Research Dissemination

Proceedings of a workshop in Brussels November 24th 1998

Elisabeth Lagerlöf (ed)

WORK LIFE 2000

Arbetslivsinstitutet
National Institute for Working Life

The National Institute for Working Life is Sweden's national centre for work life research, development and training.

The labour market, occupational safety and health, and work organisation are our main fields of activity. The creation and use of knowledge through learning, information and documentation are important to the Institute, as is international co-operation. The Institute is collaborating with interested parties in various development projects.

The areas in which the Institute is active include:

• labour market and labour law,

• work organisation,

• musculoskeletal disorders,

• chemical substances and allergens, noise and electromagnetic fields,

• the psychosocial problems and strain-related disorders in modern working life.

Preface

The workshop was a part of the *Work Life 2000* project; a major effort aimed at gathering knowledge about work life issues, organised by the Swedish National institute for Working Life. The workshop was held in preparation for the conference Work Life 2000, which will be held during the Swedish EU-presidency in January 2001.

This workshop was organised jointly by the European Agency for Safety and Health at Work, Bilbao, Spain, the Nordic Institute for Advanced Training in Occupational Health, NIVA, Helsinki, Finland and the National Institute for Working Life, Stockholm, Sweden.

The workshop was intended to sharing of experiences, the formation of a potential network and recommendation for future strategies. The brief for the workshop where 24 persons participated, combined three themes namely dissemination, vulgarisation and valorisation of research.

Dissemination may include the direct dissemination of research through international journals. The target group is usually other researchers or those experts who want and in-depth knowledge about a certain topic.

Vulgarisation or popularisation includes the translating of research results into other forms such as press releases, popular-scientific articles etc. The target group is usually the "the enlighten public", but it usually best suited to experts who will get new ideas from research results and for future applications.

Valorisation includes the provision of best practises or good solutions and the exploitation of research either as action-oriented, or, for instance, by producing products, standards, or patents.

These different themes and approaches were enlarged by international experts in the area and by the following group discussions.

The results of the workshop will be summarised in one of the sessions during the Work Life 200 Conference. The European Agency has furthermore used the results as input in its project on dissemination of research information. NIVA will in 2001 also carry out a one-week seminar on Research Dissemination.

Contents

Summary of the workshop

One of the greatest problems in the occupational health and safety community is the lack of appropriate emphasis on the research involved in dissemination, adaptation and utilisation of information.

This was agreed upon as the most important conclusion from the workshop on *Research Dissemination* held in Brussels, November 24,1998. The workshop was held as one of the preparatory workshops for the conference *Worklife 2000* to be held in January 2001 during the Swedish EU-presidency.

The workshop was organised jointly by the National Institute of Working Life, Stockholm, The European Agency for Safety and Health at Work, Bilbao, Spain, and the Nordic Institute for Advanced Training in Occupational Health (NIVA), Helsinki, Finland.

Research dissemination is a key issue

The heads of major occupational safety and health research institutes in Europe have identified research dissemination as a key issue. At the same time, there seems to be a serious mismatch between the optimistic assumptions made by the senders about dissemination of research results, and what is available, assimilated, and needed for a potential user. If this mismatch will continue it may be of potentially grave political consequences.

The brief for the workshop, where 24 persons participated, combined three themes namely dissemination, vulgarisation and valorisation of research:

- Dissemination may include the direct dissemination of research through international journals. The target group is usually other researchers or those experts who want and in-depth knowledge about a certain topic.
- Vulgarisation or popularisation includes the translating of research results into other forms such as press releases, popular-scientific articles etc. The target group is usually the "the enlighten public", but it usually best suited to experts who will get new ideas from research results and for future applications.
- Valorisation includes the provision of best practises or good solutions and the exploitation of research either as action-oriented, or, for instance, by producing products and standards, and serve as a basis for further training

These different themes and approaches were enlarged by international experts in the area and by the succeeding group discussions.

What research should be done?

A difficulty for an applied research organisation is the different environment found in basic research contra the working world, as well as the question about

what work shall be done in order to be able to achieve results according to the wishes of the customers. This applies in particular to the problem between the rapidly changing world of work and long-term research strategies. Therefore there is a need to widen the research institutes' communication with the various health and safety professionals in order to do permanent revisions and updating of the research strategies.

It is also important for a research institute to continue research that is not directly made towards rapid solutions to immediate problems. Research can only partly deliver short facts and simple solutions. Neither can a single research institute cope with all the health and safety problems, because it demands a competence, which extends to the science as a whole.

Researchers can not answer questions that not yet have been asked. On the other hand the research can bring up unperceived needs to the attention of the organisation, as one of the speakers pointed out.

Therefore it is important for a research institute to

a) Be clear about what it can *not* do; that is, to make the limitations of goals clear to the customers – but this must be done in cooperation with them.
b) Increase cooperation and joint research with other research institutes
c) Interact with the receivers, so that the research answers more directly to social requirements

The latter would need a harmonisation between a relatively large number of operators, including information specialists, trainers, experts, researchers etc. Health and safety research results can not immediately be implemented and supportive mechanisms are needed for the transfer of results. There is often need for extra efforts and support, if the results should be spread internationally. Very often the costs for research dissemination is underestimated and often only contains a small part of the institute's budget.

Another problem for a research organisation is that it is difficult to get researchers to participate, because the promotion is based on producing new research results, not dissemination. The need for positive internal incentives for conducting such activities must be recognised.

How are the results of research used?

Many occupational health and safety experts, researchers and decision makers do believe in a simple model: A problem is recognised by the decision maker, the researchers research it and forward different good solutions, and then the decision-makers decide upon a certain policy. Sic!, the problem is solved!

This instrumental way of looking at research usage represents only one function, as identified by the well-known mass-communication researcher Carol Weiss. She talks about the following functions of research:

- *Instrumental function.*
- *Political function*, i.e. research results are used as arguments in a political context.

