skill discretion. Changes are taking place in work organisation, adding to psychosocial risks. We see an ageing workforce, more dependents, and many "nations on the move" in Europe. The overall situation is complex.

Gender Issues

Christina Reuterwall considered the sum scores of the demand and decision latitude items in the **Karasek-Theorell** questionnaire. In the SHEEP study, there is no real difference between men and women with respect to demand sum scores, but for decision latitude the figures are higher for men. Age has little significance on demand. With decision latitude, there is some change with age. When the data were first presented on simultaneous exposure to high demands and low decision latitude, job strain was discussed in terms of relative risks, in terms of high demand and low control. A comparison was made in terms of learning new things, exposing higher levels of relative risk. One single decision latitude item "will learn new things" seemed to be a stronger prediction of myocardial infarction than the job strain measures in the SHEEP data. The results involved several different risk factors, suggesting higher relative risks for women, but with lower levels of myocardial infarction than in men. Calculations were made to indicate the number of "saved" cases where exposures were removed in the Stockholm population.

Annika Härenstam considered strategies to improve gender perspectives. How do the items in questionnaires work for women and men? Are they equally reliable? The boundaries between work and home are blurred. She referred to a large study of living conditions, and outlined a person-oriented approach, rather than risk oriented. She described matched sampling, a difficult experience in itself, given the differences in total situations, and multi-level analysis, using data from branches,

workplaces and individuals. Conclusions suggested gender differences for those with health problems. Women attribute the problems to themselves, while men blame external factors. Structural factors seem important, such as gender segregation in the labour market and changes in work organisation, giving overall deterioration in the situation of women. Healthy work can be found in many areas, but in lower class occupational groups we find downsizing and deprofessionalisation, influencing the interpretation of general results from risk studies.

Cross Country Comparison of Job Stress Theories and Scales

The job stress theory project was supported by the Japanese government. The project takes up current models from the international literature, applied in the Japanese context. **Norito Kawakami** compared the demands-control model in Japan and the USA. The model seems highly applicable to Japan, as seen in a large scale cohort study, but there are some differences. There is an apparent lower score for job overload, depending on the wording of the questions. There may be an association with cardiovascular risk strategies. He provided a framework to link culture and job stress, considering characteristics of the job stressor, perceptions of stressors and expressions of distress. Job demand and control, and the interactions, depend on the nature of the job. Job novelty, predictability and decision discretion are linked. Research is needed on the job stress process, on the psychological stress process and the physiological stress process. There is research on impacts of heavy job demands and active coping. Is controllability therefore partly an unconscious process? Research considered objective and subjective controllability.

Akizumi Tsutsumi presented preliminary results of the effort reward imbalance model, after international support in back-translation. Comparable scores were found, with internal consistency. Considering psychosocial job characteristics and depression, the model was applied using questionnaire data. The effort reward imbalance model seems promising for depression, which is not prevalent in Japan. Those who declared themselves distressed or very distressed were analysed in terms of effort reward imbalance, with an interest in explaining this lower rate. The sample included those with hard working conditions. The answer includes cross-cultural applications, considering more diverse data and specific Japanese questions.

Active Jobs and Risks in New Work Organisations in a Global Economy

Robert Karasek added social class and political contexts for the psychosocial model. This integration is important for wider debates. He needed to understand from Swedish data the original orthogonality of demand control with social class. Income was linked to the active quality of work. There was little covariance with active-passive dimension and income, and job strain and income. Measures can be used at the occupational level to explain status levels, or explain the variance in psychologically dependent variables.

The potential political and economic dimensions of the demand control model are important. Marxism focussed on distribution of material gain, missing out the

workers' active participation in the political process. There is a window of opportunity for a new political economy. The active dimension implies a new form of production, skill-based and associational. There are new costs, a different politics and class structure, with epidemiological implications. The job strain variance collapses to a class model. At the occupational level it collapses to decision latitude, linked to social class. At the individual level, psychological demands are often linked to individual personality, but should also capture an assessment of the environment from individual self reports. The solution was presented in a diagram of the conducive value economy, taking over from the commodity value economy. The issues are now about activation, democracy and participation. There are dangers and challenges, and dialogue needs to be structured, going beyond task level measures.

Social Class Issues

Combinations of Demand/Control and Effort/Reward in a Changing World of Working

Johannes Siegrist compared the two models, and considered some joint results. He identified three key assumptions: the psychosocial work environment as a concept for studying people and work using a variety of kinds of data, integrated at the individual level; the structure seen in terms of opportunities for fulfilment, stratified by social class. These include access to social ties and social support, access to the labour market, and access to fair exchanges in the work environment. He emphasised study at the level of the individual, with concerns for validity of data and the function of theory. Theories constitute a small set of propositions with broad explanatory power.

He outlined the effort-reward imbalance model: measuring salary and mobility, the model includes more distant aspects of the work environment. He discussed overcommitment, and the need for control and approval. In stress theoretical terms, the model comes from reciprocity theory. Lack of reciprocity implies low self esteem. Reward is part of a grammar of social exchange, linked with ideas of distributive justice. Stress can pose a threat of loss of control, requiring mastery and self-determination. Democratisation emerges as a key policy issue. The two models cover different areas, and may be applied together. He referred to the SHEEP study, covering 1200 infarction patients, looking at combined effects. Stress increased as both models were applicable.

There are some unanswered questions. Statistical modelling of effects needs to be improved to augment comparability. There are two key approaches. We can construct categories or ratios. Psychosocial work environment and inequalities in health have to be considered. Low job control tends to explain new cases of heart disease. The effects of demand control or effort reward imbalance are more pronounced in low socio-economic classes. In view of profound changes in the nature and organisation of work in the global economy, it is hard to evaluate the future applicability of the models.

Effort and Reward Components in Relation to Social Class

Richard Peter discussed standard indicators, noting the need for explanation of social class inequalities as applied to individuals. Can work stress fill the gap? We assume increased exposure with limited status and limited resources. There have been studies of employment grade and risk of coronary heart disease, with consideration of job control. He used the Swedish WOLF study, with hypertension as the outcome, linked to education and effort-reward imbalance. The impact was most pronounced on those with less than 12 years education. He analysed exposure groups, taking each model and the two combined, increasing risk estimation. Would this combination help explain the data, looking at different levels of education? He concluded that chronic work stress accounts for much social variation in coronary risk. The combination of models enriches explanation.

Social Class, Social Capital, and Health

Per Olov Ostergren linked social inequality with psychosocial issues, using a background of work in social class and health. The new concept of social capital and health is useful: is it old wine in new bottles? He drew the concept of social capital from Robert Putnam, studying Italy and explaining differential regional development. This means trust between groups, and social cohesion (from the work of Richard Wilkinson on income inequalities and health reflecting segregation and injustice). Social capital is popular, but with different interpretations. In Sweden politicians, apart from Conservatives, like the idea of social capital, and refer to the welfare state. This tells us little about the underlying driving forces behind inequality, as social cohesion is hard to present as a source of wealth. Social capital needs to be developed, linked with work organisation and work stress, in the global economy. This could mean an extension of lean production, and a risk of decreasing social capital. Marginalisation of people from the labour market has a fragmenting effect. People work harder, at the expense of their private lives, and health declines. There are new methods for analysing these issues of social capital at aggregate level. We can talk of social capital, financial capital and health capital. Changes can be made between the forms of capital, through choices and efforts.

Changing Social Classes in Relation to Demand/Control and Effort/Reward

Michael Marmot wants to explain socio-economic differences in health, given that in the UK classifications are based on work. Collapsing of psychosocial issues into social class is not a problem, but raises questions on the influence of work. The Whitehall II study showed correlation of position with demand: the lower the status the lower the latitude. By itself this is not associated with disease risk. The model is not refuted, but the civil service workforce may not include enough high demand low control workers. To assert that low control mediates class relations does not say enough; more investigation is needed, adjusting for class. There may be other factors. Social class could stand for material conditions; or other matters

such as Adam Smith's radical concerns for necessities as opposed to appearance and place in society (for example linen shirts or leather shoes); a further approach is based on Ericsson and Goldthorpe on power relations in the workplace. We lack data on the original question on social class. He illustrated ischaemic heart disease by social class in the UK, declining with high status, but not with low status. New socio-economic classifications based on control at work might help, and explanations such as smoking could be tested. Control was linked to hierarchical position, with greater control and effort, while low rewards and blocked career are low grade problems, especially for women. The research group suggests a widening social gradient, possibly linked with changes in the work environment.

He compared rising life expectation in Western Europe, and decline in Central and Eastern Europe and Russia. He investigated control over life, rather than just work. Poor health was related to lack of control, in minority communities in Russia and the Baltic States. Could control explain population differences in coronary heart disease? High perceived control was linked with low mortality; low control with higher mortality. This data raises the kind of comparisons, across countries and over time, needed to answer the original question.

Adaptation of Methods

Development of Demand Measurements

Tage Kristensen considered demands and problems of measurement, illustrated with experience from a current Danish project. How many dimensions should be included in the research? A more refined measure is needed. Emotional demands have often been requested, but have not been included. Negative and positive demands have been mixed, as have quantitative and qualitative. In Denmark five demand scales have been developed, including two for emotions, including hiding emotions. Internal reliability coefficients are high. How highly are the various scales correlated? Correlations are modest, based on a representative sample of 2000 Danish people. Looking at particular jobs, which score highly, and what are the differences between jobs? He considered quantitative and qualitative demands, and then emotional demands, with teachers scoring highly on each. The demand for hiding emotions brings out those who are obliged to be polite, including home helpers. Sensorial demands are high for drivers and machine fitters. Combining the new scales three distinct groups emerge: working with things and symbols, working with customers, and working with clients. As an outcome, there is more precision, reliability, and graduation between jobs.

Workplace Demands: Insights from Cognitive Ergonomics and Brain Research

Karen Belkic threw a different light on intensification of demands, part of a global trend, with profound effects on working people. In the cognitive ergonomics and brain research literature, the emphasis has usually been on improving performance rather than humanising labour. She outlined the brain's handling

of incoming information, taking sensory characteristics, discerning meaning, making decisions and then taking action. The number of alternatives to be considered affects the speed of decisions. Levels of information transmission can be defined. Does this help? She described work in Stockholm on professional drivers and heart disease, comparing the drivers with subway attendants. Within occupations she distinguished city bus drivers from truck drivers, the former facing more input demands. In addition we need to consider energy and arousal, and to distinguish knowledge-based processing, in series, from automatic processing, which can be in parallel. The more actions are to be executed, the less knowledge-based processes should be used. She then added another dimension, taking into account threats and priorities. This raises issues of threat avoidant vigilant activity, where lapses of attention can be catastrophic. She outlined research on contingent negative variation among professional drivers dealing with threat avoidance. Amateur drivers were given a presentation of an accident requiring a response. Electrocortical activity was high in such disturbing circumstances, with reactions faster than processing, with error and disaster as a consequence. Unrealistic pressures pose challenges, and the brain requires time in order to cope. Time pressure is anathema in such cases.

Sick Leave and Work Compensation

Finn Diderichsen outlines changes in the way that sick leave is recorded in Sweden, making longer term comparative research harder. He reflected on social inequalities in health, and effects of particular exposures. Being ill can have social and economic consequences of itself. People choose different strategies for coping with poor health in the context of work. Studies of sick leave set against the national household study and job exposure matrix give a set of odds ratios linked to demand, control, strain and passivity. In the 1980s absenteeism was a matter of selection of ill women into the booming labour market; they often took on rough jobs, such as in health and social care. Short term absences can be a successful coping strategy. Long term absences operate differently.

It is important to contextualise relations between work and absences, understanding family contexts, and the impact of heavy work on lone mothers. Many Swedish women work in caring jobs, and give priority to those with whom they work. There is debate on deregulation and removal or minimum wages, and the impact on the labour market. Men in Sweden 1979–1995 have retained higher employment levels, when encountering health problems, than in the UK over the same period, showing the effects of health selection.

The Psychosocial Work Environment, Sickness Absence and Psychiatric Disorder

Steven Stansfeld presented the Whitehall II study as longitudinal, rich in sickness absence data. He considered 1985–1988 in terms of work characteristics, a job secure period, and then 1991–1993, more job insecure. He considered short and long spells, with physicians only needed for long spells. He linked control and short sickness absence in women. When adjusting for employment grade, the

effects of control are removed. Control is not merely an indicator of material environment. He considered social support, linked to long spells of absence in both periods. In both instances, high social support is protective against long absence. In terms of demand, there was little link in the earlier secure period, considering survivors in the cohort. In the job insecure period, demand is linked with increased absence.

He considered psychiatric disorder as an outcome, where social support is protective. Effort reward imbalance adds to risk of psychiatric disorder as measured in screening. Looking at general health caseness and job demands, high levels of demand are risk factors for psychiatric disorders. This still applies when adjusted for life outside work. With decision authority, low authority is linked with caseness, but this goes with adjustment for employment grade. The effect of demand on sickness absence is different within employment grades, so at low grades demand is linked to absence, but not at high grades. It may be a matter of the salience of demands in particular grades.

Interventions

Töres Theorell argued that everyone needs to know if the theory can be translated into practical outcomes, for example through intervention. This can mean work redesign. If the way of organising work can be changed, workers can feel better and feel more in control, while improving productivity. There are problems in this area, at two levels. How should one intervene? How does one prove an effect? As researchers, we normally need double blind studies, but this is not possible in psychosocial interventions. Similar discussions arise in ergonomics. We cannot wait for ideal experiments, but need to relate to real experiments in the real world, collecting information as best we can. There are problems of statistical power. Take job strain and heart disease, where within a workforce we can in theory reduce infarctions by 10% if we reduce the strain on those exposed, but in research terms the samples may be small.

He described a study of white-collar workers in an insurance company; the intervention was a programme to improve managers, and the goal to improve the knowledge of managers on group working and employee needs. The organisation was in turmoil, with local anxiety, reflected in the authority of decision measure. Cortisol levels fell in the experimental group, and not in the control group. In the experimental group there was no change in authority over decisions whereas a marked deterioration was seen in the control group. One interpretation is that "improved managers" could prevent the ongoing feelings in employees in the company, that they were losing control at work. The company was facing possible different responses from parts of the company to the wider debate on insurance, not reflected in the empirical data. More experiments are needed, covering blue-collar workers as well. There are many studies on bus drivers, around the world. We need to take advantage of spontaneous interventions, and try to create control groups. We should not be overly constrained by demands for double blind studies, recalling the objectives of the interventions in terms of democracy and skill discretion.

Risk and the Workplace

Hans-Martin Hasselhorn considered the WOLF study of cardiovascular risk and the workplace, with 4000 people. The presentation dealt with job strain, concerning correlations between external and subjective ratings of decision latitude and demand. Correlation is low for older male white-collar workers, higher among younger blue-collar workers. Older people overestimate decision latitude. The patterns are different for women. Perhaps the questions need to be redesigned. The objective is not to maximise correlation, but to learn from the differences and address physiological outcomes. It is not enough to consider men and women, but also blue-collar and white-collar. There is higher risk for active work only in white-collar workers. The research looked for cumulative risk from multiple exposures, considering a range of workplace and lifestyle exposures. The active are a new risk group. How do they differ from others? White-collar men were studied in more detail, and compared with the overall group. Those who feel strained have less good coping behaviour, are over or under qualified, lack social support at work, but no significant physical differences. Taking external ratings, differentiation is in physiological terms, suggesting that it may be a better way of distinguishing risk situations.

Strong Relationship to Heart Disease but Not So Good to Risk Factors. What Are the Mechanisms?

Ulf de Faire was concerned with this discrepancy. We find many examples in cardiovascular research, when tracing associations with heart disease in particular families. Have we studied the wrong risk factors, or taken an overly simplistic view? There are many modifiable risk factors, established, probable and possible (totalling over 300 factors).

Lipids are easy to measure, but this is the tip of the iceberg. More detailed analysis of lipoproteins is needed. Postprandial measurement of triglicerides is useful. New measurement methods are available. He characterised borderline hypertension, considering metabolic changes. Specific analysis has much to offer. He considered blood pressure, and the range of measures available. Ambulatory blood pressure methods are better predictors than random measurements. Information is also available on vascular function and variable characteristics, which can be an early sign of vascular disfunction, possible linked to job strain. He considered inflammation and atherogenesis, with a number of measurements available, including heat shock proteins. Some of the measurements are hard to make reliably in serum. Detailed studies have been undertaken.

He gave a brief account of insulin/glucosed hemostasis, outlining the kinds of tests available to assist psychosocial research. He discussed hemostasis and cardiovascular disease. He argued for the extraction of DNA, for which a growing range of genetic tests are available. We need to understand more about the biological mechanisms involved.

Soft Methodology

Gunnel Ahlberg-Hultén made a qualitative validation of the demand-control model, based on the MOA study. One of the aims was to investigate where questionnaire data reflected actual descriptions of the workplace environment. Quantitative work checks the reliability of the data, but the presentation concerned qualitative analysis. An interview model was developed, looking at spontaneous meaning, relevance, context, and valuation of questions. This covered hard work, conflicting demands, freedom *how* to perform work, and freedom *what* to do. The model covers people working with people or with things. The core sample was of 36 subjects. Cross case stratifications were undertaken: care/not care, women/men, educational level, test response levels, response frequencies (often-sometimes/seldom/never). The data was divided in new ways, looking for new patterns. Regarding working hard, this was reported in the health care sector, with reports of intensity in terms of time, emotional, cognitive and sensorial demands, characterised by lack of control. Hard work had a negative effect on free time. Conflicting demands were more equally distributed, with concentration in health care. Hierarchical position was important. Those not facing such demands cite strong support. Influence over *what* to perform is part of the professional role, and most felt they had that influence. Many felt they had influence over *how* to perform the work, with a broad range of span of control. Superiors were either absent, or had good relations. Age and experience were important. The ambivalent group were really negative, and the negative group experienced high demands inhibiting influence. The questions are relevant for men and women, qualitative and quantitative demands interact, they reflect true differences at group level, they catch a wide span of control, response alternatives might usefully be changed, as "sometimes" is ambiguous. **Töres Theorell** noted that the individual level is a different world, where we cannot tease out theoretical dimensions.

General Discussion

Robert Karasek discussed the supplemental quality of demand control and effort reward. Job insecurity is illuminated in effort reward. He is interested in distributive justice, and has difficulty interpreting effort reward categories, as they cover very different conceptions, relating to the environment, individual behaviour, and the environment as assessed by the individual, and the social level. He located the discussion in the political-economic arena. We need to clarify what is measured in different studies.

Johannes Siegrist admitted that the model of effort reward imbalance was unclear regarding intrinsic and extrinsic elements. At this stage the personal and situational levels are clearer, but both categories of information are needed. A new study looks at the impact of overcommitment.

Michael Marmot argued that the social hierarchy is not just about material conditions, and concerns gradient, relative deprivation, which is a psychosocial concept, fitting the two models under discussion. He is concerned about demand in a conceptual sense, and is not clear that demand can be defined independent of control. High demand is a status symbol in the senior civil service, and in academia.

Johannes Siegrist linked notions of demand with notions of threat. If you cannot cope with demand due to low control, there is a problem, in terms of health and reward. It would be worth modelling threat in a psychosocial context.

Workshop Participants

Gunnel Ahlberg-Hultén, Karolinska Hospital, Stockholm, Sweden
Lars Alfredsson, Karolinska Institute, Stockholm, Sweden
Tomas Andersson, Karolinska Hospital, Stockholm, Sweden
Karen Belkic, Vetenskapsstaden Int. Centre, Stockholm, Sweden
Finn Diderichsen, Karolinska Hospital, Stockholm, Sweden
Reza Emdad, IPM, Stockholm, Sweden
Richard Ennals, Kingston University, UK
Robert Eriksson, Socialvetenskapliga foskningsradet, Stockholm, Sweden
Ulf de Faire, Karolinska Institute, Stockholm, Sweden
Roger Falk, NIWL, Sweden
Peeter Fredlund, Karolinska Hospital, Stockholm, Sweden
Johan Hallqvist, Karolinska Hospital, Stockholm, Sweden
Niclas Hammar, Karolinska Hospital, Stockholm, Sweden
Annika Härenstam, NIWL, Sweden
Hans-Martin Hasselhorn, University of Wuppertal, Germany
Irene Houtman, TNO, Netherlands
Kerstin Jeding, IPM, Stockholm, Sweden
Robert Karasek, University of Massachusetts, Lowell, USA
Norito Kawakami, Gifu University, Japan
Anders Knutsson, Umeå Regional Hospital, Sweden
Tage Kristensen, National Institute of Occupational Health, Copenhagen, Denmark
Ingvar Lundberg, Karolinska Hospital, Stockholm, Sweden
Michael Marmot, University College, London, UK
Per Olov Ostergren, Lund University, Sweden
Richard Peter, University of Ulm, Germany
Christina Reuterwall, Karolinska Hospital, Stockholm, Sweden
Johannes Siegrist, University of Dusseldorf, Germany
Steven Stansfeld, University College, London
Dagmar Starke, University of Dusseldorf, Germany
Töres Theorell, IPM, Stockholm,. Sweden
Akizumi Tsutsumi, Kurume University, Japan
Anders Wikman, NIWL, Sweden

Reflections on the Workshop

This was a high level discussion by international leading figures, including the designers of the key models under discussion. The discussion was detailed and wide-ranging, thanks to expert chairmanship.

Gender

1. Success Factors for Retraining Women in Restrictive Jobs

The workshop was led by Kristina Zamore, and held on 18–20 January 1999 at the Office of the Swedish Trade Unions in Brussels.

The SAN Model

Kristina Zamore introduced the SAN model, connecting learning to equal opportunities and organisational culture at work. SAN is the Joint Work Environment Council for the Government sector in Sweden. Describing the principal area of work of SAN, she mentioned risk factors, development and work-related health issues. She concentrated on risk factors due to ignorance: musculoskeletal problems can affect women engaged in monotonous work or where the physical effects of working conditions are different than with men, and managers are unaware of the higher risks for women.

She referred to the Demand-Control model of **Karasek** and **Theorell**. High control combined with high demand could lead to positive stress, while high demands but low control could cause high negative stress. Low demand and low control suggests passivity. A greater amount of women than men have jobs in the category low control – high demand. She identified gender differences, explored in the ADAPT project on learning, carried out by SAN, and made the link between psychosocial factors and approaches to adult learning. Some learners have faced psychosomatic problems, and a few of them severe problems, and need to learn to trust in their own capacity for learning in order to learn better. There are different gender preferences as regards learning styles, and different social needs: women are more likely to wish to work as members of groups.

There is no known difference in results from particular training, but the price paid for learning varies considerably. There can be different starting points, for example in technical subject areas, but also from a self trust point of view. Outcomes are not just based on inborn talent and dedication, but also reflect on the organisation of training, workplace organisation, the self-image of the worker or learner, the degree of trust in one's own capacity, motivation, security in the

learning situation, and reactions to stress. Learning must be seen as social, not just as a matter of brain function.

In simple terms, men own working life, while women own home life. School experience has often been negative for women, with teachers showing preference for boys. There were general conclusions regarding the SAN study of results of development projects, concerning improved benefits from training courses. Improved self esteem can be achieved from personal development. Preparatory training can be helpful for self-esteem. Networking among equals and the habit of talking in groups strengthens professional identity and a positive self-image. Women were seen as under-privileged in work-related training. Research on adult learning has emphasised dependence on the work environment. We need to take a fresh view of intelligence and organisation; learning is based on social interaction. This knowledge needs to reach managers and the workplace if training is to be effective and efficient. Individual failures reduce the motivation of individuals and their work colleagues, and can lead to future work difficulties. Psychosocial factors are linked to the outcomes of work-related learning; working life culture is often unfavourable for women; gender consciousness with reference to learning processes needs to be raised; and knowledge and knowledge transfer are needed.

Learning for Change

Anette Svensson spoke about the ADAPT project *Learning for Change*. The key job is the facilitation of learning. Over two years in Linköping, on the project "Design and experimentation with new management tools for preparing the adult population for employment changes", 112 employees worked half time in education, half time at work (with 56 unemployed people taking on their roles as substitutes). The employees were enabled to complete higher secondary education qualifications and proceed to Higher Education. They became better able to cope with structural and organisational changes, with increased employment mobility, increased competence, improved standards of service, and formed their own Learning Organisation. The international partners were Globalgarve of Faro, Portugal; Guinness Ireland Group; Diputación Provincial de Soria, Spain; and Helsinki University of Technology, Department of Lifelong Learning (DIPOLI), Finland.

She summed up the messages of the project with the acronym OASIS: Objectives Activity Sharing Individuality Support. The teachers learned new roles as facilitators. The participants have described benefits in terms of improved learning and ability to cope on their own. The project combined formal education and training to meet needs of the workplace. This meant the intertwining, over two years, of formal education aspects: theory and practice, trial and error, formative evaluations, reflections, diaries, the learner in focus, team working, personal development, group development and participation. It addressed training needs of the workplace: responsibility, activity, creativity, holistic, problem base, learning facts, learning to find information, a process approach to problems, keeping vision. The partners had objectives for themselves: to improve the way they work and learn; help each other find ways to overcome barriers which block people's learning; support and give feedback; create experiences for people to learn in new

ways; find new ways for learners to communicate; learn by evaluating processes and results; and disseminate findings to other organisations internationally.

Emotional and Rational Choice in the Learning Situation

Harriet Aurell described the situation regarding women and technology; women are normally expected to follow the male lead. This presents problems: women come from a different cultural context, and new methods are needed. Insufficient attention has been given to the emotional component of reasoning and learning. Drawing on research in cognitive psychology and artificial intelligence, she discussed neural networks and the role of the limbic system in the brain. The limbic system values information before it reaches the logic structures, which interpret it more rationally. The emotions and the feelings should be taken more into consideration in the teaching situation. She identified threats to the self-conception and self-esteem of the individual, including threats to the intellectual capacity: denial of it or lack of possibilities to show, use or be aware of it; to the emotional capacity: things or situations that are outraging and insulting to the person's self-conception; and to social capacity: isolation, loneliness and incapability to reach one's personal goals.

Women students can face particular threats to self-esteem, as they are portrayed as decorative or caring rather than intellectual, logical, philosophical or scientific. Her project, supported by the Labour Market Board, had been successful in increasing the proportion of women proceeding to technical courses in Higher Education. Differences between male and female performance in technical areas can be attributed to power rather than sex. Similar discussions might be held about other groups excluded from key power roles, such as those from different cultures, and older people. Intelligence needs to be redefined in a less culturally biased manner: there is too much emphasis on memory, rather than links and associations. It is hard to separate individual from organisational and cultural levels.

Cognitive Psychology: Theoretical Framework relevant to Technical Training for Women

Harriet Aurell emphasised the cognitive angle, seeking to identify obstacles in the learning situation for women in technology. Women on her courses have curiosity about technology, but have found it hard to gain the knowledge. The problem is not with mathematical computation, but with finding appropriate explanations of processes, with a female perspective. Simple solutions can appear mysterious. Educators can lack understanding of their pupils' difficulties, and may use inappropriate language, leaving the pupils to grapple with ongoing confusion. This can be a problem like speaking foreign languages.

Significance of Work and its Social Context during the Learning Process

Kristina Zamore presented the second stage of the SAN model. A training situation is socially a part of work. The capacity for learning has much to do with the interaction between people, including the learner. Self-image and trust in oneself are vital, and those engaged in work-related training bring their self-image from work into the training situation. New insights and knowledge lead us to see shared responsibilities by the learner and those actors who have influence on conditions at work which affect learning capacity. Restrictive, dead-end jobs, with limited professional or personal development, "degrees of freedom" and use of knowledge and capacities, can lead to frustration at the lack of learning. She introduced the concept of negative learning, and learned helplessness, or learned powerlessness, subvaluation of one's own capacity. This perception may spread. Lack of degrees of freedom can explain the inability to act. Work environment, general work conditions, self-image at work, support and organisational climate, and the attitude of managers are all important for learning capacity and interest in learning. Learning is a process: preparatory (personal development where needed, participation in planning); training (trainers aware of complex relations between learning and psychological and social well-being, methods which include participation and conscientisation); and integration (integration of new knowledge into the company).

Anette Cezanne described the approach of "black belts" in Total Quality Management and kaizen facilitation and team-building in an aircraft industry company where she was a consultant. She outlined the role of internal consultants, resulting in improved job satisfaction and effectiveness.

Lise Bisballe works at "The Culture Cellar" (Kulturkaelderen), publicly funded on a project basis, developing mutual identity among staff. A management working group interviewed the staff to identify needs, with improved communication between locations as a priority. Training was to improve techniques of organising meetings, chairman training, etc. The concept of the Learning Organisation was introduced, and an external consultant was used as facilitator. This meant change for some, but not all, staff. All need to have a chance to have their say.