- *Pedagogic or conceptualising function,* i.e. research results are indirectly used by those who "rethink", reflect, get new ideas and concepts, resulting in that the problem is defined in a new way.
- *Interactive function*, i.e. research results together with another kinds of influences become part of a knowledge bank.
- *Tactic function*, i.e. when research is used in withholding or delaying decisions. Here you can find a whole scale of examples starting from the need of pointing at a certain report, which supports your own suggestion, to delusions about results who does not suit your own or your organisation's needs.

A Swedish study about the use of social science research results found that only 15 per cent of the results were used in an instrumental way, while most use was found of the conceptual (33 per cent) and political function (32 per cent). Inter-active and tactic use answered to 10 per cent each. How would the same functions apply to health and safety research?

It is also quite clear that different target groups need different information that is relevant for preventive actions. As a sender you have to be very clear about what message you want to present to whom. The more you want to communicate your research, you will find that the number of messages and target groups tends to increase dramatically – which might put unreasonable demands on the original sender.

Internet effects not fully known

Internet is becoming a primary way of assessing occupational safety and health information but no systematic appraisal of who does or does not use Internet has up to now been done. Neither do we know how the information on the Internet is used. But we also need to know better where there are pockets of workers who are less likely to access Internet and to whom other channels are important.

We also need to understand that access to information on the Internet is not enough, because being aware of and being able to only comes with knowledge and education. Knowledge is needed to how to evaluate an excess of information, and sort into piles labelled "worthless" or "worthwhile". The question is how you can get understandable, as well as reliable, evaluated, structured and high-quality information on the net. Content is important, but a content that meets the customers' need. Another question is how we deal with information overload and/or overlook.

Is media the answer?

It is difficult to interest the media in science information, and health and safety research is not high on the ranking list. However, the media attention is closely

linked to the business cycle; in a growing economy occupational health issues will reach a higher ranking.

Usually health risks that affect many people easily attract the media's attention, while it is much more difficult to get a preventive effort ahead. From the sender's point of view we need to know more about how to communicate the results to the media in a "proper" setting.

A requirement could be to educate researchers to meet the press, and the opposite – to educate the press about research, and research methods and processes.

Mass media should not be seen as the main channel for research dissemination, but it can be useful in a supplementary way. Media can catch the attention of and inform readers, listeners and TV-viewer in general about a specific topic, but seldom change their attitudes or their behaviour – partly because the mass media is appropriate for simple and "sweeping" messages. The problem is, however, that scientific knowledge is always based on a certain perspective, and the results are seldom explicit enough to be submitted without reservations.

We need to know more about how the mass media adopt occupational safety and health research and the subsequent impact of mass media on decision-makers and policymakers.

Package solutions

Just as scientific methods and practical conditions are changing, so must implementation, its methods and strategies change. With a changing world of work we need to find ways to present our results in a way that incorporates it in guidelines laying down the corporate philosophy, in international standards, and in the occupational safety and health management system and the quality system of the company. This "holistic" method means that we need to use many different messages to the same group, i.e. a package solutions, and that we present a "system concept"– not just a single problem approach.

We need to know more about social marketing with techniques such as audience segmentation, which involves assessing an audience for differences within in it and looking for subgroups with common interests and needs, and targeting communications to these subgroups to achieve better response.

Education forms an important role here, but it must be adapted to the target groups. This implies that it must be develop together with the target groups. We need to adopt approaches that involve both the sender and the receiver. The participation approach is very important in order to reach the conclusions that are understandable to the users.

Involvement of several actors crucial – an example

A multidisciplinary research programme that ended up in about ten hand tools manufactured on the market was presented. Money was granted by a special fund and six big Swedish companies was behind the project to apply research result into at least ten user-friendly hand tools and make them available to the

customers. Another important issue was to generate acceptance and understanding of the improved tools in the whole chain of actors in the Swedish hand tool industry.

Several actors were involved in the programme, such as users, purchases in the companies, hand-tool distributors and manufacturers as well as researchers. Active participation was important for the production and introduction of the new tools.

First an inventory of tools was made and the twenty most problematic tools were identified by the users. Then followed product design and education activities. Finally the manufacturing, marketing and implementation was made.

In order to exploit research results, many projects have been forced to realise, that knowledge about health and safety is not enough. Researcher must also have a rough idea about production terms, production and materials technology, and the demands for the product in order to be able to implement their ideas.

Summary and recommendations

- There is a need of an informal network in order to cope with the rapidly changing socio-economic factors. It is a question of sharing engagements made in the professional domain of professional risks and hazard prevention research in a complex and varied environment in which industrial and business factors are of prime importance. Such communication must be worked out in joint collaboration with the currently available media and the users.
- Research is needed about dissemination of research results, how to adapt it to best suit the users and how it is used by them. How can information spread, and how can theories about organisational change and social change, the stages of change and the implementation of innovations be used?
- Research on enabling factors for the process from adaptation to action is also needed. This can include research that identifies barriers to actions, research that identifies problems people face, and research on compliance with recommendations. Why do people comply with guidelines, advises etc?
- We need to know more about decision makers and policy makers – how do they obtain and use information- and do they get the information they require?
- We need to know more about how information on the Internet is used, and how the content should be designed. Here not only the users should be participating, but also "trusted third parties", which can help not only in producing a good content, but also a good presentation, or marketing, to the public.
- Models for information dissemination that put the user in the centre, e.g. a further examination of the critical points between research and impact and where the information is transformed and utilised.
- Development of information strategies for different target groups, not at least SMEs.

- We need to know more about the press and their role for information dissemination. Education of researchers to meet the press and vice versa was recommended.
- Evaluation of different research dissemination strategies. Intervention studies are needed to assess the effectiveness and efficacy of various types of interventions, including communication.

1. Research in the Service of Occupational Safety and Health

Markku Aaltonen, PhD (Eng)
Project Manager
European Agency for Safety and Health at Work, Gran Via 333, ES-48009
Bilbao, Spain

Scientific research can often support the prevention of occupational hazards. Research in this context is mainly practice-oriented applied research, and differs considerably from basic research.