Seija Hämäläimen is involved in development projects, following training in quality management, certificating auditors. Recent development projects in environmental management have involved career changes for the 20 women involved, unemployed or seeking a change, and comprised heterogeneous groups. She identified six key processes, noting the different meanings for participants with different backgrounds, and built a self-evaluation process, enabling people to audit and take responsibility for their learning. The learning process needs to incorporate security, tolerance, collaborativeness, control, responsibility, being accepted, individual influence on learning, values, and time to reflect. The trainees, all women, now all work in environmental management systems, after late career changes. Environmental managers and consultants work through networks. Participation is central.

Roberta Messina argued that organisational and personal development levels should be linked. Executive managers should be involved. Customer oriented organisation needs to be spread, both inside and outside. Working conditions need to include time to meet priorities. Self esteem and responsibility are closely linked. At the society level, the economic value of life-long learning must be stressed.

Catherine Hennessy shared experience from The Body Shop, where they try to get people thinking about learning. LOVE means "Learning Of Value for Everyone": each employee can receive £100 annually for learning not related to work. Only 30–40% take up the gift, perhaps because the idea is unfamiliar. The company provides money, but not time. She gave an example of an employee with apparently low self-esteem, whose approach to work changed after a course in tap dancing. Another example was "Limbering up for Learning". Participants meet their fellow learners, and are presented the draft content of their course. They should make new links to old learning. The main barrier is time, and the actors are fellow learners. The follow-on stages would be development of new job-related skills, linking with external bodies for accreditation.

Roberta Messina gave examples from her experience. The first was a job rotation scheme in the tourist department in Palermo. Preparation was careful, involving trade unions and executive management. The success was seen in a high level of participation. Starting at the same level was important, and the group members continue to work together well. Another example concerned training of high school teachers, in equal opportunities and gender approaches. The start was in small groups, working from individual experience, enabling people to be less afraid of opening up to others.

Susanne Reschreiter-Töscher applied the SAN model to her course for unemployed women, seeking motivation and employment. Many are single parents. The course involves both theory and work-based learning, more about counselling than teaching, and draws on family, peer group and friends. The central focus is building self-esteem. After the course, the women undergo a form of apprenticeship, and continue to visit once a month, serving as role models for each other. It was hoped to engage the employers more in future, easing their way forward into good practice regarding training.

Liisa Nakari described how to build a learning process for unemployed people by combining development projects in SMEs and training days at the Institute. Starting training with developing values in small groups helps to develop personal skills and self esteem. Tutors support professional development, and sell the skills of unemployed trainees to employers before they meet them. They prepare the trainees to meet the demands of their new employers. The development project eases people into the world of work, and produces better results than conventional programmes.

Anne Murphy considered the integration phase. Her background was in learning design, now concerned with commercial consulting. She works in change, realising that the learning organisation is not trivial to implement. She thought that the key was design, so designed a flexible programme for the Basque Institute of Women. She encountered the real world, rather than motivation to change. She needs a clear co-mission, working with partners: business tasks are sponsored by those in

power. It is hard to sell gender as part of the value proposition. Success is when the people with the budget speak of success. She needs to see the pattern of language and interaction change. New things are measured in relation to cost and value, and measured in new ways.

SAN: Participation – Development – Learning

Barbro Burén and **Per Insulander** described their work on the recent agreement on co-operation for development, between the social partners in the government sector. The Swedish Agency for Government Employees is financed by the government agencies, and employs 70 staff. The three trade unions were represented at the workshop. The co-operative process started as a negotiation, which achieved little in the first year. A SWOT analysis cleared the way to the collective bargain. Changes in society, including the role of technology, and in the culture of organisations, have increased demand for personal responsibility, and the need for new organisational solutions.

Per Insulander set out core ideas. Co-operation is based on informal processes, proving good information, an open climate, constructive discussion, practical problem-solving, and focus on the business. The traditional co-determination act required formal relations, but has become obsolete, more based on structure than supporting activities. The change has been from negotiation to co-operation. More power is passed to the local level. The system can be seen at three levels: individual personal development talks at least once a year; workplace meetings, at the team or group level, where decisions are made; and representation by the social partners solving problems which cannot be solved at workplace level. The method is co-operation at each level, using a round table. Implementation is within the framework agreed. Where local agreements cannot be reached, the old system continues. There are problems, including the creation of confidence, encouraging the insecure. The process is more important than the procedures.

Looking Ahead: The European Perspective

Allan Larsson, Director-General, Employment and Social Affairs, outlined the Employment Strategy. The four pillars, developed in 1998, are entrepreneurship, employability, adaptability and equal opportunities. *Employability* is about a new active labour market policy to prevent unemployment. *Entrepreneurship* means a policy to create more jobs, especially in the service sector, tapping the potential of the information society. *Adaptability* is a new concept of flexibility and security, changing work organisation, bringing together the social partners: this is working in the form of the social dialogue. *Equal opportunities*: addressing family life and mainstreaming.

Employability

Employability is about reversing the 17m unemployed, especially young people, through early identification of individual needs and tailor made responses, giving systematic precedence to employability measures rather than passive support

measures. Active measures have depended on proven weakness, and targeting needs to focus on those most in need. Governments should provide a new start. Each year there has been a drift of about 4 m into long-term unemployment.

The New Enterprise Policy

The weakness has been in the service sector, by comparison with the United States. Within services, each sector is bigger in the USA than in Europe, indicating employment potential. Communal services include education and health services. There are needs to be satisfied, leading to a strong economy with strong communal services.

Adaptability

Technology is the key driving force. The rate of replacement of technology is rapid, and the organisation of work needs to change, with new ways of working. It is not possible to rely on top management: the organisation must mobilise people close to the market. We see a decline in young people entering the labour market, and more with experience but with old education and training. Organisations tend to try to get rid of older workers and recruit youngsters. We see a future with young technology but workers with ageing education and training. The workforce is the key investment project over the next ten years. Continuing education and training for adults is more active in the USA, where they are more decisive in setting objectives, defining organisations and then training. In Europe the budget and time have run out when training is considered. The social partners in Europe need to emphasise lifelong learning.

Equal Opportunities

The gender gap needs to be closed in Europe. The pattern will change, as women are the available resource for a growing economy. This means better combination of working life and family life, if the needed economic benefits are to be achieved. Equal opportunities need to underpin a successful EMU. The approach is now based on mainstreaming, with measures on childcare, parental leave, working time etc.

The Way Ahead

Key policy makers should be targeted and lobbied. Mainstreaming will continue, and equal opportunities should be pushed through the employment strategy. Soft regulation at European level is leading to hard regulation at national level, as laws are changed to comply with the new directives and framework.

Workshop Participants

Ulf Åhlstedt, OFR, Sweden
Harriet Aurell, Employability Institute, Sweden
Lise Bisballe, Culture from the Basement, Denmark
Barbro Burén, AgV, Sweden

Anette Cezanne, Goodyear Human Resources, Luxembourg
Richard Ennals, Kingston University, UK
Eva-Maria Forsberg, NIWL, Sweden
Jytte Fredensborg, CEEP, Brussels
Catherine Hennessy, The Body Shop, UK
Seija Hämäläinen, Helsinki University of Technology, Finland
Kerstin Hildingsson, SACO, Sweden
Karima Hoffmann, Eurocommunale, Germany
Per Insulander, SEKO, Sweden
Allan Larsson, DG-V, Brussels
Roberta Messina, Non-profit training organisation for women, Sicily, Italy
Anette Morhard, Non-profit employers training organisation, Germany
Anne Murphy, Trompenaars Hampden-Turner, Amsterdam, Netherlands
Liisa Nakari, Helsinki University of Technology, Finland
Irene Ost, SAN, Sweden
Susanne Reschreiter-Töscher, Network for Training, Austria
Lena Skiöld, NIWL, Sweden
Anette Svensson, Svensson & Svensson AB, Sweden
Arne Wennberg, NIWL, Sweden
Kristina Zamore, SAN, Sweden

Reflections on the Workshop

The workshop brought a refreshing change of style. Classical music was playing as the participants arrived, and during periods of reflection. Clay was provided for modelling while participants, reflected on memories of positive and negative learning experiences. Proceedings were interrupted for a song and some physical exercise. The workshop reflected the participative and consensual approach that the leaders advocate.

As so often in the workshop series, the first day ended with uncertainty. Participants who had arrived with a clear agenda in mind found new complexities, and a lack of simple answers. The experiences of the participants were the key resource. A key insight on the first day came from ***Kristina Zamore****, linking psychosocial factors with adult learning, and noting the vital importance of organisational development for advances in productivity. When we share common values, and find it so obvious how things should be done, why do our own organisations not work in those ways?*

2. Labour Market and Social Policy: Gender Relations in Transition

The two workshops were led by Lena Gonäs and Anita Nyberg, and held at the Brussels office of the Swedish Trade Unions, 31 May to 2 June 1999.

Workshop 1: Labour Market Transformations and Employment Policies, Industrial Relations, Flexible Work and Work Organisation

Lena Gonäs considered policy convergence in Europe. In part-time and temporary work, trends are not clear. There are new employment guidelines across Europe, but within separate national contexts. Convergence of ideas and ideologies is important, together with changes in gender relations. Increasing inequality, gender segregation, and industrial relations contexts have to be considered. The European Commission benchmark gender issues in employment, but segregation patterns do not correspond to changes in employment levels. The key element of unpaid and reproductive work produces a very different picture.

Labour Market Transformations and Employment Policies

Welfare States, Labour Markets and Gender Relations in Transition: The Decline of the Scandinavian Model?

Anne Lise Ellingsaeter noted that profound restructuring is under way. She emphasised the change process in Scandinavia, and the impact on gender relations. There have been theories of convergence, and globalisation, applied to welfare state and labour market changes. The extreme view is that national economies and nation states are becoming irrelevant; others argue that internal regulation continues at the national level. Some theories link globalisation to post-Fordism and flexibility in production systems, and see common trends being followed. The conceptualisation of the state is changing, with social policy subordinated to the needs of flexibility and international competition. We see convergence, and deregulation of labour is linked to post-Fordism. Ideological convergence needs investigation. State regulation restricts the free working of markets.

Scandinavian experience is particularly interesting, as the set of small markets is proving vulnerable to international changes, affecting labour markets with traditions of high levels of employment and concern for gender relations. Policies can be seen as clusters or packages, not in isolation. Typologies tend to over-simplify processes of change, and neglect the ways that policies operate, as

opposed to their outcomes. Gender relations in the labour market are shaped by complex interplays of policies and institutions. The focus should not just be on reproductive labour, but on a wider multi-dimension approach.

Comparing policy changes with practice, has decentralisation taken place? Are there similar trends to passivity in state activity? What forms of employment are generated in the context of policy change, and the development of new forms of flexible working?

Denmark has been more market-oriented than Norway or Sweden, but collective bargaining remains centralised and institutionalised. In Norway the welfare state has strengthened in the 1990s. Sweden shows modest changes in deregulation of labour, but bargaining has changed. State activities and social benefits have changed, but active labour market policies continue. Cuts have been from a high starting point, with erosion of consensus-building institutions. Changing industrial relations in Sweden reflect the institutional past. Sweden has had a consensus model, with more conflict in Norway. Across the three nations there has been a complex pattern of change, with different impacts on gender relations. Employment of women remains high.

Flexible forms of employment have had increasing attention in Europe, but are not new in Scandinavia. Part-time work has begun to decline. There has been a combination of high employment and high fertility, and changes in the perceived desirability of having children affect approaches to work. No one simple model will cover the situation, as the effects of globalisation vary in different places. Deregulation and flexibility should be seen as separate, and sources of flexibility vary considerably.

Labour Market Transformations and Employment Policies: The Organisation of Work, Care, and Leisure in the UK

Diane Perrons argued against following UK employment policies; despite comparatively low unemployment, there are many problems. Male unemployment and inactivity has been rising dramatically, with inactivity showing constant increase. New jobs have been disproportionately part-time and female. Long and unsociable hours have increased, especially among parents, most pronounced at the top and bottom ends of the income distribution. There is increasing inequality, with more dual earning households and households with no paid work, and increasing poverty among children and lone parents. 20% of households with children are "workless". Social exclusion is increasing, with geographical and ethnic concentration of unemployment and poverty. She identified different "post-Fordist" approaches in different countries, and proposed the "Care-less Society" model, where the system does not care about those who lack work, and welfare provision or caring has been reduced.

The new "Cool Britannia" involves strange new forms of work. Old industrial areas have been devastated. Former miners can become tour guides, or move from shovelling coal to shovelling popcorn in cinemas. In fashion and media, much of the work is casual. Call centres have gained popularity, but represent an archetypal

form of Taylorisation, contemporary sweatshops, but in high quality working environments. New call centres are sometimes built in former textile mills, with close monitoring and control. Work experience is fragmented and ghettoised, sometimes lacking union representation.

New labour market policies have been introduced under the "Welfare to Work" programme. At first the "New Deal" was for 18–24s, with an element of compulsion. There is a New Deal for Lone Parents, and a National Childcare Strategy. Fairness at Work includes a minimum wage at a low level. She concentrated on the New Deal for Lone Parents, voluntary in basis, encouraging parents with school-age children to work. The idea is to reduce poverty, moving women into work. There are problems of qualifications: lone parents currently out of work tend to lack qualifications, so earn low wages. The core strategy is based on "one to one advice", dealing with finance, childcare, training, and employment options. As lone parents already carry an unfair burden of reproductive work, there are problems with this policy approach.

She outlined new kinds of working relationships, for both paid work and reproductive work. Three scenarios were set out: the "universal breadwinner", the "caregiver" model, and the "universal carer", a hybrid approach based on a part-time approach to work and family for everyone. In order to move towards greater gender equity, a reallocation of productive and reproductive work is necessary.

Integration or Segregation: Ethnic Minorities Facing the Labour Market of the 1990s

Wuokko Knocke concentrated on ethnic minorities. Swedish labour market needs have had priority. Immigrants were recruited to meet employment needs; immigrant women remained invisible to the mainstream discourse, but have been more active in the labour market than Swedish women. Before the first Oil Crisis, the Swedish Trade Unions urged an end to immigration of non-Nordic workers, as the need switched from male to female employment. Earlier immigrants could be joined by their families, with employment implications. More recently the flow has been of refugees, needing first asylum and then employment in order to survive. Swedish-educated young immigrants are facing problems, in what is now an alarming situation. In the early 1990s, Sweden faced economic crisis, then needs for skills in the transition to a high technology knowledge-based society. Immigrants from the former Yugoslavia have encountered problems, with growing unemployment. Their backgrounds were in industries hit by the structural changes in the Swedish economy. The unemployment crisis hit non-Nordic workers in particular, with much higher rates of unemployment and temporary employment. The situation is disastrous: instead of integration we see unequal opportunities and ongoing social exclusion. Immigrant groups tend to be geographically concentrated, confined to suburbs, cut off from the mainstream population.

There is no single factor to explain the situation. Immigrants are concentrated in low skill jobs, cut off from learning opportunities on the job. This has been confirmed in a number of recent studies, which show ethnic segregation in the workplace, when it comes to opportunities for development. Immigrants, whether

male or female, have had few chances to learn about the new demands of the workplace. Sick leave, long-term illness and early retirement have been common. More recent refugee arrivals have found it difficult to join the labour market, even when they have high levels of educational qualifications. There are subtle discriminatory mechanisms at work, including increased educational qualifications and "perfect Swedish", possibly "Swedish social competence". Definitions include: being representative, taking initiatives, being open, sociable, service-minded, co-operative, self-reliant, flexible, and adaptable.

There are problems to be addressed concerning immigrants, now in second and third generations, and often now Swedish citizens. It is not just a matter of "their culture", but of "cultural distance". Muslim women face problems, and seek jobs where they are not visible. Immigrants often change to Swedish names to improve chances of employment. Sweden's economic needs started the immigration process, but now work against those who are in the country. Immigrants are now settled inhabitants, an integral part of the population and economy. Low labour force participation, high unemployment and social exclusion are not just an immigrant problem, but present challenges for Swedish society as a whole. Traditional labour market measures have not proved sufficient. Young people need motivation to learn and secure valued employment in society in Sweden. Rhetoric is not enough, practical measures are needed, and there is a role for research in helping dismantle discriminatory barriers. Open racism is forbidden by law, but subtler forms need to be identified and tackled.

Diane Perrons agreed that the wider economic context affects the situation of immigrant workers. In the UK most immigrant workers have been left behind in a polarised market. In some areas, social exclusion and marginalisation can be apparent, and ethnic minorities are disproportionally disadvantaged. There are questions about housing policies, if immigrants are unduly concentrated geographically. She asked why ethnic minorities were geographically concentrated in Sweden. For second generation immigrants, the problem is more one of discrimination, rather than labour market malfunction. Recent arrivals will be differently placed. In the UK there have been debates and legislation, but discrimination continues, even when progressive policies are in place. Institutionalised racism continues.

Wuokko Knocke argued that living and working issues are linked, and that immigrants are concentrated in suburbs built in the 1960s and 1970s. The children attend schools where the learning of Swedish is a priority. Training programmes tend to be conducted by Swedes for immigrants, and lack evaluation. Permanent temporariness continues. Politicians are concerned, as unemployment has increased. Discrimination is strong, and consequences in terms of youth unemployment are alarming. Discrimination is faced by those who are Swedish citizens. She discussed language: a direct recruit to a senior post is in a different position to an immigrant seeking a job. Special agencies are now addressing these issues, locating workers in jobs. Sweden accepts it is a multi-cultural society, but this has yet to become a practical reality. Many Latin American political refugees have returned, and many of those who have stayed have been able to get jobs, thanks to the provision of mother tongue teaching from 1976.

Industrial Relations and Flexible Work

Flexible Work, Precariousness and Equal Opportunities in the Retail Sector in Spain

Maria Dolores Garcia-Ramon argued that globalisation should provide flexibility, broadening opportunities for men and women, overcoming space and time constraints related to gender. Spain's political development has been different from other European countries, influencing subsequent labour market changes. Unemployment is high by EU standards, with increasing female employment and part-time work. Men traditionally contribute little to childcare, and there is reliance on the extended family. Flexibility is increased through part-time contracts, but less than elsewhere in Europe. Spain is moving from regulation to flexibility, and has a high level of fixed term contracts, especially among women. The traditional pattern, under Franco, was of full-time employment and restrictions on trade unions. The move to democracy has involved higher inflation and unemployment, and flexibilisation has been extended. Greater freedom of opening hours increased the need for part-time contracts. Fixed term contracts are poorly paid, and easily broken. The work force did not welcome these changes, and there were general strikes in 1988 and 1992. In 1996 a Conservative government was elected, pledged to reform the labour market. As a result, there are ten-year long contracts, which can be renewed. Trade unions have had to assess these new contracts, and the terms of compensation offered. Government ministers claim that new changes, negotiated with trades unions, have benefited women.

The research sample covered workers in retail, few of whom were unionised. Government presented the changes in the labour market as linked with adjustments to EU requirements, and it has been hard to come to terms with the emerging realities of the labour market. Workers with fixed term contracts and limited protection have a different set of interests to those with permanent long term contracts. The research studied supermarkets in Catalonia, employing 3600 workers, the majority women on fixed term contracts, and a major international department store, employing 6000 workers, with women were the majority on fixed term contracts. A questionnaire was distributed, followed by interviews.

Diversity and flexibility in patterns of working hours have changed, linked to patterns of demand. Those with fixed contracts are most subject to coercion to change, and given no choice. Changes are made at short notice, and with major implications for home life. Company behaviour was similar, and women were more involved in fixed-term contracts. Women had different views on flexible working, affected by economic circumstances and family situations. The majority complain of the precarious nature of their working life, and the anxiety it produces. They tend to depend on help from family members. A variety of strategies are needed in order to cope, meeting work and family demands. Women continue to have the major role in upbringing of children, and lack help with housework from their partners. Men are slow to help with housework, and do not feel responsible for domestic duties. Temporary workers feel second class, and lack equal opportunities in training and promotion. Workers' representatives are

highly critical. Supervisors are full-time employees, and usually men: they are expected to put work first.

In Spain, flexibility has been associated with fixed-term contracts. The reforms of 1992 restrained change, which had been to the detriment of women and young workers. The 1997 reforms make it easier to dismiss workers. Increased flexibility offers opportunities, at the cost of insecurity. The need remains for a better balance between women and men.

Trends in the Labour Market, Changes in Social Policy and Gender

Ursula Huws has completed a report on measuring globalisation in information services. Statistics mean different things in different countries. In the UK, having a fixed term contract is a sign of labour market strength, with no protection from dismissal for the first two years of employment. What are the key variables for international comparisons? This is the focus for a current project, exploring 14 indicators.

Changes in the labour market include skill requirements, in particular ICT, and need constant upgrading. There is a convergence and obsolescence of old clerical skills, development of new elite high technology skills, emphasis on the importance of soft communication skills, and with contradictory impacts. Rigorous comparative evaluation for equal pay is harder in an age of individual job descriptions.

Changing location of work means new choices, including home-working. Some assume that all work can be freely relocated, yet 60% of work in Europe involves physical production and services. In the UK most home-workers are men, as the bias is to technical and professional occupations. The advantages can also be the disadvantages (such as being with the children all day). The new workplace, for the privileged minority, is comfortable compared with the demands of home. IBM UK offered their staff flexible working, resulting in more time spent at work. Mobile working has increased, mainly among men. Functions such as call centres and relocated back offices can be wholly relocated. Occupational segregation and division of labour has acquired a spatial dimension, making it harder to effect constructive change in banks. Technology should make each region more diverse, but there is increased regional polarisation. The consequences can be socially divisive.

Changes in working hours are contradictory. Women may have several part-time jobs, involving diverse shift patterns, and unpredictable hours. Contracts call for responses to customer demand, individualised working hours, and unspecified working hours, paid by results. This has led to an increase in average hours worked. There is some correspondence with the dual-worker, no-worker polarisation among households.

Changing contractual arrangements are linked, with specified hours, and self-employment. Self-employment has changed in nature, offering greater autonomy, but at the price of no pension, and unpredictable hours. Staff are managed as if

they were self-employed, dumping overhead costs onto workers. There are internal job markets, project based, using CVs held on the corporate intranet.

Each change is contradictory with respect to gender, interacting with changing demography and household structures, where divorces have doubled, short marriages have increased, together with births outside marriage. Old paradigms have fallen apart. Problems go beyond the labour market, linked with restructuring of benefit systems and marketisation of welfare services. How can working hours be shared more evenly? How can social protection be given to flexible workers? Leaving full-time employment carries costs; precariousness of employment is linked with impoverishment. Flexible labour markets contribute to social exclusion. The Nordic model of individualised social protection is attractive, but would be hard to implement in agricultural societies. Skills need to be developed, and location of work should be a real choice.

Work Organisation

Between Bytes and Bricks: Gender Cultures in Work Contexts

Barbara Poggio described research on segregation and discrimination on gender lines in Italy. Neoclassical theory describing different behaviours on gender lines has been invalidated by recent research, showing changes in women's domestic commitments. Explanatory approaches relying on structural factors are not sufficient. Women have been in a minority in sectors such as banking, but as numbers change discrimination has not ended. Cultural approaches provide better understanding of what happens in organisations, and why discrimination continues. Gender is something we do, not something we are, gender in organisations is constructed, not given. Studies looked at women in conventionally male roles, and men in similar roles. The methodology was based on narrative analysis, looking at symbolic interaction and gender positions. Texts were interpreted using comparisons between the narratives of men and women, contrasting the genders and the organisations concerned. Four case studies were chosen: building site, bank, multinational organisation and computer company. The regimes were determined by the nature of the work and the organisational culture.

The *building site* was seen as no place for a woman, but workers denied discrimination. Physical force and contacts with a dirty environment were emphasised, but the key factor was the male poorly educated workforce, who tended to use verbal violence with female employees. Female employees tend to be shut away, working separately. Female technical skills are seen as secondary to assertiveness, exercised when necessary in a general context of deference. Conflicts of work and family commitments are emphasised, giving rise to a lack of female choice. Women adopt a tone attuned to the organisational culture. Working hours tend to be longer than stipulated by contract.

The *banking sector* showed frequent references to recent changes, including work organisation changes. Mythological narratives were found, including accounts of

office clothing to disguise physical differences. Female heroism was required to resist discrimination; such myths have a long-term impact in the organisational culture. It is maintained that there are equal opportunities for both genders, but separate career paths can be demonstrated, with the default option of remaining in lower level jobs. Women were required to give more frequent evidence of commitment. New technologies have provided means of recruiting more women, but professional potential and commitment have to be demonstrated. It is assumed that, having had children, women are more likely to revert to lower level jobs.

Experience in *multinational firms*, two American and one Japanese, was of organisational cultures with greater experience of gender involvement. Headquarters policy and local realities could be different. Training and development of individual career plans provide the foundations for greater equality, but analysis of the narratives showed ongoing segregation, or equality applied at the stage of recruitment, but not beyond. Once the cultural context is added to organisational policy, the position of women reverts to the cultural norm. Younger generations are better able to put themselves forward, but there can be problems of women managing older men.

The final case was in the *computer industry*, seen as young, dynamic and changing. Gender structure is reflected in the technology (hardware male, software female; Macintosh female, PC male). Interviewees described their organisations as democratic, with friendly interpersonal relations. Many men were married to women with professional careers, including couples in the same companies. There was support for participative styles of management and organisation, and men claimed to identify with the problems of women, and outlined their views of what gender relations should be.

The organisations are on a continuum, ranging from construction through to computing, bricks to bytes. Gender is not a natural condition, but a cultural and organisational construct. Policies should be focussed on organisations, rather than on individual women. Women fight an unequal battle in organisations not committed to change. Targeted measures are needed. Promotion of diversity takes place when women are seen as a resource for development. A more pleasant working environment, and more effective co-operation, make a difference. The computer industry represents a laboratory for new forms of work organisation. The challenge is to avoid the creation of new rigidities.

Corporate Strategy and Genderised Professional Identities

Reorganisation and the Struggle for Recognition and Positions

Bente Rasmussen was concerned with reorganisation. Restructuring and deregulation can have adverse impacts on women, but delayering can bring benefits. In the services sector, customers seek consistent quality, and decentralisation of responsibility is one means. The majority of services workers tend to be women,

recruited for positive skills, seen not as professional skills but as something that comes naturally. Skill and gender are linked, and women's skills may be underrated in new organisations. Under what conditions will women gain autonomy and improved positions through reorganisations?

Research was conducted in four organisations concerned with service roles, and engaged in reorganisation: home-based care, nursing homes, tax offices, and a private hotel.

1. Reorganisation of *home-based care* adopted a rehabilitation role, moving from personal servants to a nursing role. The flat organisation gave responsibility to enrolled nurses. Home helps felt more valued.
2. In the *nursing homes* there had been flat structures, but there was conflict over cleaning, between nurses and home helps. Legitimacy of professionals was being challenged. Home helps found an improvement, but nurses faced deterioration. The redistribution of tasks assumed that the necessary skills were there, among the home helps. Did the position of women improve? There was a centralised budget, handled by a management team, dealing with priorities. A masculine management ideology dominated, blaming women for providing too much care, and taking on too much responsibility.
3. In the *tax offices* a great deal changed. Lawyers use brief experience in tax offices for later consultancy work. Tax officers engaged in assessment became the dominant group, and many took the job because of security in the civil service. Computerisation was important, allowing a focus on more strategic tasks, and leading to redundancy of clerical officers. This was a battle between two groups of men, causing insecurity and frustration. Women were not in pivotal roles, with younger women seeking new opportunities, and older women reluctant to change modes of working.
4. In a *private hotel*, the move was to flexibilisation. With recession in the 1980s, the hotel responded by moving from restaurant to hotel focus, decentralising responsibility for customer service. Functions were combined, and workers operated flexibly. Maids faced work intensification, with the addition of further rooms and duties. The hotel regarded the maids as expendable, in face of a lower bid from a cleaning firm. The work of maids was largely invisible, but their uniforms set them apart. Changing methods of work involved new approaches to cleaning, imposed on the maids by management on the advice of external contractors. Maids saw themselves as essential for the success of the hotel, and organised. Other staff found their work increased, and there were opportunities for flexibility and extra earnings. This assumed an absence of outside responsibilities, and thus favoured male workers.