The following characteristics of research have been identified in the field of occupational safety (Coenen and Lambert, 1993):

- research activities are generally initiated as a result of concrete deficiencies detected in the work environment,
- in most cases, these deficiencies represent complex problems often requiring multidisciplinary or global research approaches for obtaining adequate solutions,
- research results are rarely obtained in a form allowing their immediate implementation. Therefore, appropriate mechanisms for result valorisation have to be considered already in the planning stage of the study,
- additional supportive measures are often needed for the international transfer of results.

A research study consists of various phases. Determination of research deficiencies can be based on a retrospective approach (e.g. accident statistics) or on a prospective approach (e.g. anticipation of risks due to new technologies). Deficit can be revealed by needs of an external body (customer) or as a result of the active investigation by a research institute. Acceptance of the existence of a deficit and identification of the research needs should be thoroughly charted before the detailed planning of a study (Lambert et al., 1993).

After completion of a study, even the best research results are useless if they are not available or useable for accident prevention. Therefore, valorisation of the results is needed. Lambert et al. (1993) classify the possibilities of valorisation as follows:

- institutional valorisation, e.g. legislation, regulations, standardisation, information leaflets,
- scientific valorisation, e.g. solution of still unsolved problems, investigation of new questions prompted by the study,
- technological valorisation, e.g. new device, method, software, or database,
- pedagogical valorisation, e.g. professional training, university studies, further training of employers and employees,

- valorisation via various media, e.g. publications, campaigns, databases, posters, films.

Research project activities at the European Agency for Safety and Health at Work

According to its regulations, the European Agency has implemented various activities related to occupational safety and health (OSH) research. Thematic Network Group on Research – Work and Health will contribute to the collection of information on OSH research and disseminate the results of the research and research activities. One model for the dissemination has been developed by the Finnish Focal Point, see figure 1. The OSH research information is collected and introduced to the Internet network of the Agency (http://www.eu-osha.es).

A specific data collection on future occupational safety and health research needs and priorities has been carried out in the EU member states. The objectives are to collect up-to-date information on future OSH research needs and priorities, to contribute the development of a priority document for future European research programmes and activities, to give an input to the Commission's programmes and to improve collaboration between the Community bodies and the Member States. The final summary report will be published by the Agency in 1999.

The Topic Centre on Research – Work and Health will contribute to the Agency in specific tasks related to the Work Programme.

References

Coenen W, Lambert, J. *Research in the service of occupational safety. First International Course on Safety Research.* Lyngby, Denmark, NIVA September 19-23 1993. 3 pp.

Lambert J, Muller J, and Wichtl, M. *Guidelines for quality assurance in research for occupational health and safety. First International Course on Safety Research.* NIVA. Lyngby, Denmark. September 19-23 1993, 7pp.
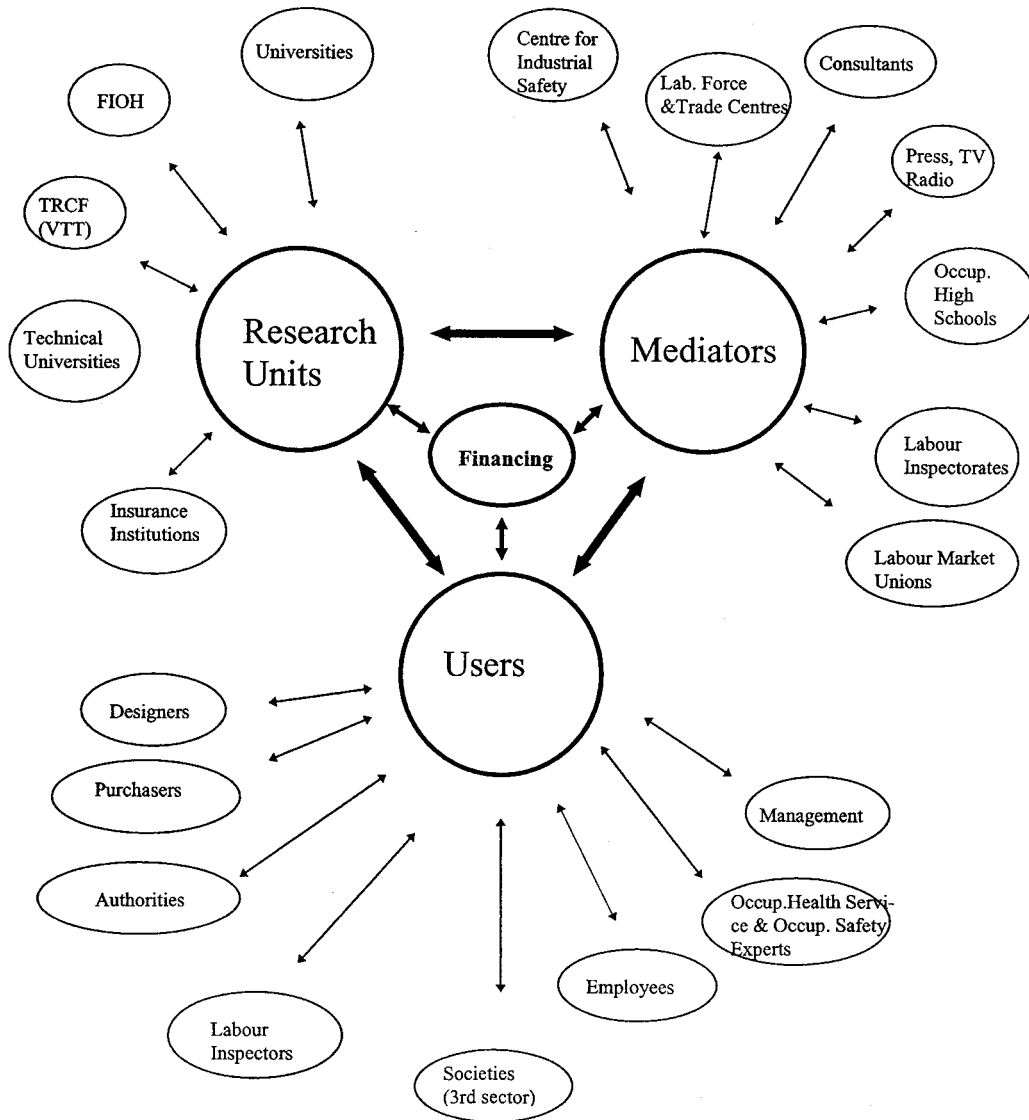
Figure 1. The Model for supplying and making good of research results in work environ-ment improvements. Developed by the Finnish Focal Point (Stålhammar 1998).