The outcome was a levelling of work and skills. Decentralisation of responsibility was rationalisation, with a new managerialism. Workers with new and better jobs accepted responsibility, those who were disadvantaged did not co-operate. In the public services, with a co-operative approach, there could be mutual benefits. Reorganisation could mean recognition, as with home helps. Nobody wants to take on dirty work, as with maids. In the private sector female clerical workers were not seen as crucial, and new technology was seen as the answer. Centralisation of power and resources strengthens the position of men, and restricts women. Even if

women organise to deal with the social aspect, they are subordinated on budgetary matters.

Barbara Poggio found similarities between the Norwegian and Italian situations. The increased focus on customers, decentralisation and responsibility raises questions for gender difference; reorganisation is not gender neutral. The dominant gender culture is of management and consultants as men. There can be a separation between ambitious young women and older women in more routine jobs. Certain skills are seen as socially constructed, such as in caring and nursing. Natural skills are less valued, and women are seen as easily replaceable. Women are under pressure to develop male attitudes, retaining female features. This is an attempt to restore differences, repairing the broken old order.

Workshop 2: Paid Domestic Work and the Organisation of Childcare

Paid Domestic Work

Paid Domestic Work in Germany

Kaj Fölster reported on the German debate, with actions at state level, but an absence of research and evaluations. Women have been engaged in the debate, working from the West German perspective. It is a political issue because of unemployment, and the presence of large numbers of women on illegal contracts. The German social security system has benefits linked to employment, and is family-based, including children up to age 27. Finance is 50% from the employer, 50% from the employee, with levels related to salary and length of service. Thus the housewife system has been perpetuated, with women working but not covered by social security, because of their husbands. Compounding this is the use of domestic labour. This is not the same problem as in Sweden, bringing women into employment: in Germany it is a question of moving women into social benefits, given the instability of marriage and the family, to reduce poverty among women.

In the West unemployment is similar for both genders, and in the East female unemployment is higher. There is hidden female unemployment, due to part-time working and unavailability for full-time work. There are four groups of paid domestic workers: paid domestic housekeepers (35,000 in a population of 80 million); apprentices in nursing and health care (while training); legal contracts outside the social insurance and tax system (1 million); and privately paid domestic work, without contracts (black economy). The last two groups need to be brought into regular employment. Conservatives have declared a need for more domestic work, and tax relief. Municipalities would offer subsidies, as there are people needing domestic assistance. 81% of one-parent families are working, but need community support at times. The sick and disabled need support, as do the aged. Among the "black economy" there are housewives, immigrants, East Europeans of German origin, Polish and Baltic women on tourist visas (often on rotation), and people on social assistance (working on an unofficial basis). The issue will change with the expansion of the European Union.

Conservatives recommended tax reductions and increased domestic labour, opposed by the Left. The system of tax and benefits is complex. There could be subsidies to NGOs, including feminist groups, to run service centres to employ women properly. Research has evaluated six of these centres. Funding pays unemployed women to work in residential homes and community work. The women are trained, gain a qualification, and become more employable. Patterns of employment vary, with new approaches to linking home and working life. There can be considerable demand for this service, providing regular unsubsidised work. Courses have been developed, catering for the broadening needs of the market.

Tax reduction was not a means to new employment but could be given to service centres. For employees, there is a minimum wage, trade union membership, a single employer, a choice of hours and conditions, and opportunities to train. Employers like having a single partner, and reliable service input. Upper income groups are happy to take the new service, middle class groups welcome the new service but do not want to pay more, and the lower income groups see the benefits of the new service. New models could bring more people into regular employment.

The Mistress and the Maid: The New International Division of Labour in the Household

Brigitte Young was concerned with inequality among women in Germany. The experience of women, East and West, was different. It is too simple to see men as winners and women as losers. The battle is also among women, and involves class and race. Labour valorisation has been transformed, with the devaluing of domestic work. Fordism goes along with the transformation of gender relations. Regimes of accumulation relying on mass production are linked with gender orders. What has changed with globalisation, and post-Fordism? How can we deal with unemployment and housework? Under Fordism, women were part-time workers, and part-time engaged in domestic duties. In terms of production, there is a new uncertainty, with the end of mass production and the welfare state. There is now a horizontal network society, as described by Manuel Castells. There are cheap wage zones, including in Europe, and a new class of global workers including well-educated women. In the USA many of the new jobs are "McJobs", but there are higher paid jobs, involving women.

There is increasing social division among women, including class, race and nationality. Notions of public and private have been challenged. Little has changed in the sharing of domestic work. Demand is due to increased wages and affordable costs. High market prices for services reduce demand. Adopting a market solution could add to cost, but could facilitate the increase in industrial production. We may have a growing self-help society. The balance of service sectors varies across Europe, and the majority of service comes from the family. Outsourcing domestic work can overcome shortage of time. Inhabitants of capitalism live in a temporal prison.

How are services are to be provided, and how can workers can benefit, women in need of improved rights? There are power relationships between mistresses and maids. Female migrant workers tend to find domestic work: the wealthy are liberated and the poor are possibly exploited, with racial overtones. These problems are not discussed in the context of refugees and asylum seekers. Women

have fought to redistribute domestic work; the result is a new international division of labour. The absence of public child care necessitates the private employment of domestic staff. Men can find security through marriage; the position is more complex for women, and ethnic relations are brought into the household. Feminist discourse needs to include differences among women.

Anette Borchorst argued that class differences have been an issue throughout the century. Democratisation of motherhood, and attachment to the labour market, have meant economic independence for women. Education, unemployment and immigration have been important. The breadwinner model prevailed for only 50 years in Denmark. Developments in housework have been marked, with a decline in time spent.

Organisation of Child Care

Childcare Policy in Britain

Vicky Randall was concerned with changing opportunities for women, and developments in child care and labour market policy, with the implications for gender equality. She described the situation in 1970, with a patchwork of provision, involving health and education, with implementation by local authorities. In the 1960s female employment and childminding increased, and in the 1970s a childcare lobby developed.

Labour market restructuring is the term used to cover global economic developments and government policies in the 1980s. Female employment expanded, largely part-time. It was conceded that women had a right to choose. Childcare was a private matter, with voluntary provision. There were few local authority day care places, and demand was increasing. At the end of the decade there was greater urgency, as demographic change suggested a need for women to return to work. After Margaret Thatcher, John Major's government was less decisive, and new trends began. There was a new commitment to nursery education, supported by a voucher scheme for 4 year-olds. Dependence on welfare was to be reduced.

New Labour promised greater support for childcare, as an instrument in restructuring the labour market. There is an emphasis on social inclusion, little reversal of the trend to privatisation, and a commitment to redistributing opportunity. Concern over welfare dependency continues. Implementation was to be through numerous local and private agencies, but with limited funding. There is a legacy of little state provision, and continuing distinctions made between education and care dimensions. The funding commitment to nursery education has remained, with early years partnerships at local level, likely to mean the marginalisation of day-care. There has been little change, and the role of the state is still limited. The shortage of childcare restricts gender equality and promotion opportunities. There has not been a great clamour for change, which could persuade government to change policies and emphasis. There are questions about demand, with waiting lists for local authority places, and increasing use of private provision. Feminist social scientists stress constraints, and the limited options

available. Revisionists argue that women prefer part-time work, and that constraints are a feminist myth. There has been little provision, and this contributes to choices by women. Some women with school-age children prefer not to work, or to work part-time. While the world of work is structured as it is, and men are unwilling to share childcare roles, women have little choice.

Who Should Take Care of the Child? The Ambiguities of French Family Policy

Jeanne Fagnani described the tradition of subsidising childcare in France, with high unemployment among women, and growing polarisation between high paid high qualified and low paid low qualified women. There are explanations for the social inequalities, but it is interesting to analyse the role of the state. Access to childcare is unequal, and flexibility at the workplace has increased. Childcare arrangements have not adapted. There are interactions between the state, the family and the market.

State benefit provision covers the first three years of childcare. Since 1994 the benefit has been extended to mothers of two children, with a high cost to the social security budget. The political aspect dominated economics, with the rhetoric of choice. The policy reduces unemployment figures. Most of the jobs concerned were routine, low-paid and tiring. There are many negative aspects, including the continuation of gender discrimination. Prejudices are reinforced, and employers prefer, given a choice, to recruit men. There is, however, a generous and sophisticated childcare policy system, involving tax and childcare allowances. There is a high level of workforce participation, wide provision of childminders, subsidy to support the cost of nannies, encouraging families to declare domestic employees. Childcare arrangements vary according to family incomes, emphasising differences.

The State and the "Social Pedagogic" Universal Child Care Services: Danish Child Care Policy and Gender Equality

Anette Borchorst considered childcare, to which there is high public commitment in Denmark. State commitment started in 1919, and has remained. Care has been integrated with "social pedagogic" facilities. Until 1964 there was a residual approach, but from 1965 all children have had an entitlement. There were cutbacks in the 1970s, but without visible falls in quality.

Historically policies look alike across Europe in their early stages. The ideas of Froebel were influential, moving from the previous model of children as small adults, followed by "folk kindergartens", which were also influential in Denmark. There were no regulations, but funding was provided to institutions which met the needs of working class families. Regulation came in 1933. In the 1960s, with universalist principles, there were new pedagogic principles, and endorsement by

all political parties. The legislation addressed children, not women. A backlash then criticised social provision.

Recent debates on the position of women have concerned welfare policy rather than gender equality. Danish fathers were late to gain parental leave, compared with Sweden. A year of parental leave is allowed, at 70% of full unemployment pay. 90% of those who take the leave are women, expected to take maternity leave and childcare leave. Decision makers do not discuss gender. The impact on gender equality reflects the different views of scholars. The right to time to care is distinguished from the right to receive care. Different patterns of provision, including the "Daddy quota" with male parental leave, have varying impacts on gender balance. It is hard to assess the impact. It is important for women to be economically independent, and risky to leave the labour market for long periods. Governments have to prioritise, and are concerned with unemployment.

Workshop Participants

Christina Bergqvist, NIWL, Sweden
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Anette Borchorst, University of Aarhus, Denmark
Anne Lise Ellingsaeter, Institute for Social Research, Norway
Richard Ennals, Kingston University, UK
Jeanne Fagnani, CNRS, France
Kaj Fölster, Hessen Ministry of Social Affairs, Germany
Maria Dolores Garcia-Ramon, Autonomous University of Barcelona, Spain
Lena Gonäs, NIWL, Sweden
Ursula Huws, Institute of Employment Studies, UK
Wuokko Knocke, NIWL, Sweden
Kajsa Lundgren, NIWL, Sweden
Anita Nyberg, NIWL, Sweden
Diane Perrons, London School of Economics, UK
Barbara Poggio, University of Trento, Italy
Vicky Randall, University of Essex, UK
Bente Rasmussen, University of Trondheim, Norway
Hanna Westberg, NIWL, Sweden
Brigitte Young, Free University of Berlin, Germany

Reflections on the Workshop

Each country has a historical background in terms of politics, economics and culture. Participants shared a general feminist perspective, translated into diverse policy positions. After decades of feminist critique, the impact on national policies is varied. Among the impacts of globalisation and changing work organisation has been the widening of divisions between groups of women. Social class proves to be as powerful as gender in many situations. Faced with priority concerns such as unemployment, governments do not always adopt policies which advance gender equality. Gender issues in the labour market were less clear than some might have expected. One outcome of globalisation is continued regional diversity.

Small and Medium Sized Enterprises

1. Jobs in EU Micro Firms: A Trade-off Bbetween Quantity and Quality?

The workshop was led by Filomena Oliveira, and held at the European Foundation for the Improvement of Living and Working Conditions in Dublin 22–23 April 1999.

Introduction

The objectives were to discuss the relationship between employment creation and employment and working conditions in micro firms; significant aspects of good employment and working conditions in European Union micro firms for employees, employers and other parties in the labour market; and effective strategies for partnerships between very small enterprises in the European Union, Central and Eastern Europe, United States and Japan.

Clive Purkiss, Director of the European Foundation, outlined the background and work of the Foundation, with a mission to deal with practical experience, rather than just theoretical constructs. The social partners are involved at board level and in projects. There are close relations with European countries beyond the EU. The key challenge is employment, and the provision of quality jobs for all who want them. Equal opportunities, inclusion, participation and sustainable development are key themes.

Micro firms account for two thirds of European employment, and support requires more than just financial aid. Access to training, advice and research are vital.

Marie Donnelly, Head of Unit at the Directorate General for Employment and Social Affairs, outlined progress on the European Employment Strategy. There is a new style of partnership in which the member states are working together in advance of treaty requirements. Employment is economically and politically vital. The focus of EU policy is employment, rather than unemployment, although there are 17 million unemployed. The USA has a higher level of participation in employment. She cited the Four Pillars of European Employment Policy. The first is *employability*, dealing with skills and competences, and member states are

benchmarking at present. The third pillar is *adaptability*, addressing both companies and workers. This means, for example, modernisation of work organisation. How does adaptability need to be addressed? How can we be more adaptable in the changing world of work? There are questions about the individual's relationship to work and the wider environment. If an individual chooses to work, how extensive should that work be, and what are the status issues? There are great rigidities and problems of compartmentalisation at present in Europe. We need to be able to move between different status roles, removing barriers. Individual and status issues outside work are also important, and raise questions about the family, the community and the state.

She set four challenges:

1. When we look at firms with zero employees, is there a capacity to grow? It is a matter of choice to work on one's own, with no ambitions to employ others. Are such firms fertile ground for growth?
2. Micro firms may be more closely linked to larger firms than has been seen: are they providing outsourced functions for those larger firms, and inextricably linked? If so, can they grow?
3. What do we really mean by sustainability? What do we want to achieve? Do we want to maintain the same jobs, or the capacity of individuals to work? Is it jobs or individuals that are to be sustainable?
4. What impediments exist in terms of status? How is growth being impeded?

Filomena Oliveira introduced strategies for developing and sustaining the smallest enterprises. Our concern must be primarily for the people concerned. There is an indication that workers in micro firms are most satisfied, but that they are least consulted about change. Financial support is necessary but not sufficient. Pay, profits, education, information, and a good working environment are needed. How can we provide an increasing number of jobs, with both quality of working life and business profitability?

Strategies and Programmes to Support SMEs

Martin Tyrell reported on the evaluation of SMEs across the EU in light of structural funds. He set the context of the SME sector, explained why it is a priority area for structural funds, outlined the methodology of the evaluation, summarised the findings, and considered the recommendations. There are 18 million SMEs in the EU, each with less than 250 employees. This figure includes subsidiaries of larger companies. There are 49 SMEs per 1000 population: 7.4 million are eligible for EU assistance, and 793,000 are receiving assistance. In Ireland there are 160,000 SMEs. In the EU there are 73 million SME employees, 66% of the total, 198 per 1000 population, on average 4 per SME. In Ireland there are 500,000 employees, an average of 3 per SME. Sectoral distribution is: 7% agriculture, 28% industry, 65% services. As for size, 52% are sole traders, 41% employ 1–9, 5% 10–49, 2% 50–250. Irish patterns are close to the norm.

SMEs are seen as sources of innovation, adaptable to changing market conditions, incurring costs of compliance. They are seen as commercial risks, lack specialist knowledge, and have limited financial options. In employment terms, SMEs offer

employment as larger firms downsize. They can benefit from outsourcing (one example was British Leyland, later Rover, which moved to outsource design and marketing).

He gave an overview of EU support clearly targeted on SMEs. The highest support per head is in Greece, Ireland, Spain and Italy. Figures of support per SMEs showed Sweden is assigning high priority, with the UK next to bottom (13,000 Euros compared with 95,000 Euros in Sweden). Balance of use of funds varies, many member states emphasising grants, with Ireland preferring financial engineering (e.g. loans and venture capital). Ireland also leads on innovation and technology, given greater emphasis than training.

The report is about to appear, recommending future strategies. There was a desk-based review of each member state, then case study analysis and telephone survey of beneficiaries. The telephone survey approached 1950 firms, and has 1072 responses. Most were beneficiaries 1996–98. The sample concentrated on small, rather than sole traders or larger companies. The number of "deadweight" firms suggests poor targeting in some cases, suggesting an improved role for intermediate bodies in future. In terms of job creation, in the sample 5092 jobs were created, 10.3 per firm (covering the range of sizes of firm). Extrapolating this data to the overall EU picture, a number of different assumptions were tested, ranging from optimistic to pessimistic via an intermediate base case. A total of between 462,000 and 2,663,200 jobs were created, depending on the assumption used.

It was recommended that there should be increased private sector input, more financial engineering, better integration of more needs based Business Advisory Services, more needs based training, improved targeting (involving proactive intermediaries), a one-stop shop approach, and networking (vertical and horizontal, and between SMEs and universities). The research has not addressed job quality or longevity.

Ion-Tudor Berza, of the Romanian Foundation for Democracy, reflected on the situation of SMEs outside the EU, in an extra-mural population of 100 millions. It is not just a matter of technical adaptation, but also a huge problem of property, until recently fully state owned. There has been a decade of transition, with initiatives from small entrepreneurs. He described recent legal changes, regarding land, property and economic activities, which have helped increase the number of SMEs. If we regard peasant farmers as sole traders, we can add to the official number of SMEs. Government has taken active interest in the support of SMEs. Support from the European Union PHARE programme has been extremely valuable. There is also co-operation in the Balkans, Southern Europe and in the Black Sea area. Romania has been planning to apply for membership of the EU and of NATO.

Tatehito Shimoda described the circumstances of SMEs and their working conditions in Japan. More details are available from the website www.sme.ne.jp/sesaku/examine/hakusyo

He gave an historical context for the role of Japanese SMEs, as the Japanese economy has experienced some years of problems. SME bankruptcies have stabilised since the collapse of the "bubble economy". Working hours are longer

in small firms, but are falling across all firms. Economic decline meant a reduction in hours worked. Service sector employment is increasing. SME employment covers over 90% of employers. As with other OECD economies, measures are needed to support SMEs. New businesses tend to be SMEs. New firms emerge in numerous fields, especially manufacturing and communications. Recently, closures have exceeded startups, while in the USA startups exceed closures. On balance, founders of SMEs are getting older in Japan. There are human resource shortages in SMEs, partly due to low wages and the poor image of SMEs, seen as dirty, dangerous and hard. Wage differentials have changed little. Aspects of employment and training need to be improved.

In a total of 65.6 million employed, and 2.3 million unemployed, only 11.8% are self-employed. A quarter of the workforce are in companies of less than 9. SMEs are either traditional, venture businesses, or home based. Big and small companies are structured differently. Big companies have a peak of employees in their late 40s. Less new staff, now in their late 30s, were employed in the years of the oil crisis.

He gave an example of a small traditional leather making company, founded in 1959. Many were family employees, few were young, and the founder is close to retirement. Home based companies (SOHOs) are more diverse in membership. Traditional firms work as subcontractors, often members of keiretsus. However, recruitment has ended, and many will not survive.

Venture companies tend to focus on software, services and retail. The home office makes full use of the PC and internet. Telework centres have only recently been established. Jobs in SOHOs are almost hobbies. As one example, computer to plate printing is facilitated by optical fibre, linking home and office. There are also examples of data input factories, using local home workers.

Traditional compensation in the leather industry is moving from a basis of seniority to performance. There are different patterns of progression, and diversity in compensation rates (varying from housewives to game software creators). Traditional employees are less motivated, while, he claimed, home based workers are more motivated. Training costs to companies have been reduced over the years, and many small companies engage in no training at all, leaving training to be financed by the workers themselves. There are public examinations, and training programmes. One problem is that training is often unrelated to employment needs, and future employment trends are not clear. How can creative abilities and new added value be developed?

Juraj Majtan explained that the history of private sector business in the Slovak Republic has been very short. The SME share of total employment had reached 57.1% in 1998, not far from the EU figure of 66%. When considering added value, the contribution of SMEs was 56.2%, by comparison with the EU figure of 60%. With regard to zero firms, the self-employed, there was a boom following the revolution, with a number of failures before a return to expansion. There is unemployment of 17%, and potentially SMEs could solve this problem. Much business is in the Bratislava region. New businesses grow where there is money. Definitions vary: small means less than 25 employees; medium means less than 500. While small firms have increased, medium firms have declined. There are many obstacles, including complex legislation and a lack of capital. Classifications

have been made using EU categories, and we see increases only in firms with 10–49 employees. Larger firms employ a large proportion of the workforce.

Perspectives and Realities on SMEs: The Relationship Between Successful Business, Job Quality and Job Creation in the Smallest Enterprises

Shelley MacDiarmid dealt with quality work experiences in small businesses, and emphasised family friendly policies. Europeans tend to be better informed about what is going on in the US than people in the US are about anything going on anywhere. Most workplaces in the US are small, with 85% employing less than 100 workers, occupying 38% of the private sector workforce. Despite the economic importance of SMEs, research has been relatively limited, and some argue that small business does not merit particular support. She dealt with job quality, its implications, and a number of US case studies, such as Sears. Small changes in job quality can retain staff and lead to considerable business benefits. She ended with conclusions that could be relevant to ongoing European multi-country research. She described the importance in business terms of improving the quality of working life, and argued that the intellectual capacity of workers can be improved by a high quality working environment, with benefits for their families and colleagues. Research on work quality and company size is limited, and there are few large-scale evaluation studies. It is clear that the experience of work is affected by company size. In general, workers do objectively worse, but subjectively better, in small workplaces. In Europe access to health insurance, child care, and pensions do not uniformly depend on employment and employers in the way that they do in the US.

Marc Cowling was co-author of a Warwick pilot study on data on job quality in Portugal, for the European Foundation. He described the context, the methodology, the key findings, and some new UK evidence on job quality. The Warwick researchers are interested in small firms, seen as responsible for major innovation. There is debate about job creation, but a clear economic role for small firms at both gross and net levels. Although many new businesses fail, new businesses started by unemployed workers do no worse than others. Self employment provides a form of training. Public policy should address constraints on small firms, in terms of uncertainty, risk, access to resources and market power. Each of these has impacts on job quality. Institutional factors can be important, such as trade unions and their relations with employers and government; culture; and stages of economic development. We need to look beyond pay when considering job quality. There are trade-offs between representation and freedom. There is less training in small firms. Quantitative measures (such as percentage of trade union membership) are inadequate: we need a richer picture.

The pilot study contrasted job freedom with representation, but the trade-offs are not the same across countries. The UK is, in the emphasis on the free market, more similar to the USA than to France. The pilot study, based on data from Portugal, saw increasing firm size as involving pressures on job quality. The worst jobs were in medium sized firms. Jobs in micro firms are not worse, but different.

Drawing on UK research, he introduced the idea of job matching, contrasting under-skilled and matched workers. Those engaged in repetitive tasks saw themselves as under-skilled, suggesting pressure from employers and a policy of employing cheap labour. Micro firms were better at matching than other sizes of firms. He presented results on job satisfaction, linked to age, education, home working, job security, job autonomy, involvement in decisions, and consultation over change. Low satisfaction comes from clerical workers, farmers and those in repetitive and boring jobs. He predicted commonality in the results of the multi-country study.

Michel Marchesnay discussed different ethnic cultures within districts and networks, for example in the New York garment industry. Managers want power, and can influence the behaviour and satisfaction of the workers. Group culture is vital, with different perspectives, for example, between Protestants and Catholics in Southern France.

Helen Grigoriou outlined the situation for small firms in Greece. There are 65,000 members of the Athens Chamber, many from the manufacturing sector. Each province has a chamber of Small and Medium Sized Industries. The majority of the business population is covered by chambers in the Athens area. In Greece, chamber membership involves employing up to 100 people, and a turnover of up to £1.6m. There are different legal forms: personal, partnerships, limited and SAs. Across the country 90% of enterprises employ less than nine people. SMIs employ 80% of employees in manufacturing, and produce the majority of products and exports. Greek SMIs have some distinctive features. The mean size is the smallest in the EU, and getting smaller. There is a higher birth rate than death rate. They manage not only to survive, but also to increase their weight in the economy. Development does not lead to disappearance. The stability and contribution of the SMIs is in part due to flexibility.

Studies were conducted in 1993 and 1997, considering views of SMIs on the role of the Chamber. Employment increased over the period, with an increase in industrial premises and turnover. Average annual exports increased, together with use of computers, and a decrease in reliance on subcontracting. There appear to be trends for two types of firms: micro firms comprising the majority, and firms employing more than 10 people. Firms covered by both studies increased their employment over the period by 9%. She drew conclusions from the surveys. There are three categories: employing up to 5 people (70%); employing 6–10 people and facing problems with competition; those employing more than 10 people, some 12% of members, seem dynamic and able to face the challenges ahead. 85% of the managers are men. The level of education is increasing. Levels of satisfaction have not changed. There are changes in the rankings of problems facing businesses. In 1993 it was finance, decreasing demand, liquidity, tax and profit percentages. In 1998 it was decreasing demand, liquidity, competition, taxes and profit percentages. The surveys were conducted to assist in pressing government to support SMIs. The role of the Chamber is to respond to needs.

Michael Marchesnay was concerned with micro firms, which he sees as the fruit of history. He has published a number of books and case studies, dealing with France, Quebec, Barcelona, Poland and Belarus. The same analytical grid has been used in each case. The core traditional group is based on craftsmanship, with

crafts registered in the chamber of métiers. This group is strong in lobbying. The Code Napoléon allows for a firm to be managed as a family, thus the term patron. More recently we see the foundation of modernist firms, given the problems faced by old firms. They have drawn on universities and business schools. In addition we have seen the development of entrepreneurial firms in new technologies (the hunters) and the hunted, single person firms created by the unemployed. Finally there is the associative sector, involving sport, tourism and music.

In microfirms the key influence comes from the owner manager. There are four types.

1. The *isolated* manager is weak, concerned with survival. Networks are limited, and the work routine. The company feels unable to expand or recruit. Some are willing to improve, through innovation and local initiatives, especially in rural areas. They use trusted advisers. The "local productive system" is now a popular focus.
2. The "*notable*" is a French speciality. He is well-embedded in the culture of the area. His profitability derives from nearness and protection. Other "notables" are colleagues, not competitors. Patrimonial logic applies, with the objective of providing a heritage for the children. Management is paternalistic, with little delegation. The "notable" seeks to retain employment, as a source of local legitimacy. The competences of the employees are based on tacit knowledge, and the "notable" is reluctant to improve training. Threats come from competitors or buyers, forcing innovation or re-organisation. Problems of quality and quantity are different.
3. The "*nomad*"is driven by managerial logic, with a need for power. He seeks to implement scientific method in a Taylorist manner, but recruits specialist managers. He does not seek integration or legitimacy, and is happy to replace people by machines. He wants efficiency, efficacy and profitability. He is happy to cut staff if necessary, or to invest in training for modernisation. Many such companies are purchased by large firms.
4. The *enterprising* owner is driven by a need for achievement. The local area may offer leverage for the business, but the business may well be national or global. Defined niches (such as food colouring) may have a global dimension. Innovation and adaptability, and the development of self-responsibility are developed. This approach is not confined to new technology sectors. Performance is high, as is risk. The firm needs high quality people, and participation, mixing explicit and tacit knowledge to produce the idiosyncratic qualities of the firm. The firm uses a network of suppliers, and can enhance both quantity and quality of employment. Unfortunately French culture gives more status to the "state nobility" (senior civil servants) than to entrepreneurs, the "patron notable". French society has to develop the legitimacy of the "entrepreneur entreprenant".

In a new departure for Work Life 2000, the second day of the workshop changed location to Brookfield Enterprise Centre in Tallaght, where presentations were given by partnerships from Tallaght (by **Bernadette O'Donaghue**) and Northside (**Fiona Nolan**), and the group visited a number of new entrepreneurs. Following the local presentations, workshop members from Belgium and the Slovak Republic outlined contrasting institutional arrangements in their own countries, before a

general discussion, concluding remarks from **Filomena Oliveira**, and an informal lunch.

The Irish economy is booming, reflected in the fall in unemployment, skills shortages in new technology industries, and pressure on more women to join the workforce. However, both Tallaght and Northside are unemployment blackspots, where education levels are extremely low, and there is a shortage of appropriate jobs. Among a range of schemes with national and European funding, there is an emphasis on developing self-employment, with a framework of support. In Northside from 1993 to 1996, 1800 people were seen, of whom 1400 became self-employed and were still in business at the end of the period. In Tallaght there had been a particular emphasis on self employment for women, and new entrepreneurs at the workshop ranged from fragrance and ecologically sound bag holders, to road transport. Among the men the businesses included golf services, heating insulation and first aid. The enterprise centres benefit from national and European support, and from involvement of the social partners as well as local government.

Roland Waeyaert described the Belgian Organisation for SMEs, a private initiative, with 1000 employees overall, providing services for 85,000 members. The organisation lobbies for its members, representing SMEs at the national level of social partners, and providing specialist services such as wage calculation, and advice on regulations, pensions, health and safety.