2. Research on communication of research and research results

Elisabeth Lagerlöf
Director
NIVA, Helsinki, Finland

Today information is everywhere, we are connected, wired and linked. Still there seems to be a serious mismatch between the optimistic assumptions made by the senders and what is available, assimilated and needed for the potential audience.

   This also applies to the health and safety field and if this mismatch will continue it may be of potential grave political consequence. Moreover, there is an inadequate empirical or policy relevant research to explain to us when, why and which people want to acquire scientific knowledge (La Follette 1998).

   Why do we want to acquire knowledge on research and research results? It can be summarise as (Schmandt and Katz 1986).

- *Science as product* – it makes possible new technology and products.
- *Science as evidence* – it help us to understand new problems.
- *Science as method* – it provide us with tools to solve complex problems.

The same thinking can also be found, for instance, in models for valorisation of health and safety research (Lambert, Muller and Wichtl 1993).

   Another way of looking at the communication of research results is to ask one-self why the users/practitioners need the information (Höglund and Söderberg 1992). Three motives to improve the contacts between researchers and practitioners have been pointed out in a number of studies, such as:

1. Information for rationalising. International studies point at the need of access to information, which easily can be adjusted to present routines and allows flexibility between different work tasks.
2. Information for better quality. A better and/or more effective health and safety information should not only result in more effective preventive work, but also to better health and safety and less injuries among the workers.
3. Information as a resource for cultural or democratic values. The access of information gives prerequisites for democracy and participation, general knowledge advancement and education. By using translators the information will not only reach specialists but also large groups of workers.

The mismatch

If science's essential product is, indeed, knowledge, then we have to discuss how it is distributed. One thing is clear and that is that the distribution is uneven and more or less follows the same pattern as wealth. There is a south and a north, there

are those who have or have not and it may also be said to follow Matthew's principle in the Bible "for unto every one that hath shall be given but from him that hath not shall be taken away even what he hath" (Caws 1998).

Many persons uncritically regard the access to information as any other commodity, such as goods. There are, however, some striking differences between knowledge and other kinds of goods. One is that the non-possession of knowledge usually is not recognised by those who do not have it. For example, you know whether you own a luxury car or not, while at the information age you can get access to a large amount of "nothing", an excess of information and data which no-one knows how to use, much less how to evaluate or sort into piles labelled "worthless" and "worthwhile". Thereby follows that access is not the same as knowledge, except in a very limited sense.

Information versus knowledge

What is then the distinction between information and knowledge? One definition is:

> "Information is essentially items of data that remains quite different from knowledge in that the latter is linked to explicit theory or theories, is embedded in a social context of explanation and is endorsed explicitly or implicitly by a discipline group or practitioners" (Johnston and Blumentritt 1998).

There exist four different types of knowledge that are worth distinguishing (Cows 1998):

- *Direct knowledge* is knowledge I can produce on demand – it's in my head or immediately at hand.
- *Indirect knowledge* is knowledge I know how to acquire – I know where to look, or whom to ask, and when I looked or asked I can incorporate it.
- *Paradigmatic knowledge* is the direct knowledge I need to activate indirect knowledge (for instance it is no idea to look up PAH if I do not know what it stands for).
- *Fiduciary knowledge* is the knowledge of the reliability of my sources of indirect knowledge.

The problem is, however, that a person's direct knowledge is limited, we do not learn very much from other persons' experiences and if we use the fiduciary knowledge we need to know that it is trustworthy and reliable. So there is a need to structure our minds and critically and imaginatively process the huge amount of information we take in each day, because being aware of and be able to, does not come with information – it only comes with knowledge and education. So even if knowledge exists, this does not necessarily include understanding.

The usage of research

What is research utilisation and how is it used? The research about the use of science started about 30–40 years ago with the main interest on how to disseminate innovations. These studies were all based on a sender perspective and no analysis of the barriers to and possibilities for research use was made.

Another approach was used by those researchers who focussed on research dissemination as an information technology problem, i.e. research reports are difficult to find, and take too long time to read. The critique of why research results were not used were met by technical improvements such as better messages, better layout and illustrations, choice of word or readability indexes.

Research about the user's role and why he or she not uses the research has its root in American policy-related evaluation research during the 60's, when a number of social reforms were accomplished. The role of the research was to make the impact as rational and effective as possible.

The ideas was based on a problem-solving model – as a process where a problem is identified by decision-makers, the social science delivers knowledge about the problem and different way to solve the problem and then the decision-makers decide upon a certain policy.

At the end of the 60's, however, more and more doubt was emerging about whether the policy-directed research had any influence at all on the outcome of the social reforms policies. Researchers found that this mechanistic way of approaching the use of research had very little to do with reality, since the decision makers did not use their results. Therefore, questions began to be asked and research started to emerge about why scientific results were not used and about the total process of research communication. An implicit assumption is of course that use of research results is rational behaviour – and non-use is what is needed to explain.

The user's use of research

What do we mean then by research usage? We need to ask us a number of questions, such as
- Is it that someone uses the recommendation from a research report and follow this point by point?
- Is it that a certain decision reflects the research results?
- Is it that a probable decision will be better, if it is based on research, or
- Is it that a person changes his or her way of looking at a political question?

The American mass-communication researcher Carol Weiss has made a distinction between the different functions research could have for a potential user (Nilsson 1995). Five different functions are presented:
- *Instrumental function*, e.g. the problem-solving model presented before. Much health and safety research information is based on this model.
- *Political function*, research results are used as arguments in a political context.

- *Pedagogic or conceptualising model*, which means that the research results are indirectly used by those who "rethink", reflect, get new ideas and concepts, resulting in that the problem is defined in a new way.
- *Interactive function,* the function is that the research results together with another kinds of influences become part of a knowledge bank.
- *Tactic function*, e.g. when research is used in withholding or delaying decisions or to embellish an earlier neglected occupational group or task, because the research has brought its magic spell over it. Here you can find a whole scale of examples starting from the need of pointing at a certain report, which supports your own suggestion, to delusions about results who does not suit your own or your organisation's needs.

How different functions of research are used within the social sector in Sweden have been studied (Nilsson 1992):

Function of the research	Use
Instrumental	15 %
Political	32 %
Conceptualising	33 %
Interactive	10 %
Tactic	10 %

A vast amount of international research exists about information and communication within science and technology, especially in the social science. For those who are interested I would recommend journals such as *Scientific Communication* (formerly Knowledge) and *Knowledge and Policy*.

The largest part of this research is mostly based on general mass communication theories illustrated by this simple model with the components:

| Sender | → | Message | → | Channel | → | Receiver |
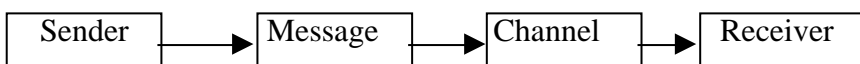
The same thing could be said as in the classical formulation of the famous mass communication researcher Lasswell:

> "Who says what to whom through which channel, for what purpose, and to what effect?"

Mass communication theories are, however, not always possible to apply to research information. It is possible to map an information process in this way if we talk about single messages or a simple information campaign. But even then it is sometimes difficult to evaluate the real effects in a scientific way. Further research has now modified the initial theories about quick and directly visible effects and today the effects are more often studied as a part of the complex interface between the human being and the surroundings (Höglund 1995).

Of special interest is that in later research the receiver and his environment (organisation) are more in focus. We are talking about "learning organisation", where use is often depending of the internal strategic need. A question to consider

here is of course if health and safety information should be driven by individual needs or by organisational needs?

For health and safety research also those theories are of interest, which express the "value" of the information as a function of the effect to decrease a user's insecurity and his or her willingness to "pay" for the information. The possibility to reduce insecurity is a very important driving force behind the use of research for normative purposes within health and safety.

The message

Other basic factors for the use of information is of course its relevance, its precision and form. The form is often difficult to adjust to the user's prerequisite. Research-based information often signifies difficult choices between on one hand the scientifically correct nuances and on the other hand the need for simple and direct communication. Research can only partly deliver short facts and simple solutions.
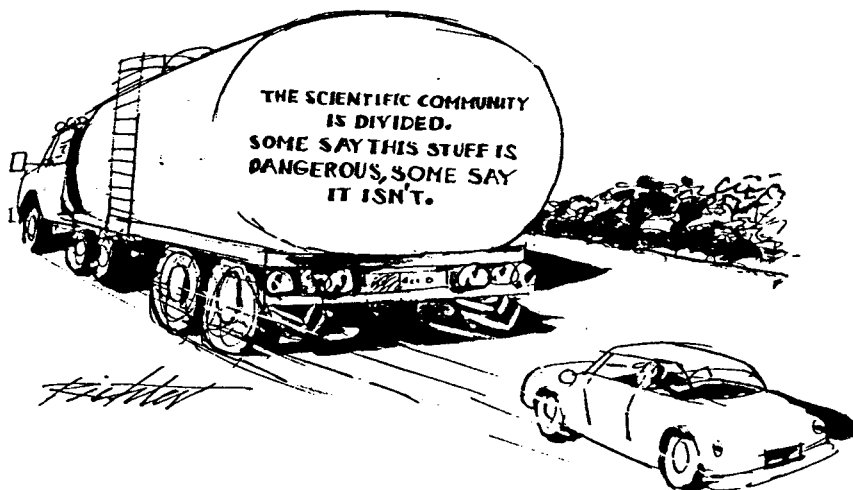
Figure 2.1. The problems with research dissemination (Source: Picture by Richter; ©1998, The New Yorker Magazine, Inc).

Furthermore when the research information is directed towards practitioners, managers or specialists, it is to a high degree a very qualified and occupied group. This puts certain demands on the research information which seldom are totally reached, namely, it should be subject-relevant, easily available and, if possible, also action-relevant. It is often very difficult to have enough resources for the reinforcement of knowledge and to translate or transform it to something that is relevant for preventive actions. Sometimes this is not even possible, because no scientific solutions exist, since research has partly other and more long-term knowledge objectives.
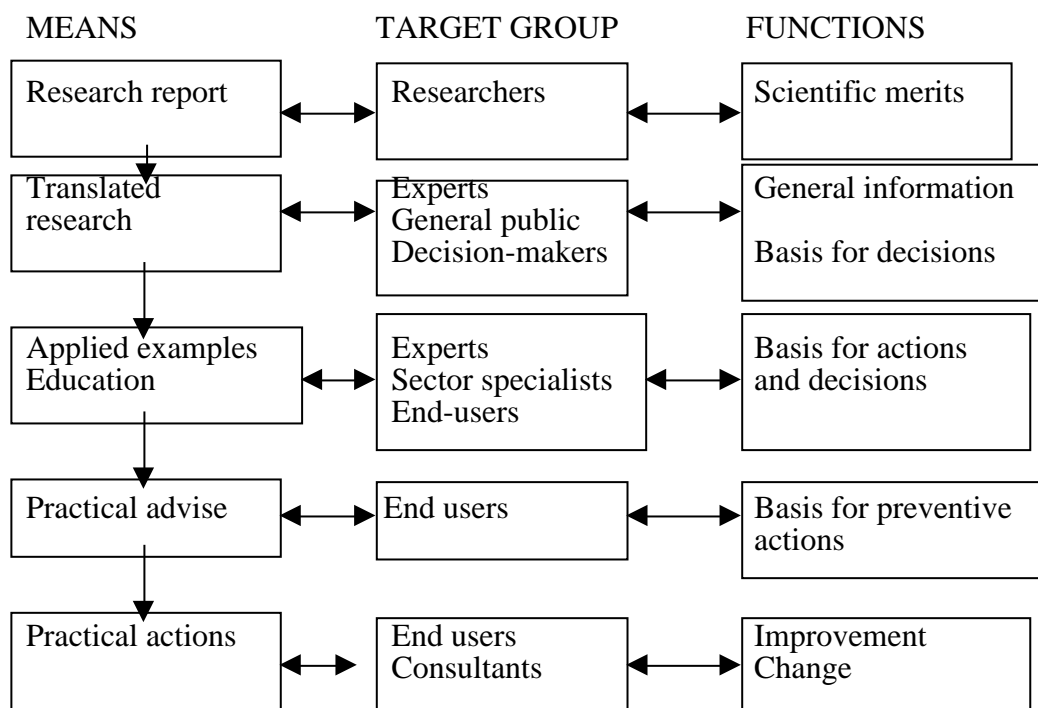
The image of research information and dissemination is that it is very informative, factual and well balanced – and so is often the case. Sociologists have, however, shown that research information neither is a simple or an unproblematic task. The scientific knowledge is always based on a certain perspective and research results are seldom good to submit without reservations. Uncritical publicity of research result may lead to a "scientific incest" society, where only scientific knowledge and solutions are valid.