Juraj Majtan, of the National Agency of SMEs, Slovak Republic, explained that there were no private businesses before 1989, and an absence of the necessary skill and capital. Whereas the Belgian organisation has existed for 100 years, the Slovak Agency was founded in 1993, with support from the European PHARE programme. It is publicly funded, not for profit, to meet the needs of the growing SME sector, seeing about 5000 SMEs per year. A separate Seed Company was established to assist in capital support.

Filomena Oliveira described the support she had been given by the Irish government and Enterprise Ireland. Visiting the different enterprise centres had been a learning process in itself. The new businesses represent the culture of the country, with products and services that relate to the life of the people.

Workshop Participants

Joaquim Bernardo, Ministry of Labour, Portugal
Ion-Tudor Berza, Romanian Foundation for Democracy, Romania
Mark Carley, European Foundation, Dublin
Penny Clarke, ETUC, Brussels
Marc Cowling, Warwick University, UK
Marie Donnelly, DG-V, Brussels
Chris Dorgan, Bolbrook Enterprise Centre, Dublin, Ireland
Richard Ennals, Kingston University, UK
Helen Grigoriou, Athens Chamber of SMIs, Greece
Lone Henriksen, DG-V, Brussels
Michael Jepsen, European Foundation, Dublin
William Jestin, Department of Enterprise and Employment, Ireland
Ilkka Joenpalo, Union of Technicians, Finland

Darren Jones, Tallagh Enterprise Centre, Dublin, Ireland
Timo Kauppinen, European Foundation, Dublin
Eberhard Köhler, European Foundation, Dublin
Stefanos Lemos, Greek Confederation of Labour, Athens, Greece
Evangelia Leonardou, Athens Chamber of SMIs, Greece
Shelley MacDermid, Purdue University, Indiana, USA
Juraj Majtan, National Agency of SMEs, Bratislava, Slovak Republic
Michel Marchesnay, University of Montpellier, France
Domenico Mauriello, Institute Gudlielmo Taglia Carne, Rome, Italy
Fiona Nolan, Northside Partnership, Dublin, Ireland
Bernadette O'Donoghue, Brookfield Enterprise Centre, Dublin, Ireland
Tenho Olin, Union of Technicians, Finland
Filomena Oliveira, European Foundation, Dublin
Clive Purkiss, European Foundation, Dublin
Victoria Rahm, European Foundation, Dublin
Diane Richmond, Bolbrook Enterprise Centre, Dublin, Ireland
Tatehito Shimoda, Reitaku University, Japan
Lena Skiöld, NIWL, Sweden
Christina Theochari, Athens Labour Centre, Greece
Martin Tyrell, DG-XVI, Brussels
Eric Verbogh, European Foundation, Dublin
Maria Vigliarolo, Eurostat, Brussels
Roland Waeyaert, Belgian Organisation for SMEs, Brussels, Belgium
Renate Weissenhorn, DG XXIII, Brussels
Arne Wennberg, NIWL, Sweden

Reflections on the Workshop

The workshop provided a series of different perspectives on micro firms, and served to emphasise the importance of cultural context. There are problems for policy makers and researchers, not least because of the conflicting definitions and classifications which make comparative analysis extremely difficult, though this does not prevent us learning from differences. Most studies tended to be in terms of individual firms, but conclusions suggested the importance of networking.

SMEs represent a vital policy area in each country, but remarkably little is known. This is partly due to difficulties of assembling authoritative quantitative data, and to a reluctance to make effective use of a combination of qualitative and quantitative data. Amid the range of objective and subjective issues, there can be problems of choosing what to report. Discussion of SMEs cannot escape issues of culture and ethnicity, when seeking to explain diversity within urban economies and regions. Qualitative understanding must accompany and underpin quantitative analysis.

The first day dealt with surveys and overviews, conducted by researchers at a distance from the workplace. The second day involved active entrepreneurs and those working in enterprise agencies. The two phases were complementary, linking theory and practice.

2. Voluntary Guidelines for Management Systems for the Working Environment

The workshop was led by Ann-Beth Antonsson, and held at the office of the Swedish Trade Unions in Brussels, 14–15 June 1999.

Why are Management Systems Important to SMEs?

Ann-Beth Antonsson argued that OHSMSs in small companies are often implemented in response to customers' demands, and perceived as unnecessarily bureaucratic. Are today's Management Systems the best choice for small companies? Many of the systems were designed for large companies, and may not be appropriate for small companies. Is there an appropriate way forward for small companies? The systems should be simple, effective, and appropriate.

Management Systems for the Working Environment: What is the Present Situation? How Are SMEs Considered in Ongoing Work? An Overview of the European Situation

Gerard Zwetsloot recalled the 1996 ISO workshop to discuss international standards for OHSMS, in light of success with quality and environmental standards. The stakeholder groups (employers, unions, government and insurance interests) advised against standardisation. OHS is seen as political, favouring workers, facing opposition from some employers, and involving participation by the workforce. The regulatory dimension of OHS can stimulate pressure for deregulation and privatisation. Recent developments have been decentralised.

Standards have been published in the UK, Netherlands, New Zealand and Spain, and are under development in other EU member states. Certification is now being organised by the market, but without official recognition or consistency. Thus a number of schemes are under way, some sector-specific (e.g. glaziers in the Netherlands). Some large companies, such as Shell, want certification as part of responsible care programmes. OHS can form part of contract negotiations between contractors and suppliers, for example by chemical companies in Netherlands. This makes systems less voluntary, or not voluntary at all. Social Accountability, based on SA 8000, has been developing globally, involving Body Shop, Nike and others who were accused of involvement in child labour and forced labour. Many sectors are seeking to improve their images, with schemes backed by independent assessors. In Netherlands unions want implementation of OHSMS as part of collective bargaining, for example in laundries. In the USA and Germany government and professions have promoted OHSMS. In some countries, OHS is seen in the context of preventing disability and reducing social costs and social security: part of disability, rehabilitation or return to work. Some see OHS as part of quality management: this will be easier with ISO 9000:2000. This will impact on definitions of terminology in OHS management.

He presented a variety of models of OHS management, showing which are compatible with related work on, for example, risk assessment, or the terminology of management consultants. SMEs tend not to be represented on standardisation committees, and models are drawn from large business. He then described OHS initiatives in Netherlands, which are top-down, but effective. The main motive is upgrading of specialist sectors, and pressure to meet requirements for OHS certification. The role of the owner is crucial to OHS, and the organisation needs to be able to cope with his absence.

From the Framework Directive to a Management System: Considerations of the DG-V Ad Hoc Group

Torben Jepsen introduced the EU context of the Framework Directive and standardisation. There are a number of obligations for employers in 89/391, involving consultation, risk assessment, and responsibilities. There are also requirements concerning outcomes. As part of the standardisation process, EU Directives are seeking to remove barriers to trade, and have an OHS dimension. The Ad Hoc Group recommended not standards, but guidance, in support of activities at member state level. The recommendation was against standardised systems, but the European Commission favoured consistency with the Directives, and clear cost benefits.

Employers wanted to remain free to implement chosen systems, and standardisation is not appropriate. ISO is seen as being about trade; they argue that OHS is nothing to do with trade. Workers are not generally in favour of ISO initiatives, which they have associated with employers. The European Commission undertook to collect ideas and experience, and circulated information to the Ad Hoc Group. Much of the material seemed too complicated for SMEs. Employers tried to take the lead, but oppose binding regulations. UNICE presented a particular proposal, based on the HSE publication "Successful Health & Safety Management". The proposal is big and wordy, and with little about management systems.

Government in Germany has developed an agreed framework, considered by the Ad Hoc Group. The attempt was made to combine the UNICE and German documents, but on the basis of a reduced version of the German document. The Ad Hoc Group sought common principles, and relevance for SMEs. Employers insisted on a voluntary approach, with no external audit or legal requirements. The Ad Hoc Group seek to develop general guidelines, with seven key elements, covering policy and strategy, structure, functions, information flows, mainstreaming, documentation and assessment.

Ann-Beth Antonsson noted that much is happening in the market, and often those developing systems claim to be catering for SMEs: this tends to be little more than words. Is it possible to have some kind of management system in all companies, regardless of size? How many companies should use OHS management systems?

Jacqueline Jeynes described perspectives on standards from SMEs in the UK. Are we talking about standards or certification? How are we to define small firms? Why try so hard to fit systems to firms where they are not appropriate?

Laurent Vogel described trade union positions with respect to OHS. The common position was defensive, as it had been for employers. European trade unions do not see deregulation as a major danger at present in OHS, unlike the USA and Australia. The link between occupational health and workplace democracy has been seen as central, and is stated in the Framework Directive. There is a danger of diluting workplace democracy via OHS. Health is not like quality. Safety, industrial hygiene and quality are different from health, including psychosocial factors.

David Morris discussed employee involvement as central, understated in the HSE approach developed under the previous UK government. He considered assumptions about those who have been certified with OHS systems, where they may not be more competent than those who lack certification. He was most concerned with small and micro businesses. Is our lack of international agreements itself restricting trade, taking the example of glaziers in the Netherlands? Certification will come, whether we favour it or not. SMEs tend to lack any management systems.

Per Langaa Jensen recalled that management systems are built on theoretical models of firms. Most of these models come from large companies, based on responses from qualified staff. We can perhaps tell small firms to act as if they were larger firms, and blame them for their problems. Alternatively we can try to understand small firms better. Decision processes tend not to be formalised in small firms, and formalisation may require growth and employment of qualified staff. Can we develop models which may be of use to small firms?

Experiences of Different Management Systems With a Focus on SMEs: Success Factors and Currently Occurring Pitfalls

Occupational Health and Safety in Australian and New Zealand Small Businesses: Factors that Influence Compliance and Practice

Felicity Lam noted that methods of managing in New Zealand are different from those in Northern Europe, and protection for workers is being removed. Systems development has lacked understanding of the nature and needs of small businesses. We need a profile of the heterogeneous small business sector. What influences decisions to implement good practice? The political, economic and social context are vital. Consultation with small businesses is essential. Key factors influencing OHS practices include small businesses access to resources; relevant training and industry experience; the influence of large businesses; the type of industry; the influence of quality management systems; the use of small business advisors; the use of family and friends; the influence of women workers; strategic HRM practices (e.g. precarious employment, sub-contracting, employing illegal migrant workers); cultural and social values; and the relationship with the OHS regulatory agency.

She set out reasons for non-compliance: divided for discussion into economic, dissident views of government, and incompetent. There are complex cultural issues, as these areas overlap. We need to understand approaches to non-compliance, and to be aware that in apparent cases of non-compliance, the key ideas may be adopted by the practitioner without seeking accreditation. The most compelling and disturbing reasons are economic: state intervention may be required to support small businesses.

OHSMS Impact on OHS Performance in the Franchised Outlets of a Large Fast Food Chain

Claire Mayhew has been studying precarious employment in small businesses, and has reached negative findings. OHSMS are potentially valuable; they can work. She concentrated on a study of a large fast food chain, many of whose outlets are franchises. 93% of the staff are casual, largely teenagers. There is a stringent management system, and the OHS system is imposed on the franchise operations. Practices and knowledge were good in the franchises, including risk assessment. Casual young workers were not injured more often, and credit seems due to the rigid OHSMS, integrated into the total management system of the company.

Improve your Work Environment and Business

Rie Vejs-Laursen spoke about ILO commitment to job quality, standards, and compliance by small enterprises. We need to understand actual needs in companies, if we are to assist them in expanding and creating employment. Working environment is one of the 5 ILO areas of activity, together with industrial relations, human resource development, social protection, and free choice of employment.

What is job quality? ILO works with developing countries, where unemployment can be up to 50% in urban areas, and small businesses are crucial. In interventions, the focus must be on the needs of the business. She described experience in Bangkok, where interventions were linked to safety and health, in the cause of increasing competitiveness and productivity. Reorganising the workplace could increase effectiveness. ISO standards would be hard to achieve, and a relativist approach to development is required.

ILO programmes for Work Improvement in Small Enterprises (WISE) and Improve Your Business (IYB) have been effective, but were too unilaterally focussed: thus the development of IWEB (Improve your Work Environment and Business). This dealt with the small shop operator as entrepreneur, selling by knowing what the customer wants, producing at the right quality and quality, encouraging workers to produce more, handling finances in the shop, and teaching practical business planning. It was vital to target the micro entrepreneur, addressing adult learning needs, with expert facilitation and worker involvement. The pilot was undertaken in Asia, and needs to be developed elsewhere. There is no one solution.

Experiences of Norwegian Internal Control in SMEs

Kristin Flagstad outlined the Internal Control approach in Norway, concerned with work environment, health and safety, and the environment. The intentions of the IC were participation, management commitment, structure, documentation, internal audits, tailored systems for each company, responsibility following the production line, and activities throughout the organisation.

She described research in nine SMEs in the early 1990s (two newspapers, a steel company, four sawmills, two local communities), demonstrating that IC requirements were not met. They lacked HSE competence, they worked with oversized documentation systems, lacked management commitment, lacked worker participation, and concentrated on fulfilling regulations, not on HSE management. The answer was networking. The network should provide HSE competence and experience. They should last over a period, with manager and worker involvement. Networks planned by process facilitators should focus on HSE management and results. The focus gets ever simpler. There are a number of interested parties: local authorities, occupational health services, consultants and customers, each of whom can be driving forces. In Norway, the Internal Control system is taken as the foundation.

The Concept of Internal Control (IC) and the Norwegian Experience

Hans Torvatn was concerned both to review implementation and to discuss approaches to increasing implementation among SMEs. Self-assessed implementation rates have increased since 1993, with marked levels of improvement, irrespective of size and sector.

Research has pursued the matter further, with an index of implementation, checking HES objectives, work environment factor assessment, action plans, documentation and new measures. About 50% of companies have implemented systems, but there is variation, linked to size. Only 19% of firms employing less than 5 workers have implemented.

Further research on systematic HES work looked at external factors, such as size of enterprise, external push and pull, competence for HES-work, time since implementation, and absenteeism in the previous year. Competence for HES work includes appointing worker representatives, buying OHS services, having trained representatives, having trained managers, and having implemented a QA system at ISO 9000 level or higher. He presented a circular implementation model for Internal Control.

Experiences of Swedish Internal Control in Small Companies

Ann-Beth Antonsson considered the results of surveys of internal control systems in Sweden, including benefits of less than perfect systems. The Swedish approach is simpler than in Norway, and the research has been intended to gain

understanding of use by small companies. Work environment is not the core process of the company, and sophistication should not be expected. A selection of 30 companies was studied, including those known to have used IC. Typically the manager tried to produce documents to meet the requirements of regulations, with little participation from employees. Those who planned most, and took internal control most seriously, were least in danger themselves. Small companies are not very organised, and complex management systems are alien to their ways of working. Internal control requires the commitment of resources, and some gains must be expected to justify the effort. Tailoring to specific requirements is a complex process. The research group developed a simple management approach, involving an annual survey of the working environment, and a yearly meeting with staff, which cause no problems for the companies studied.

Small Firms' Requirements: Management System Not an Administrative System

Jacqueline Jeynes, of the Federation of Small Business, represents a small proportion of potential members in the UK, and the majority of small businesses operate without support. Members seek to operate legally and legitimately. Definition is a problem. In the UK, 94% of businesses employ 10 people or less. Many workers are officially classed as self-employed, while really working for consistent employers, who are reducing social insurance costs. Larger companies are downsizing by farming out risk. There is no standard picture. The largest groups of small businesses are not shopkeepers, but motor vehicle repair, care homes, couriers and accountants. Accountants are the prime sources of advice to small businesses, yet know little or nothing about health and safety.

Low risk businesses include hairdressers and butchers: 200 responses from 11,000 mailings to members was considered high. They were asked about health and safety policy, representatives and risk assessments, with no consistency. What is a health and safety policy? What does it mean in practice? Typically there was a "flexible and fluid" management style. Managers may expect similar attitudes to risk from their employees.

How can small firms be encouraged to do anything about health and safety? What would motivate them? What are the intermediary routes? Who can have a positive impact? Negative motivators can include fear of bad publicity, but many companies do not care.

Health and safety management is less about process than is the case with quality and environmental management. A standard, with certification, is not necessarily the answer.

Construction Safety Management System in Ireland: A Sectoral Approach for SMEs

Peter McCabe could see a lot of good work going on in Ireland. Work supported by the ADAPT programme was not primarily concerned with construction, but

provided a foundation. The need was seen for approaches that were relevant to the needs of industry. He works with SMEs, but would prefer the discussion to be of micro and small companies. Medium sized companies have different problems. ISO 9000 and ISO 14000 were not helpful, and reflect the big company perspective.

The Construction Industry Federation, in Northern and Southern Ireland, have taken practical approaches to joint working. The focus was on construction throughout, rather than on generic health and safety issues. Complexities cannot be fudged: if there is to be an effective system, the whole set of problems, including risk assessment and control, must be addressed. Performance measurement must be built in, together with accident and incident investigation. Safety procedures manuals must be built in at the right stage in company systems. SMEs can join the new system at various levels, as long as they continue to improve. Companies are not used to the language of systems, and had no tools. The response was to design and provide a safety pack, with the key documents in simple terms. The materials have been introduced to companies, as an alternative to sending companies to consultants for certification, with new clear materials. In January 1999 the Irish Government reached decisions on health and safety for public sector clients: safety management systems are required, and small companies need help. The emphasis needs to be on improvement, and not just a paper exercise. There is some surprise that the EU have not imposed health and safety requirements on companies engaged on European funded projects, which are necessary if cowboys are to be removed from the industry.

Experiences from "Handbook for Safety, Health and Environment at Work"

Toni Geyer reported that requirements have changed in Austria in recent years, with the introduction of a systems approach, where documentation is required as supporting evidence. Small companies should be able to comply. The handbook includes environmental issues and management, based on a networking approach. It includes a disk with template documents, and was developed with pilot companies. The approach is prevention-oriented, concerned with competitiveness, and pays attention to motivation, flexibility and adaptability.

The set of tools covers the range of management functions, taking management terminology and translating it into ordinary business language. Words such as "system" and "manager" can cause confusion, as in Austria "manager" tends to mean CEO. Practical approaches must be used. It is clear that management tools must be adapted for the small business user. SMEs need to be encouraged to network. In-company communication is important. External support and links with external stakeholders are important.

Workplace Assessment: A Tool for Occupational Health and Management in Small Firms?

Per Langaa Jensen described the Danish systematic approach, which he contrasted with a systems approach. Risk assessments were required under the EU Framework

Directive, translated into practice in Denmark as workplace assessment. A telephone interview survey showed that 40% had failed to start the process, but with larger firms only 5% have yet to start to comply. Of firms with under 20 staff, 73% had yet to start. Case studies have been undertaken. In Denmark 97% firms employ less than 50, and employ 51% of the workforce. The case studies covered high tech, high skill, in an urban setting and low tech, low skill, in a rural setting. Small and medium firms are able to comply. Mandatory regulation is necessary but not sufficient. Project-based companies can take on workplace assessment without difficulty, if the willingness is there. It is a matter of establishing appropriate tools. Measures need to have local tailoring. Participation levels are affected by the ideology of the entrepreneur, affecting the role of the mediator. In some low technology firms it can be hard to persuade the managers to listen to the employees. A central role is played by mediators, providing a supportive organisational structure. Small firms should be seen as nodes in a network, and not in isolation. Many of the small firms are family based, meaning that interventions can impact on the power structure beyond the workplace. Often the man is the head of the family, but the wife handles the financial and human resource management issues. Within small firms there are no effective functional divisions, and consultants have to be able to discuss the range of issues concerned. Small firms are capable of complying, but are often not sufficiently informed at a functional level. In Denmark, the occupational health services play an important role.

Summary of the Discussions and Suggestions for the Ongoing Development of Voluntary Guidelines

Ann-Beth Antonsson opened the discussion. Micro companies of 0–5 and small companies of 6–20 are largely concerned with systematic work; among companies of 21–50; some would prefer to adopt an appropriate management system. It is a matter of developing improvement loops and simplifying documentation; market forces, where certificates may be demanded. Another approach sets overall requirements and then tests whether it is necessary in a particular case. It should be possible to introduce intelligent guidelines. She argued for proactive preventive work, with a requirement to report on previous accidents. She welcomed the idea of good tools for OHS for small businesses. The market requires certification, often linked to ISO 9000. Once large firms are certified, they require certification from their suppliers, which means having something to certify against, which tends to be bureaucratic. Large companies develop new standards, citing demand from customers. She sees problems in leaving decisions to the market. Swedish research suggests that quality systems relate to problems in the working environment. People had difficulties in understanding internal control legislation, as documentation is alien to small company culture. Standards are written in bureaucratic language, not comprehensible to ordinary people.

Kaj Frick wants simple management systems for the better half of small companies. They need systems if they are to be certified, and if contracts are to be secured. International co-operation could be valuable. Simpler systematic approaches would be helpful. Training policy is to be influenced by national bodies. He hopes that Swedish research on Internal Control will be developed, with new measures and networks.

Gerard Zwetsloot argued that micro firms must be on the agenda. Systems must be simple to use for small companies. Regulation must be easily understood. The focus has been on the owner and on the workers, and the interaction between the two is important. Many craftsmen do not want to innovate once they have established their new business; seen from a sector perspective, innovation depends on initiatives from new generation craftsmen. In this way, innovation takes place by generations.

David Morris has been an enforcing inspector for many years, and welcomed the wider perspective from the workshop. He is currently involved in a small firms strategy review with HSE, dealing with education and training, networks, the role of information, and guidance to sources of knowledge. How do we expect small firms to do it? Management systems are part of the process. What are the motivators? How can we get those engaged? There are contractual and supply chain issues, and regulation enforcement. If we get these things right, we could make a difference.

Workshop Participants

Ann-Beth Antonsson, Swedish Environmental Research Institute, Sweden
Jos Bormans, Belgian Employers Federation and UNICE, Belgium
Richard Ennals, Kingston University, UK
Kristin Flagstad, National Institute of Technology, Norway
Kaj Frick, NIWL, Sweden
Toni Geyer, Austria, and Sussex University, UK
Carin Hultin, Swedish Joint Industrial Safety Council, Sweden
Per Langaa Jensen, Technical University of Denmark, Denmark
Torben Jepsen, Danish Employers Federation, Denmark
Jacqueline Jeynes, Federation of Small Businesses, UK
Felicity Lamm, University of Auckland, New Zealand
Elisabeth Lewin, NBOSH, Sweden
Clare Mayhew, Occupational Health and Safety Commission, Australia
Peter McCabe, Construction Industry Federation, Ireland
David Morris, HSE, UK
Juan Pedro Reyes, Fundacion Labein, Spain
Lena Skiöld, NIWL, Sweden
Hans Torvatn, Sintef, Norway
Rie Vejs-Laursen, ILO, Switzerland
Laurent Vogel, ETUC, Brussels
Gerard Zwetsloot, TNO Work and Employment, Netherlands

Reflections on the Workshop

The workshop relates to the present political and economic agenda in a number of respects. There is particular focus on micro and small firms, which are seen as central to economic development and new employment, but are poorly understood. The workshop participants come from across Europe, from diverse cultures and political contexts, in which regulations have played different roles.

3. Job Creation

The workshop was led by Bernd Hofmaier, and held at the offices of the Swedish Trade Unions in Brussels, 15–16 November 1999.

Introduction

Bernd Hofmaier introduced job creation. Politicians want practical solutions, fearing that people may turn to strong leaders for alternative simple approaches. The European economy is booming. Average growth in the OECD is still 2.5%, and unemployment is not likely to fall below 7%. There are still over 30 million job-seekers in OECD nations, so a recession could bring major problems. Progress in tackling long-term unemployment has been mixed, with particular progress in Denmark, Australia, New Zealand and UK.

What are the impacts of unemployment in societies with welfare state provision? Jobs provide structure for life, acting as a crossroad between the individual and society. Tony Giddens talks about structuring and restructuring the fabric of society, putting people to work. Richard Sennett has described the erosion of individual character through recent developments in work organisation. Jobs are a social construction. Joseph Schumpeter talked about creative destruction, the replacement of old structures by new ones. What are the relevant forces? From the perspective of economic policy, we consider innovation and the provision of risk capital. How can technical innovation be supported? Innovation is seen as part of a system of actions. Technical development is important, in particular IT and ICT. These developments can destroy or create jobs. New technology has brought new forms of working, such as call centres.

What are the properties of entrepreneurs? Are there issues of competence? Are there gender issues? Is this a zeitgeist question, linked to individualism? Why do firms collapse, or fail to grow? Why does entrepreneurialism currently seem stronger in service industries? American research work on job creation and destruction suggests that it is hard to arrive at practical results. There are new jobs, but many do not last. Job destruction shows more cyclical variation than job creation. The dominant role of idiosyncratic factors inhibits comparative analysis, and suggests that policy initiatives are difficult. The Swedish response, from Per Davidson, shows that job creation takes place predominantly in SMEs, which do not vanish as fast as was suggested. Jobs are normally paid, but there are other jobs undertaken by volunteers. Demands are not satisfied through the market economy alone. Job creation has something to do with competence and qualifications. New jobs require new competences, such as in communication. This has consequences for schools and the education system.

New Employment Opportunities in and Through the Third Sector

Peter Herrman outlined the third sector, providing means by which employment

can be maintained. Societies are not running out of work, though there may be a shortage of paid employment. Some current needs cannot be met by market means, so there needs to be integration of market and social activities. There is scope for new employment and structures, using new and unrecognised qualifications. NGOs have a distinctive role in linking sectors, mediating different patterns of productivity, and compensating for deficits in other societal areas. The use of new technologies is seen in the official system as providing skills, but also involves new ways of communicating and new forms of culture. In particular, it involves those living at the edge of society, more open to new possibilities, and less constrained by current practice. Our children are more prepared to explore. Companies and training institutions are not able to take up these opportunities.

Job Creation and Micro Firms

Filomena Oliveira reported on a recent research project with the European Foundation. She considered the situation of SMEs, the overwhelming majority of workplaces. Micro firms, employing up to nine employees, constitute 90% of EU enterprises, and employ 20% of the workforce. They provide learning and vital social and community contact, and are central to the European economy and society. Various measures have been recommended, including good research and information, and specific statistics. The project involves the main European institutions, such as Eurostat, now concentrating on micro firms. It is necessary to distinguish different sectors, such as high technology, when considering working conditions. Research concerns job creation, where micro firms have a reputation for poor quality jobs. Researchers have often failed to combine quantitative and qualitative research.

Warwick University undertook a pilot project using Portuguese data, setting out a framework for a cross-country study. In micro firms, employees feel more autonomous, and experience less interference in decision making. Research covers industrial relations, the role of trade unions, direct employee involvement, working hours, wages, types of contract, training, health and safety, autonomy, security and involvement in decision making. The chosen countries are France, UK, Sweden and Greece. Greece provides insights into the situation in Central and Eastern Europe. Data collection has continued, making use of the 1996 survey of working conditions, supplemented by wage data. In micro firms, employers are often workers themselves, concerned with survival, and in need of support. Entrepreneurship is one of the four key employment pillars addressed in the research. How can we guarantee employability for workers, secure adaptability, and develop entrepreneurship? Looking at Europe by contrast with the USA, scientific knowledge is used less effectively, and universities are less close to business. In most of Europe research is weak, by comparison with the USA. Manufacturing dominates in Europe, while services have developed in the USA, including education, health and social services.

Regional Job Creation in Northern Austria and the Neighbouring Southern Czech Republic

Bernhard Schneider bridged large research and practical case studies. His recent

work concerned qualifications and future action plans, in Austria and the Czech Republic. The region has unemployment of 10–20%, with a lower rate of unemployment in the Czech Republic. He considered the potential of job creators. Patterns of problems vary, and barriers need to be removed, leaving some protection against one's own courage and foolhardiness. Work can be divided in terms of time allocations, with advantages of different working time arrangements. Careers advice to young people can be influenced to enhance opportunities for girls. Qualifications based training can include developing reserves of potential staff and expertise. Industry planning is needed, with changing market conditions and patterns of housing need. There is a tendency to assume that changes will come from politicians. Expectations need to be managed and developed. Low paid entrepreneurs may produce misleading statistics. In sclerotic regions there is a nostalgic reliance on jobs being provided.

There are ethical issues, particularly with long term unemployed in minority groups. Ideas need to be exchanged between regions. Certain groups find themselves excluded, and there is a need for a second labour market, providing rotating opportunities, and saving other costs. Incubator activities can be reasonable investments. There is potential for high technology micro firms. He concluded with consideration of globalisation and regionalisation, with impacts on small companies.

Andrea Bardi referred to experience in Emilia-Romagna, and job creation in micro firms. The increase in micro firms has been a problem, constituting fragmentation of medium-sized firms. There has been a spin-off process, creating new entrepreneurs. One answer is networking, building networks specialising in particular phases of production. An example area is furniture manufacture, where there are problems of evolution of knowledge. Industrial districts arose from knowledge development, and the transmission of tacit knowledge. Now the spin-off firms are a point of weakness, because in several cases they can fragment and weaken the medium sized firms. In the long run, tacit knowledge may disappear, as firms close. Individual decisions about work organisation may be affected by age and approaching pension rights. This problem arises particularly in the packaging industry. It is exacerbated by current problems with apprentices, as the transmission of tacit knowledge, between entrepreneur and employee, has been broken. Nowadays young people gain little more money from training, in the past learning a craft was seen as an investment.

The Skills Economy and Job Creation: The Case of a Rural Region

Robert Huggins has been working in mid-Wales, supported by development agencies concerned about deprivation in rural areas. Unemployment is relatively low. The population is 250,000 in a sparse rural area, with agriculture and tourism. The problem is structural inactivity, with low productivity and low wages. The welfare state could pay better than work, with a lively black economy. The voluntary sector involved many people. The idea was to investigate the skills economy, incorporating expectancies of employers and employees: a longer-term approach than the traditional labour market approach. Key interfaces include

policy makers and companies. There was a lack of high performance companies, though training opportunities were greater. Small businesses predominate, with little training or skill. The ICT infrastructure was not in place. The productivity and skills trap translates into low GDP per head, a proliferation of part-time employment, low levels of innovation and entrepreneurialism. Managers had low skills, perpetuating low productivity. Low capital investment in a labour intensive sector meant that potential was not being fulfilled. Companies were reluctant to recruit school leavers and graduates. The area is remote, with poor public transport and few applicants for posts. The challenge is to identify effective job creation policies; more needs to be known about the needs of small firms. The business development agenda has to integrate with workplace skills development. New initiatives are needed, targeting skills gaps. Networking and co-operation are required, accompanied by management training. Urban areas have more foreign-owned companies, compared with rural areas.

Job Creation for Women in Entrepreneurship

Agneta Hansson outlined a programme at Halmstad University, taking unemployed women from public sector backgrounds. Most women are in the labour force, few are entrepreneurs. The stereotypical entrepreneur is a middle aged male in manufacturing. The approach has been to build networks, identifying obstacles encountered by women, such as banks. A LEONARDO project, GROW, was developed, with another Swedish region, Wales, Emilia-Romagna, Catalonia, Belgium and Southern Italy. The same obstacles were encountered, but with different proportions of active women entrepreneurs. How could this be changed? Reference groups were set up, with a support system. Democratic dialogue was used to explore the issues. Vertical and horizontal sliced groups were used, demonstrating the approach of a search conference. Dialogue began, exploring the differences between men and women, who may have been treated apparently in the same way. Networks were developed, which continue to operate after the end of funding. The work is documented in the report "GROWth in your Region". The dialogue produces ideas for job creation, and bureaucracy has seemed to be the obstacle. Working with the authorities, some policy changes can be piloted and then implemented more widely.

Bernd Hofmaier discussed search conferences, a way of working with groups that has been used in Sweden in and between companies, and in regions, since 1985. The search conference is a useful tool for developing dialogue, identifying where the jobs are. Job creation is a social construction, part of a social process. The search conference involves putting people together without a normal hierarchy. It is a tool for job creation, when one invites a set of actors in a given region, looking to the future, considering objectives and obstacles. It is not an expert-based approach, but based on dialogue, and a search for consensus. The basis of the search conference is participants coming together from different cultures, with different languages. It is a matter of blurring hierarchy, and enabling people to talk to each other, finding a basic point of understanding, and a preliminary platform for joint action, enabling the participation of those who have previously been excluded.

Agneta Hansson sees dialogue as a means to producing more equal conditions for women. There are myths, such as that women enter business as a hobby. Women and men may work in different sectors, with different experiences. If entrepreneurship is seen as industrial, it discourages women. Women have to struggle to develop their ideas, lacking easy support. Women tend to choose sectors with less exalted status, such as food, flowers or hospitality. Female business advisers in Sweden need training and risk capital, aided by women understanding each other. Women seeking to develop businesses tend to have a strong educational background, and are offered courses in entrepreneurial skills. 95% of women work in Sweden, and professionalisation is widespread, covering standards of working conditions. The "glass ceiling" restricts advancement beyond a certain level. The family is the key source of support for men, but for women it can be a major obstacle. The Gnosjö area is patriarchal, oppressive of women, but entrepreneurially thriving, offering a Swedish parallel to Emilia-Romagna.

Margit Thomsen works at the Danish Technological Institute in Copenhagen. In the 1980s she established an experimental school for women, addressing particular unemployment problems in the changing labour market. Holistic methods were needed, establishing what competence people have, and making sense of the bottleneck problem, combining scarce manpower and many long-term unemployed. Active labour market policies are used, but it is hard to match supply and demand: engaging enterprises is vital.

Job Creation and Study Circles – Unemployed Female Glass-workers in Nagelberg

Lars Karlsson described a range of initiatives in the Austrian regions. Most project participants were women glass-workers. It was hard for them to move, due to houses, husbands and children. At first there was a training course; the community centre is still there, but with some new activities. A nearby project concentrated on subsidised work, producing organic biscuits. A local hotel and tourist centre have been developed by a former project participant. The objective was to enable women to be self-employed and self-sufficient, providing a form of emancipation. There was initial reluctance, and participants needed support in gaining confidence. There was resistance from husbands and the local community. There were some successes, as women established themselves as self-employed and then as directors. On occasion the women took the lead, with their husbands working with them. A small project can have lasting importance.

Bernhard Schneider noted that government policies changed annually over the 13 years, without apparent rationality. There were few jobs available, but 65 out of 110 people registered for the initial six weeks of training, before choosing directions. 20 explored self-employment. The child care centre continued until it was closed recently, due to demographic change. The project cost was small in comparison with regional policy initiatives, but large in terms of the small number of people involved.

Andrea Bardi distinguished the "low road" and "high road" to productivity improvement. Internal flexibility tends to form part of the high road, using slack

opportunities to develop new products and flexibility. He outlined approaches to flexibility, their implications for job creation, and some barriers to job creation. In some cases, the same tool can be used for both the low and high roads, such as concurrent engineering, customer orientation, networks of innovation, work-groups and knowledge management. Co-operation needs to be organised. The low road is based on cost cutting, lean production, and forced flexibility from the worker. In order to succeed on the high road the slack and flexibility need to be organised. Film and media companies have to work in the high road tradition in order to survive. Most manufacturing firms have followed the low road.

Bernd Hofmaier discussed the role of IT and ICT, used by traditional enterprises in new ways. He cited a company in Gothenburg, selling paper, with all processes handled by the Internet. He considered the needs of the entrepreneur, and needs for qualifications, including social skills. Entrepreneurs encounter gaps in their skills, and need support systems, for example in areas of new technology. Administrative skills can be learned, but support structures and networks are also needed.

Conclusions

Entrepreneurs find new opportunities, structuring and restructuring processes in society. Entrepreneurial approaches to new opportunities are a result of dispositions, a preparedness to exploit new openings. Schools may have been oppressing ways of thinking. Entrepreneurial thinking is needed at all levels. Even in later phases of life, there is a need to develop such skills, so universities can help, involved with entrepreneurs. Certain core skills are needed, such as IT, but money is also necessary for new business starts. Banks and loan systems are a normal part of society, but there should now be different ways of lending and borrowing, particularly in the case of micro-firms. Examples can be taken from India and Bangladesh. Normal discussion is of risk capital, which is too difficult. There are loans systems for women in Europe, based in Spain, where loans are given without guarantees, to start one-woman enterprises. Study circles are the basis for solidarity finance schemes, taking turns.

Entrepreneurs need backing and education. Innovative companies in the same region tend not to know each other, despite membership of chambers of commerce. Networks are needed. Each needs to take their future into their own hands, and support may be needed in developing networks.

Job creation is part of a wider context. There need to be brokers, facilitating dialogue processes in partnerships and networks. European support has been important, depending on network formation. There are high and low roads. ADAPT and other programmes have created jobs. Some consultancies have used this as an expert-based approach, but another approach is to put people together in a bottom-up manner. This needs people with knowledge, skill, and the ability to step aside. Existing jobs need to increase, preventing unemployment. This means helping prevent business failures involving people now in the labour market. There are programmes of restructuring in large companies, moving redundant staff into separate companies to evaluate their future employability, while still paid by the company. Intensive discussion is needed, involving dialogue.

It is the role of government and social partners to create a favourable environment, or nobody will have the courage to start a business or create employment. This requires taxation and legislation changes. There can be intermediate roles, for example using enterprise hotels, reducing personal risk. Such support should be available for companies of all kinds. There needs to be an ambition to be independent. In general, most people do not feel that way. Employer creation involves building up a supportive network, of some kind. One approach is to be one's own employer.

There were concerns for quality of working life, in parallel with entrepreneurship. We worried about the numbers of jobs created, and the use of public works funding. The debate has moved on to small business and development. Improving quality is an important starting point. Entrepreneurship should be developed in existing jobs. Lifelong learning should include co-operation between trade unions and universities. Courses should not be commercial products. Social dialogue must be civil dialogue. The tendency has to be towards learning organisations and lifelong learning. Job creation is a context dependent social process. It is not just about individual competence, but networked support. Job creation and technology are linked. Technology was formerly a black box, but now has to be seen as socially constructed.

Workshop Participants

Andrea Bardi, Institute for Labour Foundation, Bologna, Italy
Richard Ennals, Kingston University, England
Roger Falk, journalist, Sweden
Agneta Hansson, CAU, University of Halmstad, Sweden
Peter Herrmann, ESOC, Cork, Ireland
Bernd Hofmaier, CAU, University of Halmstad, Sweden
Robert Huggins, University of Cardiff, Wales
Lars Karlsson, Hippopotamus Education, Vienna, Austria
Filomena Oliveira, European Foundation, Dublin, Ireland
Bernhard Schneider, consultant, Vienna, Austria
Margit Thomsen, Danish Technological Institute, Lyngby, Denmark
Arne Wennberg, NIWL, Sweden

Reflections on the Workshop

The debate needs to take into account the different legal and economic contexts within which European Union member states operate, while observing the same European Employment Strategy. This affects, for example, legal arrangements such as "companies limited by guarantee", a device often used in the UK to give corporate status to charities and voluntary sector groups, but not known outside the UK. Another key issue is ownership of family property, which is in some countries, such as Austria, assigned to the husband, producing a gender imbalance in capabilities to attract external finance.

There was scepticism regarding comparative quantitative data on small firms, and a preference for consideration of the qualitative dimension, noting differences

between regions. The debate on regional job creation issues was well-informed and lively, benefiting from expert insights from Emilia-Romagna, the classic Italian case study region, and from mid Wales, Western Småland, Ireland and Bohemia. Given that jobs are socially constructed in a regional context, it is important to recognise and learn from the differences between regional settings. Approaches which work in one region cannot simply be transplanted unchanged, but interactions between regional development coalitions can be illuminating.

Job creation was seen as an outcome of a process of networked dialogue, ideally involving the social partners, as well as external actors, in which new organisational development possibilities are explored, and people matched with financial resources. This contrasts with conventional government models of job creation schemes linked to training programmes, where the objective may be largely to reduce the figures of unemployed. Often in such cases the employment which results is short-lived, and there has been little attention given to organisational development in the businesses to which new employees are sent.

There was little discussion at the workshop of job creation through market mechanisms, and the dynamism of entrepreneurial small businesses, taking on new employees. The workshop lacked participants from the private sector, and any perspective from employers or trade unions. The dialogue on job creation needs to be broader, and this is a challenge for Malmö.

Information Society

1. Information and Communication Technology, Work Organisation and Human Beings

The workshop was led by Gunilla Bradley, and held at the Office of the Swedish Trade Unions in Brussels, 15–16 March 1999.

The Workshop was concerned with human organisation in the development, introduction and use of information and communication technology (ICT). It focused on improving the quality of working life, including human resource development and productivity.

Employees Participation on the Strategic Level in Learning Organizations and Networks

Leif Bloch Rasmussen described teaching shop stewards in Denmark and Sweden, enabling them to have an influence at strategic level. Can ordinary people be enabled to have a strategic influence? Should such courses be run, given that Business Schools normally deal with managers? Can this teaching be done from outside the trade union movement, where there are clear interest groups involved? Can people decide their own future at a strategic level at work and in families? Can we teach ordinary workers what we teach prospective senior managers? The course has finished, and has succeeded. The students are better able to participate at the strategic level than are managers taught over a period of years. People can succeed in this area if they want to.

He cited Hofstede's "Organizational Culture", and considered the culture of European working life. Symbols, rituals and heroes are brought together under the heading of practices. Values determine what will happen, and may differ radically. Hofstede identified five cultural dimensions: power index, uncertainty avoidance, masculinity, individualism/collectivism, and truth/virtue. There are great differences between the cultures and values of our countries. In Northern Europe there is a low power index, and it is thought easy to contact those at the top. There are more levels in France. In Northern Europe they like uncertainty, while Southern Europe and Japan like certainty. Indians regard Northern Europe as feminine, while they are masculine. Northern Europeans are supposedly collectivist, while

Southern Europeans and Americans are individualist. The big issue concerns truth and virtue. Northern Europeans believe that the truth can be found. Perhaps it is just a matter of belief. He illustrated Hofstede's account, showing the organisational, occupational and national levels; and the locations of family, school and workplace, where values are installed. The values of the nation are installed through families, at the core of the future of working life. Work involves doing things when you want to, whereas labour involves a degree of pain. Preparation for working life may be required for the family. Work and learning life must be in accordance with private and social life in order to create a learning organisation and learning network. Network creation and functioning must be envisioned as a self-organising process, and must operate outside the normal working environment if shop stewards are to develop co-determination. Group visions must be developed before strategic processes and projects can be designed.

A group of 28 shop stewards were introduced to concepts normally taught to managers in business schools. The key messages can be communicated briefly, reducing popular phrases into ordinary language. One starting point was business process re-engineering, which implies, when used by economists, that they believe they can engineer organisations, dividing workers into core and non-core workers. The key for workers is to be a core worker, even if this means founding your own company. The project was based on shop stewards as the people in the middle, the core workers of the future. Workers tend to be silent at the strategic level, represented through elected representatives, concerned with negotiation the normal issues of pay and conditions. In Europe the Social Dialogue forms part of the Fifth Framework of Research and Development.

Key changes were identified: corporations are changing, corporations are becoming complex, globalisation, strategic alliances, pressure for improvement, political consumers and ethics in business. *Key priorities for employee participation* are to: redesign the welfare state, redesign the social dimension, develop strategic thought and co-operation, and develop a new language in management and organisations. *The goals of the project* were to strengthen shop stewards in evaluation and analysis, develop new functions and methods for representatives, and develop new cross-cultural worker language in leadership and innovation. *Prepared modules* concerned tools for analysing corporate strategy, data information and knowledge handling, future roles in the Social Dialogue, methods of networking, project development and management, decision making and multiple criteria goals, goal-oriented communications.

He discussed creative accounting. Shop stewards may start by assuming that accounting information is objective and has to be accepted, whereas at business schools prospective managers learn how to present the information. He argued against attempts to make working life wholly rational, and contrasted the Danish approach, with actual situations, with the Swedish approach, based on case exercises.

The shop stewards met for 51 days over 18 months, encountering management tools and counter-measures. One shop steward left through finding the process too academic, and another became engaged in strategic projects in her own organisation. Her institute was being privatised and sold, and she favoured developing her own company to continue with the cleaning contract. The objective was achieved, but she then returned to work in graphic design. After 5 months

managers had some involvement. Communication had been impeded by an intervening level of management, frustrating both senior managers and shop stewards. There was agreement to a new strategic project, with a risk of the shop stewards being hostages. Trade union top officials were also invited, 2 months later, but with less response. What conclusions should be drawn? It is to do with power. Top officials were elected on the basis of old issues, and have little concern for new issues.

Education in strategic thinking and counteracting management strategies, combined with a unified view of life, is based on a vision of what human beings want, as argued by Maslow. It is a matter of freedom. There has been excessive emphasis on efficiency and effectiveness, at the expense of human values. There is an important role for work apart from just earning the money to enjoy oneself.

He drew on his own work experience redesigning a shop layout, and undertaking practical research. He encountered problems of hearing loss in the workplace, but was told it was not the concern of the researcher. As an engineer, he could not accept this position, and became involved in courses on work environment for engineers. He encountered the work of Krysten Nygaard, developing technology agreements on EDP in Norway, and became involved in developing data agreements in Denmark. He then met the national signatory of the technology agreement for nurses, who faced questions but had not read the agreement before signing. People need to know what they are doing. His concern has been for accountability: ICT is not the problem, but is just a technology. The issues are political, ethical, cultural. He established the course for shop stewards, with the objective of becoming self-organising, so that, having started the process, the academics could withdraw. He referred to theoretical debate about open systems, and the approach of taking systems away from stability so that they are obliged to self-organise. The conclusion was "Get in there, do the job, and get out of the way".

ICT and Quality of Working Life:

Implications for Competencies and Well-being

Eila Järvenpää looked at the electronics and telecommunications industries, the most rapidly growing sector worldwide. Companies are merging, privatisation has been spreading, changing work organisation. Effects include globalisation of markets and companies, development of information society, importance of networks and knowledge, knowledge work, and individuals as knowledge workers, symbolic analysts. Why study ICT? Competition in fast-changing global markets means the development of competitive advantage: communication independent of space and time, and new business opportunities: new geographic business areas and e-commerce. We find networks of companies: co-operation and information sharing. There is a growing market for ICT products and services: mobile communications and ICT products.

Tacit knowledge is found in jobs that do not appear to have an intellectual content. Companies that have not appreciated the importance of such tacit knowledge often discover their dependence when the key workers leave, and have to be re-employed.

At the global level, IT is an industry and enabler, with impacts on competencies of workers. There are demands linked to globalisation: understanding different cultures; skills to work in multicultural environments; leadership and management skills; multicultural motivating and reward systems; communication skills; and language skills.

At the organisational level, it is a matter of business, communication and competencies. She quoted a nine-country study of multinational and nationally based companies, some with good ICT and HRM reputations, based on interviews with HRM managers. Skills could be categorised as technical, human and conceptual, looking at managers, technical and administrative staff. She identified those technical skills needed for the future: foreign languages, project planning, cost control and management, software use. Gaps were found among managers and high level technical staff. Human skills include analysis, creativity, flexibility, leadership skills, responsibility and teamwork skills.

Sebastiano Bagnara looked at results from national statistics. In 1991 the list of occupations needed major revision from the 1981 classifications in order to cover the range of occupations. **Leif Bloch Rasmussen** saw the core as networking between people. He challenged the concept of leadership, and saw alternatives to teamworking and communication.

At the individual/work level, IT is content and tool. **Eila Järvenpää** had already discussed knowledge and information work. Research has examined stress factors and outcomes, looking at six occupational areas and 258 employees. The hypothesis was that knowledge work involved more skill and autonomy, but more stress due to responsibilities. The findings were that job satisfaction was higher for knowledge workers, but with stress levels the same. She linked a number of stress factors to the use of ICT: ambiguity of job roles; lack of autonomy; poor organisational climate; leadership practices; low level of job control; high workload; fast changing work environment; need for continuous learning; and complicated tools. She emphasised networking among peers, knowledge sharing and knowledge acquisition: borrowing stuff from peers; leveraging existing materials; outsourcing to vendors; using vendors as consultants; and surfing the net. Stress can also be managed through personnel arrangements: acquiring staff, hiring temporary staff, re-engineering staff and re-educating staff; and through time management, by adjusting your working hours and guarding your schedule. She ended with promotion of well-being through: Stress management, Job redesign, organisation development, knowledge sharing, knowledge management, communication and training.

The Knowledge (or Cognitive) Society: A Critical Analysis from the Social Organisations Point of View

Jacques Berleur reflected on the Delors White Paper and identified the nature of current society, raising questions for later answer. "Towards the Learning Society" was published in 1995 to prepare for 1996 as the European Year of Lifelong

Learning. The title is different in French, where the title is "Knowledge Society". To refer to "The Cognitive Society" implies the artificiality of artificial intelligence. Knowledge is defined as linked to society and technical skills.

The White Paper presented an education and training policy: employability and adaptability to the labour market; competitiveness; and lifelong learning. He saw the virtual university as a new business opportunity for lifelong learning. He introduced European guidelines for action: raising general levels of knowledge; bringing schools and business closer together; combating exclusion with a second chance; multilingualism; and improved arrangements for financing training. He saw a move to competence rather than qualifications, and a form of customisation, a move from collective to individual approaches. Metaphors have reached a new high speed, moving from bronze and steel to information. We have moved from hunting to rural; then industrial, consumption and leisure; and now an information society, post-capitalist; and the knowledge society. The Knowledge Society derives from the Bangemann Report of 1994, following Peter Drucker in 1993, two reports from the European Round Table of Industrialists in 1994 and 1997. The result is a one-sided view, and the end of discussion at this stage for DG-XXII. Bangemann had discussed new ways of living and working, talking of a revolutionary challenge. The report was not signed by trade unions, but by industrialists.

There are three simultaneous kinds of upheaval. The information society is transforming the nature of work and work organisation, leaving the worker more vulnerable to change as merely an individual within a network. Globalisation is bringing down the borders between labour markets, raising issues of qualification. Technical progress has produced cultural problems and misgivings. There is no real analysis of the information society: it is taken as given. We need to reintroduce the merits of a broad base of knowledge "valorisation of general culture", seeking to avoid a split between haves and have-nots, knows and know-nots. It is then argued that traditional educational routes over-qualify young people for most jobs. We need to build up employability, noting the perverse effects of traditional qualifications, reducing flexibility and locking out talents which do not fit standard profiles. The keywords are flexibility and mobility. There is no account of how this is to be done. Who will certify or accredit? Who will validate the skills? Who will do it, and how? A personal skill card is recommended. This approach emphasises the individual approach, freeing employers from their obligations. This is customisation, based on a view of instrumental knowledge.

Gérard Valenduc is research director at the Work and Technology Research Unit in Namur, working with trade unions. He added a report on knowledge and competence in the workplace, from the point of view of workers and their organisations. The future of skills and qualifications involves the emergence of new skills and technologies, and a shift in skills requirements, with positive and negative impacts for workers. Knowledge workers may be empowered, while the codification of knowledge adds to routine work. Improved skills are not always needed, including for high qualification jobs. In finance, skills are less in professional financial analysis and more in customer relations. The typical knowledge worker is a consultant in a knowledge based service firm. Current networks are integrating implicit and explicit knowledge, leading to standardisation of formally high skilled tasks, and a reduction of high skilled tasks.

Key words include discrepancies and inadequate skills: there is a gap between technologies and available skills, to be bridged by education and training. Employability is a new keyword, derived from OECD. It accompanies a shift from blaming countries for poor employment policies, to a new approach to unemployment. There is a lack of critical literature. Employability can be adaptability with mobility. Employability replaces employment, which is no longer guaranteed; self-employment is a means of realising employability. Employability is thus a responsibility of the employer. Unemployability explains unemployment; jobless people are not employed because they are no longer employable, through a lack of skills and flexibility. The expected behaviour is therefore not only to become trained but also more flexible. Employability is only the expression of the relation between the current skills and qualifications of the applicant and the current labour market situation. It is thus relative to contextual conditions.

He then addressed knowledge, skills and flexibility, distinguishing flexible professional/conceptual skills; flexible Taylorised skills; and flexible dextrous/ analytical skills. He characterised learning organisations as the missing link in European competitiveness, as anthropocentric or post-Taylorist organisational change, and as a leading edge principle for regional policies, as in Flanders and North Rhine Westphalia in Germany, based on vocational training, and Italian industrial districts.

Pascale Carayon emphasised the local level, as a complement to globalisation. She cited foreign investments in France, attracted by state subsidy. There need to be local connections to attract and retain business activity. This is a vital networking question. Regional initiatives involve training and economic development. It is a matter of bringing together active people in the region.

Sebastiano Bagnara distinguished between SMEs which were derived from outsourcing of functions of large organisations, and, on the other hand, SMEs founded as such in Emilia-Romagna know that their own secrets will be stolen, and need to be exploited at speed. Their strength is locally based and derived, interactive in nature.

Gérard Valenduc discussed the shift from qualifications to competences. Experience and ability of workers have a collective dimension, built through teamworking and collaboration. The borders between individual and collective dimensions are not clear. New forms of work organisation make the distinction less clear: they are more based on individual competences than on the workplace. It is a matter of function, profile or role in the organisation, related to the worker not to the workplace. This means an individual approach to collective bargaining, through bargaining about training. Classical negotiations based on the workplace are no longer possible.

If you replace words like qualification by employment, and competence by employability, this reinforces the logic of entrepreneurship as opposed to employment, and a move from wage-earning to entrepreneurship. This means a new approach to polyvalence, now based on a mix of competences. Reorganising enterprises, for example into call centres, may mean a reintroduction of specialisation. Communication at work equates to managing events. Work becomes the collective dealing with events.

Jacques Berleur concluded by noting that the intention had been to raise questions for the Work Life 2000 conference. Whose knowledge society are we building? What about the workers? How and why are these historical revolutions happening? What kind of transformation of work is involved through the information society? What is meant by raising the levels of qualification? What are the ethical rules of the information society? What education structures are to be used to develop a broad base of knowledge? What is the price of flexibility and mobility? To what extent do we accept employability? What are the consequences for the workers of the "learning organisation"? What about the customisation of education? Is this freeing employers from their obligations? Who is to certify and validate lifelong learning? What is the role of the trade unions? How can we restore a collective approach?

Ulrika Danielsson noted that a more knowledgeable worker can pose threats to the company. She then noted that individual responsibilities have been highlighted, posing questions about the structure of education at a local cultural level. Her work consists of a series of projects, with new ones being prepared while current work continues.

Evaluating Quality of (Working Life) in Services

Sebastiano Bagnara, professor of multimedia in Siena, considered what is happening in the area of services, covering the role of clients, ergonomics, then detailed consideration of call centres. He has only recently had data from services as opposed to manufacturing. In the 1980s the balance of employment shifted, with a change of model of working in services. Ergonomics had assumed a border around the worker in the workplace, with others doing the same job as members of the same organisation. People were "at work".

There have been major changes. People discovered that services were inefficient, compared with industrial work. A production model was applied, in designing and delivering services, meaning the technology of office automation. There was a concern to measure efficiency: this had been easy in production, not in services. One approach was measuring user satisfaction, derived from marketing. The other major change was involving the client in designing services. Hirschmann studied the behaviour of the client in the changing organisational context. What happens when quality degrades? The client may exit; he may remain loyal or he may complain. He took the case of telecommunications, where there had been a monopoly. In the 1980s, competition developed, and quality was forced to improve.

He distinguished inbound and outbound voices of complaint. Understanding complaints involves interaction, making sense, negotiating and enhancing participation. The client is the re-designer, the re-engineer, or at least one of the stakeholders. New jobs and systems are designed using outbound voices and marketing analysis. Discussion of services work then includes consideration of the client. He then considered ergonomics and users. Traditionally the user had been absent, but in the 1960s and 1970s became part of the working conditions, then with marketing, the user constituted the task's final goal, and is now seen as co-

participant in collaborative tasks. Service depends on clients. Our view of work has moved from workplace to a place where people interact.

He gave a detailed account of call centres for customer care. They have expanded 30% per year, with increasing employees: by 2000 there will be 1 million call centre employees in Europe, with 40% of centres employing over 100 people. Centralisation was seen as more efficient than distribution: these are service factories. There are marketing benefits from outbound voices. Performance has improved, 72% within 10 seconds, an average response time of 25 seconds, and 81% of requests are solved in one call. The next change is from call centre to communication centre. Web use and email has expanded, especially outbound. 83% of time is spent interacting with people.

There are paradoxes. The communication centre worker is highly educated, facing constantly changing problems, but is treated as an industrial worker (though paid lower wages). The social occupational role is weak, and there is no recognition of skills. Many of the workers are part-time and temporary, catering for oscillating demand. Their career development is unclear, and organisation is at three levels, operators, supervisors and managers. The call centre is crucial for getting, maintaining and updating information on the market and clients. However, only a third of call centres have a people retention policy, and only 40% of staff have an overall vision. Staff are seen as disposable. The call centre operator needs complex knowledge about products, services, clients and technologies, but there is no educational professional curriculum, and little training, despite the rapid pace of technological change.