From a democratic point of view the public need the possibility to discuss science in an equal way. The research also need perspective and feedback from the general public in order to produce better knowledge than today. Knowledge may be available but it may also be inherently inaccessible unless it is "integrated" for people in a useful way, for instance by the "marrying" of experts with a more public participatory approach.

A strategy for the future

In short, an effective approach for communication of research and research results should build on a strategy which combines traditional one-way information, dialog with the users and accessibility (Grönkvist and Lagerlöf 1995).

How could such a model look like? Windahl (1994) has proposed the following model (slightly revised by myself):

MEANS	TARGET GROUP	FUNCTIONS
Research report	Researchers	Scientific merits
Translated research	Experts General public Decision-makers	General information Basis for decisions
Applied examples Education	Experts Sector specialists End-users	Basis for actions and decisions
Practical advise	End users	Basis for preventive actions
Practical actions	End users Consultants	Improvement Change

Figure 3. A model over the steps needed to transform research to practise, the different target groups and the function of the research results. After Windahl (1994).

The first level represent the research report, whose main target-group are other researchers, but other groups may be interested if they first have developed the interest through the second step, translated research. An underestimated problem in the field of health and safety is that the researchers are found in different disciplines, which means that they have to spend time explaining to each other not only the their own results, but also their significance, e.g. their contextualisation.

The next level represents the translated or processed research, which is the popular science report. This could be in the form of a press release, a short article about the new result or general overviews of a research area. It is directed to certain target groups. It can be of interest for the "educated" public, but is mostly aimed at specialists who want information about new results and about future adaptations. For decision-makers this information may give inspiration to new decisions or to acquire more knowledge.

The news report is often of special interest for the mass media, but is also needed by experts to be able to follow the research area and to get inspiration to solve new or old problem. The problem with the information presenting new results is that it is fragmentised and therefore a supplement is needed in order to increase the knowledge of the target group. The popular scientific overviews or education can serve such purposes.

An important function of the "translated research" is to indicate where to find new knowledge, but also to stimulate the reader to look for more complex information. Therefore is it important to tell the reader where and by whom the original research report is published. Another important task of the "translated research" is to show the interested public where the research frontier is. Sometimes this also has a normative function, especially in fields where legislation does not exists or is too old-fashion, such as electromagnetic fields or genotoxic research.

The problem with the translated research is that, if it should be used, it must be topic specific, easily accessed and also, if possible, action relevant. This forms special demands on research, which can not always be fulfilled. But it is still a problem that often the "How-knowledge" is missing, i.e. motivating and action-releasing information.

The next level is the applied example. This could be built on the result of research but just as often on a "good solution" fetched from a research-based development programme. In both cases there can be problem to use the examples because they do not reflect the reality of the user. Therefore, there is a need of a broker or an intermediator, who can use the example to draw conclusions, which are relevant for the end-user. The involvement of the users is important to derive this kind of research communication. Education and training are important tools to be used at this level.

The next level is the preventive or problem-solving research dissemination. There is a lack of research communication on this level – a lack that also is a problem of the health and safety authorities and supervisory bodies. Today, their main emphasis is on genetic solutions, and less of direct advise. Checklists, health and safety audits are one way, but it is very difficult to mass communicate this knowledge. It is mainly in a dialogue that this type of dissemination occurs.

This lack of relevant research results to be applied in practical action is even more evident when we are moving to the level of practical interference or development. We can find researchers directly participating with the workers in organisational or technical change such as in action research. These are case studies where the knowledge achieved is highly specific and difficult to disseminate to other organisations as well as target groups. To communicate research to this level, a strategy could be to train consultants to serve as brokers between the existing more general information and the specific preventive actions needed to be taken.

What the model tells us, in conclusion, is that as a sender you must be very clear about what message you want to present and to whom. For instance, the processed research produced in a popular scientific overview can usually not be used as a material for giving advice or to act. The information must be further processed and targeted to even more specific groups or problems.

Another conclusion is that the further you want to communicate your research, the number of messages and target groups tends to increase dramatically, which can put unreasonable demands on the original sender.

So I will end this presentation by leaving the crucial question to the participants of this workshop: How far and by which model should, for instance, a European organisation or a national research institute disseminate their research results?

References

Caws P. Communication lag. *Science and Communication*, 20(1)14-21.

Höglund L and Söderberg I. *The use of research information in the occupational health services*. Report from the Sociology department, Umeå University, Sweden 1992 (only in Swedish).

Johnstone J and Blumentritt R. Knowledge moves to center stage. *Science and Communication*, 20(1)99-105.

Grönkvist L and Lagerlöf E. Research, research use and knowledge use. In: Grönkvist L, Lagerlöf E (Eds). Arbetsmiljöinstitutet, Undersökningsrapport 16(1995)1-16 (only in Swedish).

LaFollete M. The transforming political landscape for science communication. *Science and Communication,* 20(1)5-13.

Lambert J, Muller J and Wichtl M. *Guidelines for quality assurance in research for occupational health and safety. First International Course on Safety Research*, NIVA, Lyngby Denmark, September 19-23 1993.