We should try to design the situation as a cell system, comprising the operator, the technology, the client and the support team. No operator can remember everything by himself: knowledge must be distributed. Some knowledge will remain in the technology, and some in the head of the client. This affects the layout of the call centre, offering access to the technology and to the team. We should develop communities of practice, sharing tacit and explicit knowledge, developing a collective memory, and evolving a professional and social identity; and new approaches to negotiation, based on communities of complementary people rather than groups of homogeneous members.

ICT and Work Organisation: Achieving a Balanced System

Pascale Carayon decided to focus on studies of ICT and work organisation, conducted at Madison, based on principles of balanced work. Her perspective includes work organisation and psychosocial factors, their effects on the individual, both positive and negative, and the impact on the design of work systems. How can we achieve balanced work systems? She reviewed past studies. *A work system* involves individuals, tools, task, environment and organisation. She conceded that the model omits the client, unless included within the task. She works from a perspective of industrial engineering, rather than an organisational point of view. The positive and negative features are relative to the individual. The chosen approach is pragmatic, based on balance. It opens up consideration of compensating actions which may be taken, depending on the situation, context

and the extent of local knowledge. *Work organisation* is seen as a description of the way work is structured, supervised and processed: the objective nature of the process. *Psychosocial work factors* are comprised of subjective perceptions of work organisation. *The work system* via stress load has effects on the individual, affected by individual characteristics. All of these issues arise in the context of ICT. There is a literature on psychosocial work factors, with particular relevance of role ambiguity and job future ambiguity to our understanding of occupational stress.

At Madison studies have dealt with a series of topics, driven by the same core model.

Electronic performance monitoring concerns computer tracking of transactions and operator performance. The data can be monitored on an individual basis in the USA, but this approach is controversial in Europe. She cited cases in insurance, airlines, banking, telecommunications and call centres, and referred to American company guidelines on time taken per call. The technology could be used for workload distribution, as an effective management tool, not an instrument of control.

The impact of computer system performance can vary. The technology can break down or slow down, despite continued assurances concerning improvements. There are issues of interface design and flexibility. Resources questions are raised in terms of documentation, training and specialists. Effects are often mediated by psychosocial factors. Computer breakdown at a time of tight deadlines can cause problems. Implementation of new ICT such as image processing technology raises new questions. The Department of Transportation in Wisconsin processes numerous documents, now relying on computers. Workers can be given more control, following problem cases; but dependence on the technology is increased, with reduced social interaction.

Turning to work organisation and health outcomes, she concentrated on a study of communication assistants, the "ham in the sandwich" between a deaf user and the computer. The research was concerned with psychosocial factors, with people working four 10-hour days. The company increased business by offering services outside the state, with resulting pressure on the employees. This was also reflected in increased hand–arm discomfort, and major staff illness, seen very quickly between research rounds. There are clearly multiple factors involved, with temporal factors significant. Work organisation interventions include participatory ergonomics. A model of participatory ergonomics has been used to change work organisation, moving from external regulation to internal regulation. Progressively self-organisation develops, in a learning process for those concerned.

Designing new systems involves technology and organisations. Networking is increasing, requiring new forms of work organisation and new forms of regional activity. There are cognitive demands, affected by characteristics of the technology, and the extent of dependency. A key concept is performance obstacles: some removed, some introduced through technology. There are issues of organisational design, and changing work systems. There are losers and winners. Skills, training and time are important.

ICT and Humans: How We Will Live, Learn and Work

Gunilla Bradley addressed allocation of resources, personal, financial and political. ICT emphasises the importance of flexibility and integration of professional, personal, social and citizenship roles. The same software is being used around the world, which could help promote desirable qualities and behaviour. Networks offer reduction of barriers, relocation of power, continued change and openness to the surrounding world. There are opportunities and risks. The Internet resists political control. Communication has a variety of functions, visible and invisible. Stress has been reinforced by the Internet, with information and contact overload, as we are always available, and need strategies to cope. There are no organisational filters, such as secretaries in the past: contacts come directly to us, wherever we are. Hierarchies have gone, and no longer protect us. Expectations and aspirations are changing, we have to continually adapt. The peripheral workforce is growing alongside a shrinking core. The focus of skills has moved from engineering to imagination. Individuals are free agents rather than employees. Knowledge media are more diverse, and the perspective is global. Responsibility is placed on the individual. Employment in the traditional sense is fading. Individuals have to market themselves, be flexible, low cost and competitive. There are new life cycles to master. There are issues of identity, self perception, social competence, integrity, trust, emotionality-rationality, female-male and involvement-alienation, all linked with ICT developments.

What can we learn from other cultures? What could be the role of ICT? What are the desirable conditions and human qualities we would like to refine? What are the lifestyles and values we want to sustain? How do we handle leisure and work in the new technology-aided era? Maslow discussed human requirements, including the capacity to effect change, social belonging, learning, growth and meaning.

She addressed the local level and daily life. In 1994 she took on a bakery in her home village. A network of people developed, interested in change, with local press support. The objective was to improve quality of life and local employment. Yugoslav immigrants had moved into empty apartments, but needed employment. Long term goals were ambitious, concerning knowledge transfer, virtual organisations and international networks. Skills in securing European funding developed. An application was submitted for computers in the bakery, but this needed to be redrafted in order to succeed. This was action research, resulting in a local IT infrastructure, a learning programme, new workplaces, and spin-off companies. The role of the initiators reduced over time. In 1998 the project received the award of community of the year, based on the work of self-organising groups. She now looks forward to bringing these experiences to a new project, a new global village. There has been a trend to move to the city, but there are alternatives.

She addressed theory and action, referring to her own model of IT and the work environment, with a focus on environmental factors such as organisational structures. Over time measures have been developed for psychosocial factors, with a stress model, health and democracy. What is needed for a better working life? Reliability and the international level have increased in significance.

Conclusions

Lisa Sundin asked if we need all the new concepts in our research? What is the life cycle of these terms: fifth generation, knowledge management, information superhighway, learning organisations, organisational learning, learning networks, etc. Looking at firms, there are virtual organisations, spin-off organisations and network organisations. Jobs are categorised in new ways; managers, administrative staff, office workers, employees, blue and white collar workers, information workers and knowledge workers, process drivers, knowledge brokers. We need research on new career patterns: does it help us to understand the labour market? Are there impacts on competences and capabilities? Universities are seen as providers of knowledge as a commodity. Education and training have been individualised. The knowledge society reflects a paradox: industry declares a need for qualified staff, but that the younger generation are over-qualified. Dialogue is needed. The vocabulary varies: Gore and Clinton spoke of a National Information Infrastructure, while Bangemann spoke of Information Society. In 1994 the message was Global Information Infrastructure. Is there some hidden agenda? Are there implications for the future roles of universities?

Katerina Riabacke introduced the discussion of infrastructure, users and providers. There is a need for balance, meeting social service needs, within the context of working and social life. Underlying principles included: human values and the individual; the body and the importance of physical contact; the importance of language and vocabulary; multi-disciplinary perspectives; and critical analysis. ICT is now infrastructure in the service sector, with issues of boundaries between areas and phases of life, invasions between users and providers, the place of work and place of life, and the role of technology. Organisations may not survive in their current forms. ICT needs to be adaptable, independent of space and time. Flexibility has positive and negative aspects for employment.

Leif Bloch Rasmussen was concerned with the conference, which should re-think who are the partners in the social dialogue. New partners should be present and participate at the conference. They should then prioritise integration and allocation issues: allocation of work, leisure time, citizen services, production and reproduction; allocation of resources between cities and rural areas; allocation of profit between sectors industrialised countries and the third world; between hand, heart and head; and cross-cultural issues. Sweden needs a European agency, with a distributed basis, possibly concerned with immigration and ethnic issues, as part of the social dimension of Europe.

Workshop Participants

Sebastiano Bagnara, University of Siena, Italy
Jacques Berleur, Institute of Informatics, University Note-Dame de la Paix, Namur, Belgium
Gunilla Bradley, Mid Sweden University/Umeå University, Sweden
Willny Bradley, ShareIT, Sweden
Pascale Carayon, École des Mines de Nancy, France
Ulrika Danielsson, Mid Sweden University, Sweden

Richard Ennals, Kingston University, UK
Marla Haims, University of Wisconsin, USA and École des Mines de Nancy, France
Eila Järvenpää, Helsinki University of Technology, Finland
Gertrud Krarup, Copenhagen Business School, Denmark
Michele Mariani, University of Siena, Italy
Eivor Nilsson, Joint Industrial Safety Council
Charlotte Olsson, Umeå University, Sweden
Leif Bloch Rasmussen, Copenhagen Business School, Denmark
Katarina Riabacke, Mid Sweden University, Sweden
Lena Skiöld, National Institute for Working Life, Sweden
Lisa Sundin, National Institute for Working Life, Östersund, Sweden
Gerard Valenduc, FTU Fondation Travail-Université
Maud Werner, National Institute for Working Life, Sweden
Mikael Wiberg, Umeå University, Sweden

Reflections on the Workshop

There was a higher proportion of Swedish participants than at other workshops, and at the start there was a more conventionally laid out advance programme. One of the impacts of Information and Communication Technologies has been on the organisation of educational work, yet the backgrounds of the workshop participants were in relatively unchanging university environments, where senior professors were seen as appointed for life.

2. New Management, Information and Communication Technologies, and the New Working Life

The workshop was led by Åke Sandberg and Göran Ahrne, and held in Malmö 7–9 May 1999. This account is based on the report by Lena Skiöld.

Introduction

Trends appear contradictory in the world of work. We talk about networks, but old hierarchies are still going strong. We talk about management through shared values, but companies often want loose connections with their workers. Is this one trend, or many? Might it not even be a question of new phenomena, but of using new words to describe familiar situations?

Complicated Trends

Göran Ahrne argued that change in organisations is complex, and not necessarily what it seems. Flexibility is seen as meaning that companies can hire people for short periods of time and quickly change in size. There is another kind of flexibility, which is all about companies having the capacity to do new things quickly, adapting to changing conditions. On that basis you can argue that it is better to have permanent staff. Their contracts of employment tend to allow greater freedom in terms of the kind of work they can do.

Loyalty, and the importance of shared values, are phrases which come up frequently when talking about the new ways of working. New-style organisations are said to be designed to increase staff loyalty, but do they really do so? **Åke Sandberg** sees this as questionable. Old bureaucratic organisations created loyalty by offering an almost guaranteed career. If loyalty is best created through permanent contracts, why change?

Paul Thompson has analysed the situation. There are two pictures of what IT means for the new way of working. One is *utopian* with horizontal organisations where management is through shared values and trust. The other is *dystopian:* the new way of working means that staff are kept in their place through total control. **Paul Thompson** wants to cut a swathe through the whole idea that there is something radical going on at present. He stresses the continuity: companies are continuing to rationalise through different methods, just as they have since the advent of Taylorism.

Few Real Changes

Jan Karlsson argues that there is more talk about changes in organisations, rather than actual changes. The University of Karlstad studied the extent to which

Swedish workplaces are organised in a new flexible way, and how this affects working conditions. To count as "new", companies had to be

- *functionally* flexible: many people had to be able to carry out several different tasks
- *numerically* flexible: contract staff had to be used, and
- *financially* flexible: part of employees' pay had to be directly linked to performance

The researchers did not find a single company which met all three conditions. **Jan Karlsson** and his colleagues had to modify their criteria to find any companies at all in which to study working conditions.

Teamwork Is Not Common

Teamwork is another feature often thought to characterise modern organisations. The extent to which it exists is debatable. A study by **Jos Benders** at the University of Nijmegen shows that only a small minority of the companies questioned allowed groups of staff to decide how they were going to work for themselves without first consulting the company's management. People have been talking about teamwork for the last fifty years, but it does not look as though anyone is seriously putting it into practice.

Nor is skills development in the workplace necessarily taking place to the extent that many might think. **Jos Benders** reported that when on one occasion money was set aside for skills development in wages negotiations in the Netherlands, hardly any was actually used. **Jörg Flecker** argued that it is becoming more difficult for people to participate in organised learning in the workplace. Companies have to achieve good results in a short time, and have fewer employees, and the workers do not have the time to share the skills they already have. Flexibility, and what is known as "integrated tasks", often means having to take on new tasks in addition to old ones, without receiving any training in advance.

Polarisation and Modern Taylorism

Jörg Flecker believes that working life is becoming polarised, and that differences in working conditions are increasing all the time. **Jan Karlsson** agreed, based on his study of working conditions in new-style workplaces. The study is not complete, but the results are likely to differ according to the type of work involved. The new system results in better conditions for graduates and worse conditions for workers.

Many researchers see Taylorism, where tasks are strictly divided, gaining in importance, albeit in a new guise. One key example is call centres, which can be found in many sectors. Using the latest information and communications technology, call centres can be far away from the companies for which they work. Despite the fact that call centres are based on modern technology, when it comes

to the way in which work is organised, some of them are more reminiscent of old-fashioned factories. **Philip Taylor** reported that the calls coming in are piled up and then distributed to the operators, who have strict instructions as to how the calls are to be carried out. There is a constant flow of calls, like a conveyor belt. He points out that call centres can take many different forms. Some staff answer questions according to standardised formulae, while others are given complicated tasks.

Complex Situation

Software development is a profession undergoing complex organisational change. **Hervey Ramsey** declared that software developers are seen as the prototype for knowledge-based workers. They carry their expertise with them towards a bright future. However, they suffer from greater control, are more likely to have fixed term contracts, and often have to start their own businesses after having been outsourced from their previous companies. Furthermore, there is great variation between different groups.

Kendra Briken reported that more and more companies in the car industry and the processing industry are using a modified Taylorist model when it comes to teamwork. Groups are allowed to do more things than before, but this freedom is restricted to specific tasks, and they are not allowed to take part in production planning. The distinction between management and workers remains. Independent groups with greater responsibility are considerably less common.

Short Termism

The researchers at the workshop saw one explanation for the trend as the short term view taken by many companies. This can in turn be due to new forms of ownership. Institutions are often the largest owners, and want quick results. With institutional ownership, company managers, consultants and experts take on a larger role. **Alan McKinlay** was interested in the role of consultants in global companies.

Stephen Ackroyd argued for studying changes on the basis of professions, rather than companies. **Michel Freyssinet**, who studies the car industry, argued that there is rarely just one good model. Lean production is not the only option. Car markets do not develop in the same way around the world, despite the talk of privatisation.

Ingemar Göransson, from the Swedish Trade Union Confederation, wanted the researchers to provide empirical practical tools, to make it possible to evaluate different organisational models and management strategies, and their consequences.

The workshop concluded with two open questions. What are the links between international, technical and social distribution of work? How are different disciplines, which often work at different levels of analysis, to fertilise each other?

Workshop Participants

Stephen Ackroyd, University of Lancaster, England
Göran Ahrne, University of Stockholm, Sweden
Fredrik Ausgustsson, University of Stockholm and NIWL, Sweden
Jos Benders, University of Nijmegen, Netherlands
Carol Boyd, University of Strathclyde, Scotland
Kendra Briken, SOFI, Göttingen, Germany
Christofer Edling, NIWL, Stockholm, Sweden
Pelle Ehn, KK, Malmö
Jörg Flecker, FORBA, Vienna, Austria
Michel Freyssenet, GERPISA, University of Evry, France
Christina Garsten, SCORE, Stockholm, Sweden
Ingemar Göransson, LO, Sweden
Henrik Hansen, Technical University of Denmark
Nanette Juhler Hanser, Technical University of Denmark
Peter Hasle, CASA, Copenhagen
Helge Hvid, University of Roskilde, Denmark
Gerd Lindgren, University of Stockholm, Sweden
Sanja Magdalenic, University of Stockholm and NIWL, Sweden
Rianne Mahon, University of Carleton, Ottawa, Canada
Alan McKinlay, University of St Andrews, Scotland
Hervey Ramsey, University of Strathclyde, Scotland
Åke Sandberg, NIWL, Stockholm
Lena Skiöld, NIWL, Stockholm
Philip Taylor, University of Stirling, Scotland
Renita Thedvall, SCORE, Stockholm
Paul Thompson, University of Strathclyde, Scotland

3. The New Media Industry: Regions, Networks and Hierarchies

The workshop was led by Åke Sandberg and Ann-Katrin Backlund, and held at the IT Commission in Stockholm on 2–4 June 1999.

4. The New Media Companies: Work, Organisation and Employee Relations

The workshop was led by Åke Sandberg and Peter Leisink, and held at the IT Commission in Stockholm on 5–6 June 1999.

The two workshops were co-sponsored by NUTEK (Swedish National Board for Industrial and Technical Development) and the Swedish IT Commission.

What Is Meant by New Media?

James Cornford addressed the term "new media". Are we talking about a production technique or particular kinds of products? Might it primarily be a social and/or political project, whose aim is to create an image of a more or less homogeneous industry? Many aspects of what is commonly termed new media are neither particularly new nor have much to do with media. Many companies are structured in traditional ways.

Åke Sandberg argued that new media covers products and activities, and the efforts of companies to constitute an industry for business reasons. In New York, for example, this encompasses efforts of real estate companies to raise property values in downtown areas. The focus should not be immediately on firms, but on activities in a variety of contexts. The old media sector has a role in delivering content to the new media sector. The products include internet solutions and CD-ROMs. Activities include management consultancy, content development, and digital design. We can distinguish between core producer firms and those who distribute. The companies link into many other industries, including IT, entertainment, advertising, publishing, and management consulting. The balance of the picture varies in different EU countries. In Stockholm there is a concentration in the Stockholm area. It is important to remain flexible in our definitions of a rapidly changing field. The term "new" media is likely to become misleading. There is a particular role of "old" media, being transformed but contributing content.

Regional Networking and New Media

Susan Christopherson summarised the geographical aspects of the clustering of companies. Researchers are interested in location from the perspective of economic development. They start with place, looking at cities and clusters. This arises from the agendas of policy makers. In the US, new media has been seen as a

means of urban regeneration, oriented around increasing real estate values, and high profile production, as opposed to sustainability. In the EU the emphasis has been more on regional development, but with a similar focus on clusters. There is a need to consider different sub-sectors, and their production activities, which may have different locational patterns. Relations with the customers for the product vary. Multimedia, for entertainment and information, is different from software development for business information systems, which may not be conducted in a network context. The computer games industry is different, with long development times and less interaction with customers.

She presented a model in terms of distributors, producers and outlets. The spatial form of new media activities depends on relations between these groups, and the competition environment, determining whether the organisations disintegrate or remain integrated. Distributors have information and capital: if there is a barrier between them and the outlets, then risk is increased. In the US there was a regulatory barrier, with the objective of increasing variety. There can be barriers between producers and distributors, leading to direct access to outlets, and the formation of networks. In the UK, distributors can control the end market, thus reducing their risks and costs. As vertical integration proceeds, distributors work directly with small firms, eliminating medium sized firms. As a result, there can be a bi-modal pattern. It is important to understand the background from which clusters emerge, rather than starting by a concentration on clusters. We should look at sub-sectors and particular areas, before we address policy questions.

Workshop Topics

Peter Leisink introduced work, organisation, and employee relations. The new media industry is interesting in itself, embedded in convergent sectors. Developments could foreshadow wider trends in the future of work in the information society. There are current terms such as flexibility, information society, post-Fordism, network society, learning society. New media companies offer insights into the future of work.

1. He addressed *organisational* issues in the regional context, adding the dimension of network organisation within firms. We know about project teams in new media companies: will this trend spread to new sectors? There are issues about networks, and the focus of commitment of employees. What does this imply for cohesion, responsibility and the division of labour?
2. *Work* is a new point of emphasis. Which perspectives are helpful to us? Is highly skilled creative work a general phenomenon: for example website design? Do we see the emergence of web-slaves? What skills are needed? What qualifications are required? Working conditions are important, including RSI and stress at work. In the past, trade unions protested against IT surveillance.
3. *Employee relations* and the position of trade unions vary across Europe. In the Netherlands, the trade union situation is not markedly different in new media from media generally. There are questions about trade union agendas.

New technologies and new forms of work organisation are taken by some as signalling the end of conventional contracts. If there are no collective agreements, why have trade unions? Traditional approaches have been updated, including

training in arriving at individual contracts, and occupational interests. Self-employment and freelance work is not new; is this becoming more prevalent, typical, not atypical? What does this imply for relations between employers and employees? What can we learn from experience in new media companies? Can we reach conclusions regarding skills, flexibility, autonomy: all elements of "good work"? The EU Information Society budget is largely technical and commercial: this is short-sighted, as institutional adaptations are required.

Åke Sandberg sees no contradiction between good work and solidaristic wage policies. There are close links between the wage system and the work system. This means a need for collective agreements, determined at a local level, where work organisation, competence and wages are linked. For blue collar unions this is a revolution. Academic Unions have been more individualistic, and have strengthened their collective side.

Stephen Ackroyd argued that some things have not changed. In the UK there have been trends to weaken trade unions. Strike activity and unemployment records for the present century show links between unemployment rates and strike rates. In 1974 the balance switched, and strike levels are at a 200-year low. This is partly disguised through part-time working, and insecurity for the low-skilled. Traditional industries, which employed the manual working class, have gone. Instead we see inward investment, and different demands on workers. Trade unions have found it hard to organise. He noted the absence of strong trade union traditions among skilled and professional workers.

Susan Christopherson reported that trade union density in the US is down to 10%, and over a third of the workforce are contingent workers. In response, the revitalised trade union movement is developing the concept of "good work", in industries where the infrastructure is absent. They seek to organise freelance workers, and re-think labour institutions to fit the emerging workforce, but do not want to undermine existing collective agreements. She noted the switching of roles between workers and managers, which raises issues of jobs and social relationships, differing between countries. Unions are concerned with the bottom end of the workforce, and use the bargaining power of skilled workers as a lever.

Lutz Michel asked whether the new media industry is, in general, highly skilled. The state of the art is highly skilled. 80% of those surveyed in 1996 had a background of higher education, and this remains the case. Only in design has the level fallen. Web-slaves could be a future development, as skill requirements fall. Differentiation is increasing. There are new IT professions for the programming side, meeting lower skills needs. Regarding trade unions, there is a similar pattern of convergence as we have seen among employers. Which unions are responsible for call centres? The trade unions overcame their previous competition, and were able to offer better service. Bifurcation is indeed a problem for the trade unions in the new media. What is the role of a union in a small company founded by friends? The answer is qualifications for the future.

Christer Marking asked about the academic background of German new media workers. Does this refer to a high entrance cost, rather than the skills needed? The low skill dimensions of call centres are being automated, while there are also some high skill requirements. He referred to relationships to work on the part of those with full-time or temporary contracts. In Sweden, employment relations are

changing, which may necessitate changes in social security arrangements. Actors are accustomed to this kind of relationship, and their trade union provides a platform for joint negotiations. **Lutz Michel** responded that specific skills are not needed, but the secondary skills of communication (key skills) are vital, enabling the worker to change topics and tasks, and to deal with senior customers. German call centres have a more stable workforce, pay well for training, and thus want to retain staff. The same is true in new media, with permanent positions.

Åke Sandberg reflected that trade unions are now integrating in Sweden, but it has been a long process. In the US, new associations are fulfilling this function. In Sweden there are new collective agreements in printing. There is a concern to avoid social dumping, and to maintain relations between individual, local and national levels. There are now issues being raised at the European level. 85% of employees are permanent in Swedish new media, as in industry as a whole. 60% have a higher education background (overall similar to Germany). He reflected on interviews with home decorators in the 1930s. Nothing was regulated in a small town; home decoration was a new activity. There were individuals and groups taking jobs, and problems of under-cutting. The employers decided to organise; a cartel was not allowed, but a trade union representative recommended a trade union as the solution, offering regulations. The group therefore organised as employers and employees. It took some time to gain acceptance, but they were able to force the self-employed to choose. A similar process may happen again in new media.

Work, Organisation and New Media

Stephen Ackroyd argued that the key is to understand the nature of the activities involved. The relations between activities and institutional structures are vital. We need to distinguish firms with different degrees of involvement, including those who structure demand without themselves being active. At the macro level it is important to see organisations as enacting their environments, leading to complex patterns of interaction. Change in the largest firms is driven by global ambitions. Outsourcing is changing labour market relations, and increasing dependence on subcontracting relations. This is affecting smaller specialised agencies, which are taking on fragments of the roles of larger organisations. This is not a one-way process. In Germany this has been seen as part of a cycle, in which the activities return in-house.

There is a temporary symbiosis between large and small firms. Rivalries at senior level in large firms are producing changes to their long-term disadvantage. The section is fundamentally fragile, funded in ways linked to structural change. Small IT firms are often unwilling to grow by normal means, fearing a loss of control to predators, and instead grow by replication. There are policy issues here, and in the UK a shortage of medium sized firms. How does this pattern of development stimulate occupational development? Comparative research is needed. In the UK there is a new class of entrepreneurs, in contrast to conventional professional middle-class skilled approaches.

At shop floor level, skill requirements are changing, new requirements for high levels of skill are changing, some tasks can be rapidly routinised for less skilled

workers to take on, and there is a need for new skills. This makes it hard to organise in a conventional trade union manner. If it can be organised, managers will take over, as they have done in call centres. In the UK there is little link between industry and the education system.

Brian Quinn cited case study work with Scottish Television, who removed collective bargaining in the 1980s, and brought in individual contracts. Trade unions found themselves negotiating each day on behalf of their "clients". Stress was a major issue, as was surveillance, linked to appraisal. Technicians faced imbalance of workloads, linked to their interpersonal skills. Trade unionists are optimistic about the future, with members returning, albeit for selfish reasons rather than out of solidarity. There have been debates over craft skills, as technology has become more reliable. Debates address the aesthetics of television production, though some workers just do what they are told. Tracing global trends requires study of individual organisations: some have adapted well, others have not. There can be benefits in slow change: one can learn lessons from those who have gone faster.

Robert Tchobanian described work in his research centre. The interest was in the use of IT in companies, affected by the sector. Computerisation is growing, but much is involved in networking, internet and information systems. The impact on organisation of work is more linked with the collective organisation of labour. The results are new tools for employees to work together, and changing work organisation. There are three levels:

1. Technology, where there is no direct determinism, but there can be important changes: new developments are implemented quickly and without considering the strategic context.
2. What is at stake in organisational terms? The manager hopes for major changes as a result of technology change, reducing layers and improving working relations; this tends to be less dramatic than expected. Does the manager want to improve co-ordination, or improve co-operation? These are not the same. Introducing IT can be similar to introducing QM, in terms of procedural changes.
3. The real use of IT is often less important than was envisaged. IT tends to be used as a tool, and not as a new way of life at work. It was assumed that IT could increase autonomy, but in practice there has been a utilitarian approach from employees. Both sides expect efficiency, but along different lines. Employees focus on the work itself, while employers seek overall cultural change. Implementation needs to be able to address both approaches. Some employees are more involved in and through the change, developing their own skills, and facilitate the work of others, as managers tend to underestimate the need for support.

News

Henrik Fagrell reported on interviews with journalists in Stockholm and Gothenburg, who report and present news. Journalists cannot know everything: there is collective knowledge. It is a matter of allocating resources, including time. The same event can be reported differently, tailored for different audiences, and it

helps to know what others are doing. What does this mean for IT? How do we support makers of the news? This means sharing knowledge, framing problems. Journalists take what they can use in a busy life, and make effective use of IT. A sharing system is being built, so they can see the news as it is about to be broadcast, and can intervene. Under pressure, the journalist seeks guidance. How important is the story in question? Systems are being built to support such a sharing culture. What is routine for journalists? What constitutes creativity? Paradoxically, journalists tend to have formal work roles, enabling the building of flexible teams.

Lena Skiöld is a former journalist on a daily paper. She appreciated the focus on improving the quality of content, as opposed to the frequent emphasis on standardisation. New technology for journalists tends to be introduced without training. She argued that the problem is less autonomy for the journalist, removing the choice of what is important, and reducing professionalism. **Richard Naylor** noted that journalists are a distinct profession, developing a news agenda, which varies by context and region. There is then a modus operandi for implementation, and the form of IT can change the content, changing news values. The BBC pass new ideas on through the organisation, through placements.

New Media in New York

Susan Christopherson described recent work on the new media industry in New York City, where half of the workforce are contingent workers. She gave a rapid summary presentation of a longer paper, highlighting the role of intermediary organisations. There had been little previous interest in the workforce, as earlier concerns had been for real estate. The focus is on the advertising industry, and the role of digital design and internet work. Income came from complex sources, not only wages, as well as intellectual property rights, speculation on the domain name market. They play complex and varying roles, as team member, team leader and entrepreneur. The average duration of employment is six months.

The survey that she described, with responses from experienced members of the industry, covered a workforce with 66% female, 64% full-time, members of organisations through which the survey was conducted, and supervising other workers. The hierarchies remain.

There are continuing gender differences (women in the sample have higher educational attainment and skills; men start and continue better paid). Skills are developed through self-instruction, with more unpaid hours spent training than in paid time. Women spent more time talking to colleagues and in classes. There are long working hours, and less stable employment; with experience, they rely less on the primary employer. Workers become entrepreneurs; personal networks are the key intermediary organisations

Turnover is rapid in the new media end of advertising. They do not prepare CVs, but a "reel", as in the motion pictures industry, motivated by hot projects. The companies concerned have no human resource policies. In Los Angeles the focus is entertainment, and in San Francisco business software.

Intermediary Organisations: Trade Unions and Others

Peter Leisink considered the role of intermediary organisations, emphasising services, rather than standards. Should there be a package of pay and overtime etc, or should the starting point be the needs of the workers as they see them? The majority of workers in advertising agencies in 1992 indicated a preference for individual contracts, but also wanted a collective organisation combining a trade union and a trade association, dealing with training, intellectual property and social security, together with parental leave, career breaks and part-time work. There may be a variety of appropriate collective organisations.

Åke Sandberg noted that only 20% of Swedish new media workers were covered by collective agreements, as opposed to 85% in other sectors. What will happen to these people over time? Development is beginning among trade unions.

Roman Hummel observed the diversity of traditions with respect to trade unions, between the US and Europe. Germany and Austria have institutionalised social partnership, within which collective agreements can be discussed. In Austria, collective agreements cover everybody, whether union members or not. Journalists are almost all unionised, whereas in advertising few are unionised. Expectations vary: some see new media work as transitory, while others seek careers.

Christer Marking spoke of work as a "homogeneous good", handled as such in collective agreements. In new media, the work is far from homogeneous, with no codification of long-term needs. Workers want security, a home, and the usual objectives. Trade unions reach out to new recruits, but there are rules to complicate life: the unemployed self-employed must close their companies in order to receive benefits.

Stephen Ackroyd noted that it is easy to be pessimistic about the situation in the UK. There are permanent pools of unemployed and unemployable people, an underclass. The implicit threat of unemployment forms part of a shift in the balance of power. One third are structurally disadvantaged, one third temporarily employed, and one third permanently employed. Trades unions are currently stronger in countries where there are wider employment opportunities on offer. Generalisations are difficult.

Work and Organisation

Ove Ivarsen works with LO, with an IT steering committee, with representatives of 8 major unions. They address three areas:

1. Work, Work Organisation, Skills, Further Education: Is IT a Support?

LO is largely concerned with blue collar workers, who often meet new technology defensively. They are rarely masters of the technology, but receive orders from the computer. This affects reactions to new technology, and may induce fear. Typically systems do not support good work and good practice in work organisation. SAP R3 is very hierarchical and standardised, hard to adapt to different company

needs. Systems are expensive, depend on the extended use of consultants, and represent an obstacle to group work, leading to problems in the development of more human-oriented systems. LO members tend to have poor educational qualifications, with a limited background in IT. Their skills need to be upgraded, so that they can work with new technology.

2. Internal Union Development: How can Unions be More Efficient?

There is a difference between "boxing" and "dancing" in industrial relations, with codetermination encouraging local choreography and regular talking. LO have tried to dance with boxing gloves on. One problem is the lack of knowledge: the normal approach is to phone the union head office for advice. Horizontal networking, and the use of new technology, weaken the link with head office, and reduce central power. The political power situation is likely to change, with more local self-reliance, requiring a new response from the centre.

Democracy

Since 1994 there have been annual surveys: the same differences between groups, on class lines, apply in new technologies as in traditional industries. Computer access is linked to wealth. In 1997 LO decided to give members the opportunity for cheap computer rental, and the market of 2 million members was attractive to computer companies. Hewlett Packard and then Compaq won the contract, leading to 53,000 LO families renting LO computers. The alternative would have been a bank loan or a lottery win. The Swedish Parliament passed a law allowing employers to help employees obtain computers, tax-free. Thus 500,000 LO members have computers, are linked to the Internet, and have had access to training.

Robert Tchobanian referred to problems in the French trade unions, which are parallel with the Swedish situation, but very different, as union membership is 8–10%. They are too weak to "box", and there are problems with "dancing". There is the problem of central and local relations, and a set of past laws and agreements, but few current practical results. Recent work on information society has omitted the trade union perspective. He described the changing situation in terms of computer use at work in France. The higher the hierarchical position, the more computer use. Often the computer is little different to other tools: it can be prescriptive. There is variety within organisations, and no real context where IT is discussed in the company.

Lutz Michel emphasised qualification requirements and profiles, outlining the multimedia labour market, different in each country. In Germany there are 1200–1500 companies, with an average of 13 employees and eight freelancers. Companies predicted continued expansion, with a declining percentage of freelancers, as they seek to retain key knowledge. The core were multimedia producers, with a first periphery of producers and users, and a second periphery of users, covering the full range of economic sectors. The perspective was educational, rather than organisational. There is an absence of tailored learning provision on the market. The picture regarding multimedia professions is complex. Specialists are sought from many sectors, with the media only comprising 6%, and the share of multimedia agencies will fall. Conceptualisers,

screen designers, project managers and programmers are the key qualification sets, covering 90% of specialist personnel, and each with 75–80% from a background in higher education.

He set a model of core professions, including freelancers with double competences, such as online editor, systems technician and video editor.

Work

Ursula Maier-Rabler has run a new media agency and managed a number of web applications. The new media see their content as connections, processes and services, using traditional content from old media. A web project is never finished. Businesses develop between groups of users and producers. Advertising agencies tend to buy new media companies, while many new media companies like to work directly with customers, cutting out the advertising and communications agencies.

Skills and Competences

Sören Lindh argued that intelligent services require new production coalitions, linking the technology back to the content, requiring more widespread skills for those commissioning and using knowledge-based systems, and more interactive learning.

Peter Leisink noted that the majority of those working in core multimedia companies have academic degrees. University training is important, the capacity to explore and take different perspectives. There has been a lack of intervention by the state in the curriculum, and there is a case for new structures building on existing provision. **Åke Sandberg** reported on qualifications of those in the Swedish survey: 60% had higher education, including non-specialists. 50% had some kind of computer science training, and 13% in advertising and marketing, 7–8% in business and management, 7–8% multimedia, 5% graphics. This reflects the links between new media and IT and management consulting. The picture is different in different countries.

Lutz Michel emphasised cooperation with universities, rather than setting up new courses. Companies are not interested in retrained staff, yet that is where the state is investing. How can we help those who are unemployed, or under threat? **Sören Lindh** argued for moving aspects of spare time learning into working life, such as art courses, developing "hobby skills". There have been studies of interactions between course designers and users, and the need to embed skills has emerged as vital.

Christer Marking saw skills as the reflexive pattern of established stable work practices. Skills can become obsolete, without people being obsolete. Training is being replaced by interactive learning. We need to transfer experience of older practices into high quality practices tomorrow. **Brian Quinn** argued that training is almost non-existent in British broadcasting. Grand political projects will not take us very far. British unions know what they can and cannot do, and are now going along with management. Customers do not want trainees working on their

projects. **Nelson Pretto** sees the word training as misleading. A better concept is "formation", involving knowledge. The network is a new mechanism for the production of knowledge. Students should not leave schools and universities, but continue in contact via networks.

Policy

Christer Marking argued for work on pedagogy at the workplace, and the design of work processes to deliver products and raised competences. Unions should insist on training being in place, for example, in broadcasting, seen as lifelong learning. He spoke of training in the method needed to produce results. In multimedia the goal, method and results are not clear, and the training is different.

Ove Ivarsen noted that greater union strength in the new media industry would help in the case for improving training. Unions are strong in printing, and negotiated national agreements on training. **Åke Sandberg** reflected on the Swedish model, the impact of high unemployment and the loosening of international regulations. Those working for competence development and good work have a harder job now than ten years ago.

Wilfred Dolfsma discussed the current creative approach in new media, and a move to a more mechanised future, encouraged by governments. He drew the parallel with creative and performing artists, skilled but poorly paid, who survive by maintaining other sources of income. Government should ensure that there is a diversified labour market, so that this remains possible. **Christer Marking** found the parallel fascinating, linking with the cultural side of cities. Diversity, in cultural life, labour market and available knowledge, is a prerequisite. Is such a centre needed to stimulate regional development?

Workshop Participants

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Fredrik Augustsson, NIWL, Sweden
Barbro Berg, RITTS, Stockholm, Sweden
Martha Blomqvist, Centre for Feminist Research, NIWL, Sweden
Ann-Katrin Bäcklund, Copenhagen University, Denmark
Susan Christopherson, Cornell University, USA
James Cornford, University of Newcastle, UK
Wilfred Dolfsma, University of Bonn, Germany
Richard Ennals, Kingston University, UK
Henrik Fagrell, Viktoria Institute, Gothenburg, Sweden
Gerhard Fuchs, TA-Akademie, Stuttgart, Germany
Ewa Gunnarsson, Stockholm University, Sweden
Roman Hummell, Vienna University, Austria
Ove Ivarsen, LO Stockholm, Sweden
Peter Leisink, Utrecht University, Netherlands
Sören Lindh, Swedish Agency for Administrative Development
Anne Lintala, City of Stockholm, Sweden
Sanja Magdalenic, NIWL, Sweden

Christer Marking, IT Commission, Stockholm, Sweden
Ursula Maier-Rabler, University of Salzburg, Austria
Paul Mayer, Copenhagen University, Denmark
Lutz Michel, MMB, Essen, Germany
Richard Naylor, University of Newcastle, UK
Mads Odgaard, Roskilde University, Denmark
Carsten von Otter, NIWL, Sweden
Nelson Pretto, Federal University of Bahia, Brazil
Hasse Samuelsson, Consultant, Stockholm, Sweden
Åke Sandberg, NIWL, Sweden
Lena Skiöld, NIWL, Sweden
Robert Tchobanian, CNRS, Aix en Provence, France

Reflections on the Workshop

The workshop reflected the subject matter: it was primarily process-oriented. The dialogue was rich and authoritative, with detailed case study insights from different EU member states, the United States and Brazil. Informality facilitated participant input, due to the experience of the organisers, and their calm amid creative improvisation.

There was a strong input from trade union participants, and the powerful contrast between the strategies of "boxing" and "dancing" had resonance in each country. Governments are desperate to make progress, as new media industries are seen as sources of employment and economic regeneration; the information society provides a new foundation for economic activity. There is no such thing as the *new media industry: in each country new media industrial activities take different organisational forms, dependent on university educated workers, capable of independent learning with new technology in a rapidly changing environment. These workers need support services which could be provided by remodelled trade unions and professional associations. New media should be building on the intellectual foundations of university knowledge, which may imply curricular and organisational change in universities; unions could be partners in delivery, as part of their new set of services to members. It can be vital for new media industries for unions to organise, where employers often find it impossible. This is a new partnership role. Training was viewed critically, while "formation" was presented favourably, in the context of networks as environments for the formation of knowledge. Training in isolation may achieve little; employers are not seeking to recruit re-trained staff, and in many countries new media companies lack a culture of training.*

5. Telework – Labour Market, Health and Well-being

The workshop was led by Timo Kauppinen and Lars Grönkvist, and held at the European Foundation for the Improvement of Living and Working Conditions, in Dublin, 22–24 November 1999.

Introduction: A Nordic Report on Flexibility

Timo Kauppinen considered life in the European Foundation, founded in 1975, and outlined the structure. There are six current challenges being addressed, as means of providing coherence to the work of the Foundation. A new plan for 2001–2004 is in preparation. Telework has been a recurrent theme.

The Nordic perspective on flexibility concentrates on internal flexibility, with continuous learning and responsibility as core themes. Front runners are more productive and innovative, with learning organisations using new technology, built in structures to promote continuous change, less absenteeism, and teams. This enabled continuous skill development. Current flexible patterns contrast with those of traditional industrial society. The recent survey on paid employment and self-employment showed 13% self employed, with telework relevant. Proportions vary between countries, with self-employment levels low in Scandinavia and France. There is willingness for more work to be done at home. Why is this happening?

Managing Change: The High Level Group Report on the Economic and Social Implications of Industrial Change

Carlos Perez reported on managing change, with an emphasis ways of anticipating change. The report derived from the Luxembourg Job Summit in 1997. What should be done to promote employment, ensure effective labour markets and prepare for change?

Industrial change must be seen as an opportunity. Social dialogue needs to be fostered. An observatory was needed for industrial change, linking existing structures and collecting information. A managing change report should be required from companies employing over 1000 staff. Preparing for the economy of tomorrow requires infrastructure for new technologies, and lifelong learning, developing and maintaining employability. New areas of employment include primary personal services, and creative arts and entertainment, raising issues of flexibility and tax régimes. The role of SMEs was emphasised. Start-up companies face problems after a few years, such as the loss of key staff. Internet connections remain expensive. The role of the social partners is vital.

The report took a practical approach to crisis management, going beyond downsizing and social exclusion. Co-ordination is required, involving local authorities and social partners, modernisation programmes, mobilisation strategies and partnership, pushing for local rather than national decisions.

Poorly performing companies should not receive support. Preparing for change means involving workers in maintaining employability. SMEs were encouraged through outsourcing. Member states were urged to encourage social dialogue. Barriers to access to technology should be removed. The creative arts should be encouraged. Employability should be a focus of policy on training and employment, helped with tax changes. Learning and assessment centres are needed, with European level recognition. Regional development is to be supported, with new roles for local authorities, seeking greater coherence in addressing social problems.

Marie Louise Thorsén-Lind saw the report as opening the door to telework, a matter of management decisions. Telework is a means of creating jobs for oneself and others. We have to learn to live with the unknown. Change management is important, in the context of technological innovation and creative uses of existing technologies. Change management requires insights, accepting change, securing new information, learning, experimenting, and securing co-operation.

The information industries are all about improving information goods and services, creating more jobs and good working conditions. In turbulent conditions, companies can die fast. Labour market regulation must take account of the real social functions of companies. Social dialogue is not an automatic answer, and should focus on where it can add value. The managing change report is of doubtful value. Employability is fine, but employability for what? How can employers, largely in SMEs, foresee the future and make provision? Why should the employer be held responsible for duties they cannot deliver? Punishing employers could have catastrophic results.

Willy Buschak took up issues of managing change and the organisation of work. There had been similar debates over lean production, and trade unions are taking a pragmatic approach. Telework is a matter of improving the organisation of work, not just cutting costs. Companies should be places for exchanges and creativity. Training is important, but there is a gap between rhetoric and reality. In call centres we see deficiencies in work organisation and in training, a matter for employees and managers. New forms of work are of value only if introduced through involving workers in negotiations, directly or through representatives. Teleworking offers flexible ways of handling working time and family life, but in call centres we see the inflexible framework of regulations applied to workers. Dialogue is essential, enabling employees to develop autonomy. Modernisation is often discussed, we see the reinvention of Taylorism in its most stupid form; it should support job rotation and social dialogue. How can dialogue be organised for teleworkers, located remotely? How can confidentiality be maintained? Decision making processes should enable workers to return to more conventional modes of working. This is a matter for the social dialogue. ETUC have asked UNICE to discuss a framework for telework, seeing the new technology as a means of enhancing innovation.

Carlos Perez responded that the Vienna Council considered job opportunities in the information society. There was focus on schools, information society, employment initiatives and future trends. There has been support from unions and the European Parliament for the establishment of the observatory. UNICE has been less supportive of the observatory and the report in general. The report

supports a proactive approach, and the response has been constructive. Telework pilot activities are ongoing.

From a Latvian government perspective, argued **Ieva Jaunzeme**, government has responsibilities in situations where SMEs do not understand new technologies. **Carlos Perez** argued that SMEs are to be encouraged because of the good practice that can result, rather than simply to add to statistics of company formation. **Josef Hochgerner** considered the quality of SMEs as linked to their length of life. Often the creation of SMEs is seen as an answer to unemployment, with short training preceding independent business activity of short duration.

Andrzej Maciejczyk was responsible for SMEs in the transitional economy of Poland. In each country, most companies are SMEs. There are good and bad companies and laws. Training is not just a solution to unemployment. Companies formed by those lacking entrepreneurial skills tend not to survive. The average life of an SME is 3–4 years, due to the initial energy of the founders, but if new ideas are not introduced, the company ends. This is not bad news, as new companies form and provide employment.

Patrizio Di Nicola discussed call centres, now revealed as less beautiful than first thought: black holes in the information society, not improving working life. He described call centres that use self-employed staff, renting premises, and using 1000 workers but only 15 employees. When pressed, owners of call centres threaten to relocate to more favourable settings. **Andrew Bibby** reported that the UK main telecommunications union has called a strike at British Telecom call centres. The complaint is of oppressive working conditions, over-high sales targets, and use of agency staff.

Eberhard Köhler described the swing over change and telework. Change is rarely planned, but constantly happens. Technology is used by humans, who make the decisions. Charles Handy argued that this century had been the century of the employee: now workers are being thrown into a new uncertainty. We are not prepared for this, having been accustomed to being told what to do. New skills in responsibility and decision-making are needed. How can we define new rules for the soft situations faced by teleworkers and other knowledge workers?

Willy Buschak considered the role of trade unions with ICT. Telework suits many people, but they need maximum autonomy. Unions are negotiating framework agreements to maximise benefits, and have brought together groups from across Europe to review good practice in teleworking, which tends to be a reorganisation of existing work in companies, and should be linked to principles of voluntariness. Call centres are often the first employment opportunity for many people, in need of training and further development. There should be good training and good work organisation, offering variety, and enabling workers to organise themselves.

Marie Louise Thorsén Lind observed that some call centre staff enjoy their jobs. The tradition this century has been for workers to be dependent in some way. We can see a more autonomous future. People like change, but not being changed by others.

Telework in a European Perspective

Jeremy Millard introduced an overview of European telework, from the ECAT project. Finland has the largest number of teleworkers, 17%, followed by Sweden, Netherlands, Denmark. Different kinds of work were considered. Many workers engage in two or more types of telework, linked with moves to flexibility. There is more teleworking in Northern than Southern Europe, and differences as we move East. Teleworkers work from home, are largely male, and have above average educational backgrounds, holding positions of professional responsibility. It is more widespread in large establishments, less in SMEs. Teleworkers work longer hours. Those with lower qualifications may find themselves under pressure to work in conditions not of their choosing.

Who you work with is more important than where you work. People, not places, define organisations. Teams are set up between companies and within or across branches of large organisations; personal relationships are more important. We play different roles, enabled by technology, requiring new levels of trust between social partners and between individuals in the workplace. Teleworkers have emphasised the social aspect of working in teams, and less with the physical workplace and hierarchies. Telework is a response to changing needs, and can facilitate strengthened relationships. The key factors seem to be small team relationships, rather than corporate cultures. Teleworking need not lead to isolation, but can help build trust.

There are now 25 million workers in the USA who consider themselves free agents, with more than one employer. There may be a preference for "hard fun", combining work and hobby. Another idea is the fast company, set up quickly and liquidated after a short period, once the job has been done. The impact on individuals needs to be considered. In the past, organisational form often determined the task we performed. Hierarchies were based on qualifications and precedent. Today the tasks to be undertaken are so varied and complex that diverse new forms of work organisation are required. Workplaces are being transformed. There are diverse trends at once: personalisation and depersonalisation of space. Committed workers may want a bed in the office, or office facilities in the home. Hot-desking, or the use of a laptop computer, is a growing trend, with adverse effects such as increased noise levels. Some companies cut costs while introducing open plan offices, but increase choice by allowing staff to work at home: one goes to the office to be disturbed. Office design is changing, increasing creativity in interactions. New design involves new technology, flexible within and away from the office.

There are opportunities for people with special needs, including the disabled and unemployed. There are threats and challenges, including stress and long working hours, particularly in the USA and UK. He cited the Rowntree Foundation report "Whose Flexibility?" and attempts to discuss stress with those too busy to stop. It is a matter of confidence in oneself and trust in others.

Irish Experience of Telework

Richard Wynne drew on ECAT and other recent studies. He was concerned with home based working, mobile working and centre-based working, based on the use of telematics. In Ireland the background is high economic growth, and emerging labour shortages, with major infrastructure bottlenecks in transport, housing, roads and telecommunications. More women are in the workforce, and concentrations of population and economic activity are on the east coast. Service industries are growing. There has been industrial development policy emphasising high technology, linked to an information society policy and a national forum on telework developments. Ireland starts from a low base, but plans to increase IT rapidly. The level of teleworking was the lowest in Europe. Many people are interested, and welcome opportunities, but it is still a recent phenomenon, and few schemes have been in place for more than 5 years.

Transport and commuting bottlenecks are significant, as is technological infrastructure and cheap telecommunications. Knowledge and information based industries are growing, with supportive government policies, and scope for labour market flexibility, benefiting employers and workers. Teleworking has been encouraged by high costs of office accommodation, the drive for competitiveness, employee demands for atypical employment, and market push. Industrial history and demography have been important: there was no major heavy manufacturing to remove, and a young workforce, fitting the needs of a new e-commerce approach. Ireland is catching up, and teleworking is accelerating, influenced by supportive public policy.

Telework Practice in Large Business Organisations

Nicole Turbe-Suetens has studied the situation in the USA and France, finding major similarities. In 1993 a government study considered telework, resulting in legal definitions. The work is executed at a distance from the person ordering it, out of the control of the person ordering it, and communicated via technology. In a large corporation it involves a scheme with a pilot period and extended negotiation, taking longer if social partners are not involved from the start. Management needs to be convinced. Re-engineering is normally involved in the process. A solid good quality intranet is needed, with sound education and training, and effective communication.

There are a number of approaches, including nomadic telework, telecommuting, and co-operative work using groupware. Work in tele-offices, neighbourhood offices or telecentres, has diverse social implications. Others work at home and in the office, or just at home, not favoured by unions. IBM started the process for economic reasons, and is now a virtual company worldwide. France-Telecom have been developing a packaged programme for two years. The approach is accepted as a means of retaining skilled staff, despite geographical distance, and is part of the recruitment package for key staff. Competitive advantage is derived from a reactive organisation, saving time and money, enabling reorganisation of offices. Productivity increases by at least 15%. Change takes time: people like to do it in their own way. Pilots are essential, and take at least six months. Clear objectives

and performance indicators are needed. Technical problems tend to be underestimated. Social partners should be involved from the start.

Josef Hochgerner remarked that work is a socio-technical system. The discussion has been of technological change, but it is a matter of changing social networks. Satellite offices and telecentres were contrasted. The latter is a social laboratory situation, and is not entirely new. Unions need people together in order to organise. What is new is the network that links them, offers new solutions, and enables new forms of co-operation. Can we reduce work, but not reduce jobs?

Transborder Telework: Towards the Formulation of an International Research Agenda

David Birchall presented the conclusions of the January 1999 conference on transborder teleworking. He is a global teleworker, and at present is working electronically with students in the USA, Singapore and South Africa. The conference had included representatives from four countries, Hungary, Slovenia, Czech Republic and Poland, all at the workshop. The lack of a universal definition makes quantification difficult. There was little teleworking, and in transitional economies there have been issues of costs, reliability of telecommunications, and management culture. Management by observation was more prevalent than management by results. Alternative workplaces are seen as inadequate. There is a lack of skills and social protection, opening up risks of exploitation. There was a lack of policy at national and local level. Why would a company want transborder teleworking? Companies in the UK are struggling with teleworking within the country, as investment costs are considerable. Cost reduction benefits need to be great. There is an absence of teleworking supply organisations. Teleworking may offer a way out for an individual, with a later move to the employing organisation. From a government perspective, there are issues of regulation and training, but the priority is low. He cited Indian government support for similar initiatives, and the lessons this offered for clusters. Trade unions are concerned with employee rights.

The research agenda includes information gathering on current activities, the nature of work undertaken, and forms of teleworking. Reliable data is hard to obtain; monitoring needs to be systematic, linked to policy perspectives. There needs to be an understanding of business perspectives, with benchmarks for best practice. Consideration of the regulatory framework means information gathering on government policy, assisting business decisions in a complex context, as well as organisations for employees and self-employed. Transborder teleworking has different effects on ordinary people.

There is a gap between the opportunity and understanding by business. In e-business, there is scope for shared services. Shell Europe and Elizabeth Arden have centralised back office services, where cost cutting is required. In the case of Human Resources, this would include call centre functions, but considerable investment is needed. There is a gap between traditional values and the new style approach where everyone is an entrepreneur. In California, only 25% are in traditional employment. The future of work may involve major change, impacting

on quality of working life. Longer working weeks and different shift patterns involve transborder teleworkers in changes in the quality of working life. The real drivers will be from business.

Short Presentations on Telework in the Central and Eastern European Countries: National Reports

David Birchall reported from the group dealing with Hungary, Latvia and Slovakia. How does a country become entrepreneurial, enabling them to do transborder business? What can be changed? There need to be international comparisons, for example learning from Ireland. Countries need to understand the skills that they have to sell. Best practice should be shared, using partnerships. Legal and financial minefields face business in this changing environment, especially in smaller countries. He considered issues of social health and well-being.

Bengt Knave reported from the second group. In Greece the greatest problem is bandwidth, but there is dramatic progress, assisted by deregulation. In Germany there has been rapid development over five years, and there are weaknesses in social insurance for the self-employed and quasi self-employed. In England the term "teleworking" is now passé. In Sweden there is concern for unemployment, in Portugal self-employment, and in Romania telework centres. In Norway there is concern for national regulations, on working hours and working environment. Loose regulations could make a country attractive to overseas employers of teleworkers. There are questions of limiting working hours, and of overall harmonisation of regulations, an area for national competitive advantage. Common technical standards may be preconditions rather than areas for improvement. There was discussion of variations of competences, and of transborder links outside Europe, such as with the USA and Asia. What are the long-term implications? Is this a form of brain drain? What about employment and unemployment?

Josef Hochgerner reported from the third group, which took a strict approach to considering the EU and Central and Eastern Europe. The focus was on the Czech Republic and Slovenia, looking at definitions and forms of work. The Czech Republic works with EU definitions and recent data, and there are feelings of insecurity. All forms of teleworking are available, with more informal than formal. Many workers are forced into their current roles. In Slovenia the definitions are open, allowing self-rating. 30% of workers are teleworkers, with 15% using ICT from home. Tele-cooperation is increasingly important, but not necessarily transborder. It depends on wage differences, legal frameworks and sectors of cooperation. Figures derived from national reports, and many are weak. The absence of definitions impedes measurement and thus management. We are too reliant on anecdotes. A priority is the provision of reliable data from comparable studies. Basic assumptions need to be clarified, regarding modes of employment and the nature of international links. It is worth selecting interesting sectors.

Roger Blanpain described the work of the fourth group, with Swedish, French, Polish, Hungarian and Romanian membership. Central and Eastern Europe have moved to a market economy, changing styles of management and government, encountering infrastructure and skills problems. Progress has been rapid, with

computers and modern ways of working. In Poland employees are covered by law, and the self-employed are registered. In Romania, young people are active in this area, on call and flexible. In Hungary, the situation was unclear. The key discussion was on self-employment. What about the free movement of workers once new members join the EU, and the movement of work via telework? There may need to be a legal framework for virtual organisations based on telework. Creativity requires teamwork; teams need to meet.

Josef Hochgerner considered networking. The roles of the social partners are no longer clear, and roles of people switch more rapidly. New systems are needed, affecting national legal systems. New forms of work do not always involve employment, but instead cooperation. We could envisage international harmonised labour law.

Telework – A Longitudinal Study on Work Environment and Well-being

Carl Åborg is an occupational health psychologist, and described a study on part-time teleworking and health effects, focusing on physical and psychosocial work environment issues, before and after the introduction of teleworking. Physical issues included lighting, psychosocial and legal aspects. There were four groups: two from a local authority, one government, and one a major telecommunications company. The study faced problems with the closure of the government department and changes in company organisation. The local authority groups were largely project leaders in professional areas. Questionnaires were used with teleworkers and other staff. Diaries were kept, noting details of tasks. Interviews considered work content, load, and hours. The results showed increased efficiency, increased workloads, longer working hours, increased individual control, and elements of "technostress", induced by equipment problems. Although there seemed to be progress, workers were worried about future problems. Teleworking hours reduced over the study period. Co-workers reported that teleworkers were positive, but with less contact than before, meaning they needed more support. Teleworkers had less health complaints than their co-workers. It was hard to get technical support at home. Teleworkers like to be available, adding to their strain. Physical ergonomy at home is less satisfactory than in the home. Working hours tend to be longer at home. The technical computer and communication system needs to be better when working from home. Working hours tend to be longer. Social contacts are a worry, if not a problem.