Nilsson K. What is research use and what factors are important for how research is used. In: Grönkvist L, Lagerlöf E (Eds). Arbetsmiljöinstitutet, Undersökningsrapport 16(1995) 17-20 (only in Swedish).

Schmandt J and Katz J E. The scientific state: A theory with a hypothesis. Science, *Technology and Human Values* 11(1) 40-52.

3. What does Prevention Research have to offer the Working Environment?

J.C. André
Director of Research and Studies
INRS, Avenue de Bourgogne, F - 54500 Vandoeuvre, France

> "Civilised man has given up a certain amount of happiness to obtain a heightened sense of security."
>
> <div align="right">S. Freud</div>

In his *Introduction à la pensée complexe* E. Morin states:

> "We have acquired hitherto unknown depths of knowledge concerning physics, biology, psychology and sociology. Science is successfully imposing empirical and logical methods of testing across an ever-widening field. The light of reason would seem to be chasing obscurity and myth into the nether recesses of the mind. Yet, everywhere, error, ignorance and blindness progress no less quickly than knowledge. I should like to show that these errors, sources of ignorance and danger have a common root that derives from the mutilating nature of the way in which knowledge is organised. Such a mode of organisation is incapable of perceiving or recognising the full complexity of reality."

Whether it be a matter of cause or of consequence, public confidence has been undermined, science has been questioned and found wanting. The current wave of lawsuits is adequate testimony to this. We have succumbed to a form of judicial folly at the same time as we have been caught up in a number of, both formal and informal, alarm or monitoring organisations. These structure are ostensibly designed for the protection of the man in the street, but perhaps just as much for the protection of the politicians that govern him.

In the meantime, the world of work is changing particularly rapidly, more rapidly than individual mentalities and culture in society at large. This gives rise to the central importance of "complexity", a complexity that derives from technological change, from the reorganisation of the workplace, the growth of service industries, globalisation, the ageing of the population, diminished job security and so on.

Conventionally, compensation arising in connection with occupational risks is established on the basis of a consensus between the demands made by employees, represented by trades unions, and companies required to pay damages to those whose health or integrity has suffered, in one way or another, as a result of their work activity. This state of affairs involves what is traditionally termed "risk mastering".

This reciprocal or bi-polar arrangement has recently been modified by the emergence of a new factor. Different associations or action groups, acting in the name of society's general interest, have begun to pursue particularly effective forms of lobbying, with the result that the usual risk and hazard prevention system has been thrown off balance. A shift from a state of law to a state of lawsuits and, why not, even to a legal "free for all" is perhaps to be detected in this movement. Ensuing public concern is then passed on by the media reinforcing the sense of imbalance.

The fulfilment of their responsibilities concerning the improvement of working conditions supposes that research organisations engaged in the field of occupational health and safety must encompass a domain which roughly extends to science as a whole. Stated in the most general terms, this involves the reduction of the undesirable effects of work on individuals whether these be occupational diseases or work place related accidents. The size of such organisations – whatever Western country considered – is, however, manifestly insufficient to deal with the full range of the tasks allotted them. Nevertheless, there is general agreement in industry and business that progress has been achieved as attested, for example, by the drop in the number of work place related accidents.

All the same, the impossibility of fully covering the domain they are confronted with, the fact that information is made available prematurely or after the event coupled to the insufficient generalisation of information due to the mono-disciplinary or partial character of knowledge produced by research activities are all factors which increase uncertainty and further undermine public confidence. Heightened precautionary measures represent a possible refuge for some. They can easily appear as a sane and healthy response motivated by the highest human motives in an environment in which coherent, properly validated knowledge is lacking. Certain legal experts, not unlike certain political parties, advise such precautionary decisions as soon as there is even the hypothetical possibility of there being a risk. Naturally, policy options of this sort break with "classical" preventive measures which are applied once a risk has been identified (i.e. risk mastering).

What might be termed the "ideological" character of reactions of this sort is likely to modify the context in which institutes working in the domain of workplace health and safety operate. Such institutes are required to propose satisfactory solutions to the questions posed by their various partners in both the enterprise and social security domains. In France alone, occupational risk and hazard prevention research must respond to the needs of 15 million employees, 1.5 million companies, 6,500 company medical officers, 16 regional health insurance funds, 4 general social security funds, one national health insurance fund (not forgetting the importance of both direct and indirect ties to the French Ministry of Employment). Effective action is thus further diluted due to the multiplication of "clients" with a consequent loss of efficiency and hence of public confidence.

How should a research institute specialised in risk and hazard prevention react when faced with a complex, often obscure set of forces in a rapidly changing working world (if only because of the number of different organisations with

which it has to interact)? How does the institute ensure its contribution to the general well being – through its ability to supply preventive, technical, socio-technical and scientific "products" – in a framework characterised by uncertainty not to say irrationality?

Two potentially mutually antagonistic propositions might be made:

1. The first consists in anticipating the social requirements arising from the risks produced by the interaction between employees or workers and the production system (whether these are material or not). This involves translating such social requirements into research activities but also recasting them in suitably appropriate forms of communication. In such top-down driven operations, several professional domains and skills must be harmonised. As in any human venture, interdisciplinary activity is never an easy matter but the "clients" none the less expect it. To make do with partial, or even worse, with one-sided or biased solutions when serious problems are involved – problems with direct consequences for the lives of men and women – is invariably to fall far short of the mark.

To this can be added the requirement that research and study activity offer feasible solutions in the face of the socio-economic imperatives confronted by the clients themselves. This imperative necessitates developing the quality of scientific and social evaluation (good working practice). Nevertheless, as has already been mentioned, the activity of researchers – possessing specialised but fragmented knowledge – remains hesitant in relation to the complexity of the world with which they are confronted. Under such conditions, a diagnostic approach aiming to limit uncertainty cannot be wholly deductive in nature. Approaches of this sort necessarily also depend on accumulated experience (expertise relying on inductive perspectives or practical know-how), relational and communicational skills, etc.