Swedish Experience – Applied Telework over 30 Years

Walter Paavonen started the work in 1979 in the pharmaceutical industry, with new organisation of work. There was experimental telework in Södertälje in 1982, as part of a new town development. He worked with his wife in the same work centre, but for different employers. The project was funded for 2 years, but continued for a third year. Since then he has worked from home, with a double housing arrangement of summer houses. The telecottage was a continuation of the neighbourhood work centre. The telecottage association ended recently. He

described the Folksam call centre, based on the Stockholm archipelago, with a small well-motivated staff. It was important that the responsible minister was a teleworker. He dealt with mobile teleworking, such as with hotels and trains, where time could be made productive, reducing pressure for speed. The Braintrain project offered seminar facilities on the train. In 1998 the National Energy Administration relocated to Eskilstuna, and that teleworking should be adopted. Now 120/166 workers telework. It was possible to employ people in remote places, save considerable time, and use efficiencies of working at home. New ways of working can facilitate family life, but require more planning. Management styles are changing. A good telework environment is about more than ergonomics, and varies between individuals. It gains from a holistic outlook.

The Overview of the Finnish ESF – Telework Project

Tiina Hanhike works in Helsinki in the Ministry of Labour, while her employer is the University of Tampere. She looked at the range of current telework projects from a practical perspective, with a focus on the development of the organisation of work. Telework is important in inter-organisational development and regional development. There were a total of 40 projects, 13 R&D, of which eight were based on current organisations. 22 were training projects, developing teleworkers, and producing a few new jobs, largely short-term. There were also four projects which were aimed to develop learning environments and distance learning. The line between learning environment and working environment is a fine one. Most of the organisations were in education, rather than the private sector. Ideas included bringing work from outside the region, outsourcing work, developing a network economy, supporting entrepreneurs, seeking additional income, supporting enterprises and building infrastructure.

When considering regional projects, the content concerned finding work, new forms of labour exchange, and encounters of micro enterprises with customers. In projects directed to existing enterprises, it was about changing ways of action in existing companies, using telework. The changes are linked to change in conventional employment, new forms of work and earning a livelihood, and networking activity, in particular entrepreneurship where physical location is less important. Teleworking is not work in itself, but a way of organising work. The unemployed do not necessarily become teleworkers. There are also the two dimensions of internal development and regional development. The project work was regional, with no inter-regional dynamics in Finland. The project realm and business realm were different. It is hard to promote both employment and telework. Employment goals are met through developing company activities, rather than having unemployed job-seekers running start-up ventures. The work concerns ICT, and interactions between workers. This means searching for new employment opportunities, often using ICT.

Telework – New Paradigm in Work Organisation

Patrizio Di Nicola emphasised the initial motivation from traffic problems, and practical progress in recent years. In 1994 there were 97,000 teleworkers in Italy,

with 350,000 Internet users, and low information society awareness. By 1999 there were 720,000 teleworkers, and over 3 m Internet users, with free Internet services to 5000 cities and villages. Telecentres have developed, and awareness is high. The largest increase is in home-based teleworkers. A regulative framework is being introduced, concerning disability, and there is support for PCs and telephone lines for employees, schools and prisons. Laws cover telework for civil servants, and a national work agreement.

He then considered pilot cases. Telecom Italia, with 1000 mobile teleworkers. This is covered by a new work agreement, and has led to higher productivity, lower absenteeism greater satisfaction and reduced commuting. Network technicians are now teleworkers, involving a change in attitudes to work. Digital have technicians in telework centres. The Municipalities of Naples, and Perugia have won awards for experiments with staff. Communication is by intranet, rather than paper. The cancer research centre in Genoa is exploring telework. Telecottages link networks of SMEs, with 13 such centres in Emilia-Romagna. There are further examples in Alto Adige, including network "taxi" approaches to software development. Logos in Modena runs a team of 2000 translators around the world. Creative approaches to the e-economy have provided free Internet access. There are convergent issues, of delocalisation of services, reduction of costs, tackling social exclusion, offering new job opportunities, increasing work for women, new work organisation, new motivation. New paradigms are emerging. The firm was a castle, now a web. The employee was a slave, now a resource. Synchronisation of time has changed to the de-synchronisation of society. Government was on site, and is now on line. Intermittent democracy can become continuous democracy. From reduced participation, we reach enlarged participation. From formal structures we move to informal networks. Telework changes work and society.

Austrian Experience – from Teleworking to Networking

Josef Hochgerner considered telecentres and telework development in Austria. Why telecentres? The starting point is dissemination to rural areas, with new advanced potential for partnership. The debate is polarised: high expectations but limited commercial success. He considered telecottages and telecentres, combining different facilities. Technology centres and parks are something else, on a larger scale. We can consider virtual technology networks. There seem to be some 500 telecentres worldwide, but they are small and weak. British research, with 70 replies from 130 centres, suggested an average of 1.5 employees, and 40 customers. Profits rarely arise, and many fail to achieve break-even. Telecentres have developed in Austria in recent years, but still employing at most 100 staff. More generally, telework in Austria, as shown through the micro census in 1997, has reached some 50% of the sample. It is hard to translate the categories, but there is a spread of occupations. The emphasis was on home working, for at least a day per week equivalent. This gave a small total. If the criteria were relaxed to an hour per week, the numbers reach 0.9%. It is known that 80% of teleworkers are home-based, so a further 20% was added to account for other modes of working, and the European rate of expansion was followed, then 1–2.4% of the work force might be seen as involved. The figures are low, but can be counted.

Teleworkers prefer to work at home. Outsourcing is still on a small scale. Competitive advantage comes through qualifications and education. A critical competence gap remains for the unemployed. Telecentres have a poor image, lack a clear commercial focus, offer too many services, and missing links remain. There are alternatives: drop the idea; explore possibilities for adaptation, using one big contractor or a functional mix; or it is just a matter of time, and the new paradigm will emerge, with critical mass, and appropriate collaboration. He outlined three possibilities: commercial telecentres, non-profit telecentres, and new organisational entities, representing partnership, involving networkers. Teleworking drops out of separate consideration. The topic becomes social networking, reducing workloads, not jobs.

The Impact of Telework on Employment: Regional Development and Gender

Ieva Jaunzeme sees telework is seen as a form of work organisation. There are challenges, when we consider European Employment Strategies, and in particular the third and fourth pillars, concerning adaptability and equal opportunities. National action plans should use teleworking as a tool for effective adaptation. The concentration was on gap reduction, and in particular regional development. Telework can decrease or increase regional unemployment. It could increase female participation, but many women seek an escape from the home, not means of staying at home. The skills package for a successful teleworker needs to be identified. Telework can mean job displacement. IT development could facilitate gap reduction, but not necessarily. Attention needs to be given to content of the services provided, and the audience.

Telework, Safety and Health

Marie-Louise Thorsén-Lind summarised the discussion, involving Swedish, French and Hungarian experience. No specific diseases have been linked to telework, and benefits could be identified. Employers' risk assessments are important, and often neglected. The legal status of teleworkers varies greatly. In some cases it can mean involuntary self-employment, as in France and Hungary, but not in Sweden.

Telework and Organisational Change

Imogen Bertin reported that the group was concerned with constant organisational change. E-commerce poses threats to many companies, who have to get closer to customers and overcome information barriers to achieve competitiveness. Quality of life is important. Success depends on planning, and information systems, including support help desks for teleworkers. Good champions and communication are needed. This presents problems for SMEs, who are less informed and more informal. Within SMEs, micro enterprises are very different from companies with 10 employees. Legal systems can present barriers to

experimentation. Relationships with e-business tend to be led by the need to cut costs and develop agile bureaucracy. Call centres and distributed call centre work present problems.

Best Practices

Nicole Turbe-Sueten presented a submission for the Malmö conference concerning best practice. A focus has been defined, telework implemented in corporations with salaried people. This sets aside the self-employed, and regards call centre staff as ordinary employees. Best practices could be geographically segmented to take account of culture. There is a Nordic group, a Central and Eastern Europe group, Southern Europe and the rest, the middle. There is already data available for use in Malmö. With additional resources, more could be done. The net economy with network workers, knowledge workers, engaged in the skill story. There is a need for an account of the evolution of the knowledge worker in the net economy. There will be regional differences, and benchmarking expertise should be used to build a best practice database.

Telework and the World of Work in the 21st Century: Rights and Obligations of Teleworkers

Roger Blanpain brought with him a proposal for a European initiative in telework. Everything is in motion, including telework and industrial relations. There is a wider context of change, in the global economy and the network society. There are numerous books, such as by Peter Capelli on the new deal, the market-driven labour market. Workers are increasingly inclined to look for new employers, using online job hunting. Creative workers are the most mobile. In the individualised corporation, added value comes from individual collaboration. The 24 hour economy is driven by the consumer. The move is from industrial to network society, from assembly line to individualisation. We have moved from necessary to what he termed futile goods.

New technologies determine when and where we work, and the nature of the work we do. When studying impacts, we start from sectors, and superficially move upwards: we see the emergence of one sector, the third sector, in tertiarisation. Taking the examples of a kilo of butter, and of a car, he identified the different sectoral inputs to the final product. We see a shift in the source of added economic value, increasingly to knowledge. This raises issues regarding copyright, where digital copies are seen as critical. There are vast archives of information available digitally. What is emerging is an invisible economy. The roles of the state, social partners and the European Union become less effective. We see an increase in externalisation and outsourcing, with shared service centres.

Traditional companies are exploding. In the past Ford had its own mines and garages, but the future is in terms of networks. Tasks at all levels are being externalised, and companies co-ordinate the activities of others, through sub-contract arrangements. Industry and services go together. Power is with

outsourcing, and the economy becomes a chain. We work for clients, not enterprises. This is a continuously expanding network society, where the worker himself becomes outsources, Employment relations are being transformed, based on teams and translateral relations, based on projects. The distinction between employee and self-employed is becoming arbitrary, and social skills are gaining in importance. Hierarchies are on the way out.

There is an impact on the types of jobs. Robert Reich's book "The Work of Nations" set the scene. Repetitive jobs are in decline, or being exported. Personalised jobs are increasing, but with limited income. Creative jobs add value, and are proactive, creating interaction in networks. There are problem finders and problem solvers. Creativity is an issue for all. There is a battle of the brains, attracting foreign students. Skilled workers are surfing the net, looking for new opportunities. In the past there was a pyramid structure, then a flat organisation, and now networked society, where the knowledge worker owns the means of production. This causes chaos for human resource management and training, and raises new questions of responsibility and loyalty. Lifetime employment has moved to follow an Elizabeth Taylor-style approach to marriage. Labour relations is becoming decentralised, automised, and based on deals. Employee relations systems are giving way to globalisation and the power of employers. Unions are happy if they can negotiate flexibility.

Telework is part of that larger movement of diversification, freer but also more secure. We need clear definitions. Telework is at a distance from the traditional workplace. It is not just a tool, but implies content of certain types of jobs. He suggested a cut-off point of 8 hours per week, and a maximum of 80% of time at home. Law is lacking in many EU countries, though flexible contracts are covered. As for collective agreements, progress is slow. We find individual agreements in many countries, which can cover teleworking, and deal with working time, incapacity to work, costs etc.

He considered legal status, where presumptions differ across Europe. There are numerous employment issues to be addressed, covered in a proposed collective agreement or directive. Telework is there; there is a gap where there should be comprehensive rules. There is a parallel with part-time, fixed term and working time issues. Flexibility on place of work needs to be addressed. He considered: scope and definition, place of work, obligations to provide information, incapacity to work, equipment and costs, confidentiality, insurance, equal treatment and training, privacy, information and consultation, right to organise and to collective bargaining, more favourable provisions, defence of rights, and final provisions.

Telework in Relation to Swedish Work Environment Legislation

Christina Jonsson is an ergonomist, concerned with work environment and computer work. The Board is the central administrative and supervisory authority, with basic regulations on the working environment set out in law. At regional level, there are labour inspectorates. Inspectors cannot inspect private homes without requests from employer or employee. The location, duration and autonomy of work are considered. The employer is responsible for the working

environment, wherever the work is done. Employees are responsible for co-operating, recognising that when you work at home, part of your home becomes a workplace. She considered provisions regarding display screen equipment, frequently revised in line with EU directives. She discussed health questions, and issues of responsibility. It is important that employers monitor the working environment, as covered in internal control regulations, reflecting total quality management principles.

In 1998 there was an official report, recommending harmonisation of definitions and statistics, but not changes in work environment legislation. More information and research is needed, and minor legislative changes. The Board has a 1999 national project concerning inspections of the office working environment, and telework. The focus is on computer work, with ergonomics and physical and mental work. The Board has also taken part in a reference group for a TCO project on furniture for the home workplace. Recommended home office furniture, on wheels, with closing doors, was illustrated. Computers are often used by children at home, and are covered by Work Environment legislation. TCO has made recommendations for family furniture purchases. Guidelines were produced. Statistics suggest that computer-based work, which mainly means data entry, editing and proof-reading, has increased, among both men and women. There are issues of technology use and work organisation. The Malmö conference needs to help us avoid the development of work that is damaging to workers.

Telework, Labour Law and Social Security – A Trade Union Perspective

Imogen Bertin has worked on the telework handbook, and with the CWU, which is now a part-owner of the privatised telecoms company. Her focus was on Ireland, where the union seeks to represent teleworkers in call centres, etc. Teleworking is the second issue for employers, following growth. She discussed the quality bus corridor, symptomatic of traffic problems. Childcare is a key issue, enabling women to return to work. Telework is another means of aiding returns to work.

There are also *problems.* Costs are high, and there is a shortage of data. In Ireland there is regional imbalance, with population and IT literacy in Dublin. Most statistics come from small sample surveys, and larger surveys are needed. There are legal problems over employment status. There is a new teleworking action forum. The union has been active in the area since 1996, and in European projects and training programmes.

There are *grey areas*. There is a partnership approach in Ireland, which has resulted in a code of practice, agreed by employers and unions. New and traditional union members have different perspectives and profiles, as do self employed and union members, who take different views on regulation. Self-employed teleworkers are a target for union recruitment, and different marketing approaches are planned. Call centres employ young women, with little knowledge on employment rights. Unions have had to develop new communication and membership subscription methods. There is a conflict of interest at local level regarding local loop unbundling, given union shareholdings.

Recent developments include a telework action forum, funding for support of business teleworking, pressure to remove tax in kind on computers at home, an emphasis on business competitiveness in general.

Success factors include key people with determination and vision; a critical mass of companies; tax breaks; and a partnership approach. It is hard to unionise call centres. A day of action at call centres attracted interest from Swiss TV, but not from Irish TV.

Growth sectors include shared services: for example Black and Decker, and Oracle. The work is less mobile, due to skills requirements and shortage languages. Webfarms and web-related businesses are developing, but they are not servicing the Irish market.

She considered *virtual companies*. Those leading teleworking companies can be vulnerable. There are issues of quality control and deadlines, and for retrospective decisions by tax authorities amid legislative confusion. Her example was of five women and one man, handling farm relief services. Work is tendered for, at low rates of pay when costs of self-employment are considered, in terms of equipment and pensions, etc.

Research must address legislative, health and safety confusion. Many teleworkers do not want to be self-employed, so we need to cope with mixed employment and working conditions, for free agents and others, and improve our research methods.

ILO and Telework – An International Perspective

Vittorio DiMartino offered a perspective on Europe and the rest of the world, and outlined the new geography of teleworking. The three lead areas are North America, Europe and the Pacific Rim. The two leading countries are the USA (6–8% teleworkers) and the UK (home 1.3 m teleworkers), in terms of statistical data. There are relevant issues of flexibility of work organisation and employment legislation. The next group covers Europe, with telework doubling each year to reach critical mass. We have to be careful with definitions. The gap between North and South has polarised. Countries with large unpopulated areas have a different logic for telework, covering Scandinavia, Canada and Australia. High technology Asian companies are expanding telework at speed. We know less about Latin America, Africa and the rest of Asia.

He identified three waves. One pressure has been for rapid cheap data entry. The West tends to use other countries, then complain about working conditions at the WTO. The challenge is to find ways of adding value, taking on more sophisticated services, as are offered in India. The next wave has been based on call centres, linking providers and suppliers in global competition, such as Korea, India and Mauritius. The third wave involves large countries such as South Africa, Brazil, China and Russia taking on diverse roles in economic and social development.

Issues of working conditions were considered, as quality of work, quality of service and quality of technology are balanced in a global context. The risk comes in vulnerable countries who need to increase the value of work done, or they will lose

in global competition. The key is to take the high road to teleworking, not dumping problems on other countries, but making use of knowledge and technology for economic and social advance.

Swedish Experience on Telework, SMEs and Regional Development

Ewa Thorslund discussed the ECATT survey (www.ecatt.com), funded by the European Commission. The survey was made in companies and householders, identifying 9 million teleworkers in Europe, 6 million on a regular basis. The lead is in Finland, with 17% of the workforce. Most are male, well-qualified, based in services and finance, in large organisations. They do not work longer hours. The main concern of managers is for data security, while there are doubts about productivity and quality. Numbers are growing, but interest is strongest where telework has begun. The question is whether telework will grow. Some ECATT survey evidence in Sweden suggests decline. Rapid product cycles require co-operation, which may conflict with telework. Face to face contact is important.

Recent NUTEK survey work in Sweden covered the use of IT, and new ways of working. There were strategic, regional and sectoral perspectives, relating to telework.

Strategic: To move from traditional working to teleworking involves structural and mental change. There are five groups, based on managers and their relations to the company, external environment, company relations with the external environment, and characteristics of the managers: local growth, bureaucracy, bread and butter, entrepreneur and adhocracy.

Regional: There is concentration at regional levels around big cities. The focus is thus urban, not rural, despite predictions. Traditional sectors of industry tell us less.

Round Table – Research Priorities, Action Priorities and Input to the Work Life 2000 Conference in Sweden

Research priorities

Speakers argued for an integrated approach, with telework as part of a global picture, considering new forms of working at a distance. This means conceptualising, and determining consequences for employment relations, individual and collective. Research should concentrate on comparative data, on where, what and why. We need to consider flexible working and knowledge working, and the network economy, winners and losers.

What do we know about telework? Telework is comparable with the elephant, explored by the blind men. This can be dangerous. Who are we, as researchers, social partners and politicians? Where is the action, and how can we learn? How can we combine insights? What can we learn from the IT industry? Where is technology going? How has the legal situation developed in the European Commission? How much do we know from experience and from the literature?

How can we make use of the knowledge available? We need to shape the knowledge base on the road to Malmö, and to address the public, with particular target groups not currently engaged, such as SMEs. We need to address the politicians and the general public, taking a more global perspective.

Definitions are needed for comparative work, in order to analyse trends and new organisations, in the context of the European Employment Strategy. We need benchmarks, and to cater for occupations and sectors, and company size, noting the difference between micro and small companies. The change is global; something is developing, evading easy definition, and at great speed. The situations vary for employees and the self-employed. We know little about mobile teleworking. We need data and cases on good and bad practice, and emerging possibilities.

What are the implications for the social partners? How can we create practical tools? How can we cater for responsibility for health and safety? How can we deal with personal and social relations beyond the workplace, gender issues, and approaches to security? Is there a move back to face-to-face contracts? Can we include clusters, and in particular IT clusters? We need to consider the function of securing work for teleworkers, a new form of employment agency. This function is rarely filled at present, but is vital. This links to tele-entrepreneurs, local champions.

Action Priorities

National statistical agencies need to be involved without delay, engaging them in the statistical process across Europe, and developing an inventory of databases on best practice. This is an adjunct to the research programme, addressing qualitative as well as quantitative issues. We must take account of the variety of experience available.

Action should focus on awareness and infrastructure. The role of housing needs to be understood, and choices for actors need to be increased. Telework needs to be enhanced in the social network, with labour relations and health and safety. There needs to be a website for teleworkers and employers. Action needs to target SMEs, and their problems. Social dialogue should be promoted, with initiatives from the Commission. This includes consideration of the case for new directives and codes of practice, a dialogue developed through networking with the public, and with the European Commission.

Telework employment agencies need to be brought together, in a specialist workshop, to share experience. Barriers to teleworking must be addressed, including data security, and means of clarifying concerns in detail. There is tension between the need for experimentation and the need for regulation. Isolation is interesting as a phenomenon: teleworkers encounter important kinds of isolation, to be viewed in the long term.

Inputs to the Malmö Conference

In Malmö we will report on research, discuss an integrated approach to work and the quality of life, and deal with forms of work and telecommunications, the nature of employment conditions, notions and institutions, and the world of

teleworking tomorrow. There should be appropriate monitoring, legal and collective bargaining, and concentration on SMEs. There should be an exhibition of good practice. We need a high level panel, able to discuss the key issues in advance of the conference, addressing issues for applicant countries.

Workshop Participants

Vytautas Astraukas, Seimas, Lithuania
Carl Aborg, Previa Future, Uppsala, Sweden
John Bakke, Telenor Research and Development, Norway
Bruno Barth, Ministry of Labour and Social Affairs, Berlin, Germany
Imogen Bertin, Communication Workers Union, Ireland
Andrew Bibby, consultant, UK
David Birchall, Henley Management College, UK
Roger Blanpain, University of Leuven, Belgium
Willy Buschak, ETUC
Dan Ciceu, Romanian Foundation for Democracy, Romania
Stavroula Demetriades, European Foundation, Dublin, Ireland
Clara Doyle, European Foundation, Dublin, Ireland
Richard Ennals, Kingston University, UK
Ildiko Ekes, ECOSTAT, Budapest, Hungary
Eric Forbourg, European Foundation, Dublin
Camilla Galli da Bino, ILO, European Foundation, Dublin, Ireland
Elena Globanova, Ministry of Labour and Social Affairs, Slovakia
Lars Grönkvist, NUTEK, Sweden
Tiina Hanhike, Tampere University, Finland
Joseph Hochgerner, Centre for Social Innovations, Vienna, Austria
Ieva Jaunzeme, Ministry of Welfare, Latvia
Christina Jonsson, NBOSH, Sweden
Timo Kauppinen, European Foundation, Dublin, Ireland
Bengt Knave, NIWL, Sweden
Eberhard Köhler, European Foundation, Dublin, Ireland
Patrick Levy, Solvay SA, France
Andrzej Maciejczyk, CS Creative Solutions, Warsaw, Poland
Thomas Maier, IPRO Consulting, Stuttgart, Germany
Vittorio Di Martino, ILO, Geneva, Switzerland
Mirta Michilli, Commune of Rome, Italy
Jeremy Millard, Danish Technological Institute, Denmark
Patrizio Di Nicola, Rome, Italy
David Norman, Mitos SA, Greece
Filomena Oliveira, European Foundation, Dublin, Ireland
Karin Olsson, European Foundation, Dublin, Ireland
Walter Paavonen, Paavonen Consulting, Södertälje, Sweden
Jean-Jacques Paris, Brussels, Belgium
Carlos Perez, DG Employment and Social Affairs, European Commission, Brussels
Olivier Richard, UNICE
Renato Rizzo, Mirti European Consortium, Padua, Italy
Alexander Simonov, Academy of Sciences, Bulgaria
Cecilia Sjoberg, NUTEK, Sweden
Lena Skiöld, NIWL, Sweden
Vladimir Smolka, Trexima Ltd, Czech Republic
Vibeke Sylvest, Danish Employers Federation, Brussels, Belgium

Marie Louise Thorsen Lind, Swedish Employers' Federation SAF, Sweden
Ewa Thorslund, NUTEK, Sweden
Adrian Toia, Science Technology Innovation Management, Romania
Fran Trcek, University of Ljubljana, Slovenia
Nicola Turbe-Suetens, France
Tivadar Ught, Commission of Hungarian Trade Unions, Budapest, Hungary
Joao Paulo Vaz, Instituto das Comunicoes de Portugal, Portugal
Patricia Vendramin, Foundation Travail-Universit, Belgium
Patricia Watts, European Foundation, Dublin, Ireland
Richard Wynne, Work Research Centre, Dublin, Ireland

Reflections on the Workshop

This was a large workshop, allowing relatively little interactive participation at the outset in plenary sessions, but broad dissemination. The agenda, while linked to themes of Work Life 2000, was in part inherited from previous European Foundation projects and publications. The expert representation from applicant nations to the EU was excellent, and the workshop gave indications of the quality of discussion we should expect during forthcoming negotiations.

Conclusions from the 1999 Workshops

From a core of concerns with working life, the second year of workshops has addressed the state of the art on specialist areas, with contributions from international leading experts. The Swedish Presidency is prepared to set a long term course. In addition to the context of this direction, the process itself is of significance.

The outline of the Work Life 2000 conference in Malmö in January 2001 is taking shape, based on the preparatory workshops. The scale of the enterprise is becoming apparent, as over 70 international workshops are represented in knowledge update sessions and round table discussions. In some cases, work reported at workshops has been identified as worthy of further development for presentation at the Malmö conference, taking advantage of international collaborative input. The conference is not seen as the end of the development organisation process, but as a reporting point for an emerging agenda. Following workshop meetings, the networking continues, changing the pattern of work of the professionals concerned.

A New Paradigm of Knowledge for Knowledge-based Society

Underlying these questions is an emerging realisation that knowledge is not simply a matter of elegantly presented results of scientific research, but an organic phenomenon. A new paradigm is emerging, in which the network may be seen as a concrete and active form of knowledge. Each Work Life 2000 workshop creates a new international network, strengthened by common experience of working together, as the ongoing set of products of a European development organisation. In the workplace, knowledge includes tacit knowledge, individually and collectively held, and with little apparent relationship to the formal products of research. The key is partnership within the workplace and networking between workplaces, which have to see themselves as learning organisations. Large scientific institutions, with researchers on lifetime contracts, can become remote from the realities of the workforce. They may have little to say to the increasing number of Small and Medium Sized Enterprises, discussed at the workshops on ***Jobs in EU Micro Firms***, ***Job Creation***, and ***Teleworking***, and at the workshops on ***ICT*** and ***New Media.*** Research institutions and universities must themselves learn to network. SMEs are best understood by seeing them operate in networks and coalitions at a regional level, and much can be learned from innovative patterns of economic development, varying greatly across Europe. We need to understand work organisation and Europe as a development coalition.

Practical Implications: Work Life Programmes

Work Life 2000 has emerged as a dynamic European development organisation. There is a case for maintaining an ongoing development organisation structure on the same lines, enabling networking and collaboration across Europe. Having been initiated by Sweden, Work Life 2000 has been broadly European in character, and has benefited from the support and involvement of the European Foundation for the improvement of Living and Working Conditions, in Dublin, who have hosted a number of successful workshops, and the European Agency for safety and Health at Work, in Bilbao. The Yearbooks, reports, popular summaries and other products of Work Life 2000 represent an educational resource in the English language, on which copyright is held by the Swedish National Institute for Working Life.

Subject Index

Name Index

This CD-ROM contains the full text of

Work Life 2000 Yearbook 2 – 2000

Edited by Richard Ennals

The text is in a single file, called **WL2000_2.PDF**

If your system already has *Acrobat Reader* installed, you can usually see the text simply by clicking (or double-clicking, according to your system) on the file name.

Alternatively, open your *Acrobat Reader,* click on FILE, OPEN, then type the file location and address (such as **D:\ WL2000_2**) before pressing ENTER.

You can use *Acrobat Reader's* features to locate words or text (use TOOLS, FIND) or to print or copy parts of the text.

If you do not have Acrobat Reader on your system, this CD-ROM includes all you need to install it on your IBM-compatible PC, running under Windows 95198 or Windows 3.x

Two versions of *Acrobat Reader v.3* are included on this CD-ROM. They are located in the **Acrobat** directory. One is a 16-bit version for Windows 3.1, the other is a 32-bit version for Windows 95198. The reader takes up about 5MB of disk space.

Windows 95/98:

Make sure all Windows applications are shut down. Use Windows Explorer to explore the sub-folder on the CD-ROM **..Acrobat\32Bit**. Double-click on the file Ar32e30 to begin installation. Follow the on-screen instructions.

Windows 3.1:

Make sure all Windows applications are shut down. Use File Manager to open the CD-ROM subdirectory **..acrobat\16bit**. Double-click on the file **ar16e30.exe** to begin installation. Follow the on-screen instructions.