How are social requirements to be met if the goals set by the practitioner have not been fully anticipated? Indeed, it is not all that easy – a perennial characteristic of the activity of all INRS type bodies in the Western world – to produce an objective, rapid and "credible" approach to the definition of the fields to be explored. Moreover, in pursuing different tasks should one aim to respond directly to what has been requested or to respond instead to needs or even bring as yet unperceived needs to the attention of the organisation that will potentially benefit from the implementation of solutions to such needs?

It is not difficult, therefore, to see to what extent such an approach-orientated, by definition, towards the prevention of occupational risks – involves uncertainty as to quite how to act. It nevertheless remains true that it is advisable to define both target goals and the different course of action, including different modes of communication, enabling their realisation.

2. The second proposition is freer of incertitude and "risk mastering" difficulties. It is based on the relatively stable disciplines of the sort found in any institute and involves a bottom-up approach to the task at hand. At a hypothetical level it can be assumed that for a given piece of published work there will be at least one "satisfied" client. Another advantage from this perspective is that complexity in work tasks can be circumvented by simplification of supposedly complex situations or by breaking such situations down into their elementary components.

A didactic approach is thus generated, one which relies on the "art of logical demonstration" progressing step by step from the simplest elements. Such a "normalised" not to say "Cartesian" perspective epitomises, to a greater or lesser degree, mono-disciplinary university teaching founded in the science of exact reasoning drawing on tried and tested proofs. In such cases, communication channels are easily opened into the scientific media turned towards the traditional and, for that matter, elitist process of validation by peers.

However, organisations involved in basic research are notoriously accustomed – whenever a space without rigid financial constraints opens up before them – to undertaking research independently of specific, previously defined goals. This involves a framework, which might be termed "generalised social irresponsibility". The freedom to define courses of action and goals to be achieved that is typical of such contexts coupled to the possibility of collaborating with individuals skilled in practically the whole range of scientific domains enables diverse and detailed research. However, such a model entails a large number of researchers and does not correspond to the applied research activity typical of the work undertaken by INRS. In such a context INRS is unable to develop autonomous strategic forms of action.

As a result, this second proposition with regard to available strategic courses of action is markedly remote from "social evaluation" by the world of work. On the other hand, it might be a powerful contributing factor to the quality of the "brand image" enjoyed by a publicly controlled insurance fund which thereby shows itself capable of generating internationally validated scientific research papers. Is this enough to encourage the unqualified confidence of those whose immediate concerns are governed by the world of work?

It can, nevertheless, be recognised in principle that this sort of approach undoubtedly affords the researcher greater peace of mind given that it implies an elitist strategy divorced from the definition of the ties with concrete social or societal measures. These latter require the establishment of goals – the project – and the mobilisation and co-ordination of human and financial means in the quest for operational efficiency.

To further economic development in a social framework – with the limitations imposed by finite means and specific project goals – or else to be a shop-window or an element in the self-promotion of a publicly controlled insurance fund concerned with occupational risks: such is the dilemma! Reality, as ever, is less Manichean. There are numerous grey areas just as there are a number of centri-

fugal tendencies, which arise from the complex interactions of science, technology, society at large, risk and hazard prevention measures and politics.

Having outlined this very general framework – made up of the different interests, cultures and ideological and political engagements affecting all individuals involved in industrial an business environments – the present article aims to define the way in which health and safety information circulates in relation to the different protagonists involved (the "clients"). It also includes a number of remarks concerning the development of research products designed to satisfy – in so far as possible – societal requirements and needs in the field of risk and hazard prevention.

I - Self-promotion and information in the public domain today

P. Lecomte de Nouy writes in *L'avenir de l'esprit*:

> "The force and prestige of scientific argument lies in its rigour, its clarity and in the confidence it has in the events on which it is based: observed scientific facts, or perhaps preferably, facts that have been properly subjected to recognised control mechanisms and which are, as far as possible, repeatable. However the number of people that can bring these facts together and who are then able, after having subjected them to criticism, to draw legitimate conclusions arising from logical reasoning grounded in all previous experiments, whether performed personally or otherwise, remains extremely limited."

In this statement there are two complimentary aspects. The first is linked to the quality of practical methodology, the second to individual competency.

Whatever the course of action undertaken, quality is an unavoidable factor in building up confidence. Indeed, in published work, whether that work is scientific or based in occupational safety and health (OSH), it is almost always impossible to subject the results attained to fundamental criticism (unless the same study is undertaken). By contrast, it is possible to question the hypotheses assumed and the conclusions drawn in a given piece of research. Moreover, in our domain, quite distinct networks have to be dealt with – as much internally as externally – as these involve overlap between science, society and the politics. It is far from impossible that overlaps of this sort enter into conflict with one another (a state of affairs arising from the influence of socio-economic factors which distinguishes the domain in question for us from the state of affairs to be observed in the case of "academic sciences").

The quality of such work is attested to by the evaluation undertaken by peers when INRS researchers publish in international scientific journals. Such factors belong to the "display of elitism" already mentioned above. Yet, it is also a fundamental aspect of any researcher's activity.

Given the size of the institute, a researcher cannot (above all must not) take on basic research which is best undertaken – and more efficiently undertaken – in more specialised contexts. In such a framework, scientific departments should be

orientated towards the reformulation of knowledge originating in research centres in such a way as to render it of concrete use in the OSH field. To achieve this end, they must naturally be familiar with the language and concepts of those with whom they co-operate. This, naturally, imposes reciprocal collaboration and publication in scientific journals.

The next stage in the communication process – *scientific* research work undertaken with an aim to preventing occupational risks – can be broken down into several different types of action. These should be distinguished from the often generous desire to offer more prescriptive forms of action.

- Observation and measurement of phenomena. There is a ready overlap between application and scientific research through the definition of validated methods of measurement. Scientific publications are "translated" for the prevention sector with this goal in mind. This covers prevention departments in the different health insurance funds and their control laboratories, occupational physicians and other medical specialists working in the professional sector, the business sector, ministerial bodies and so on.

- Understanding of the "reactions" of workers in the professional environment. Work in this domain involves industrial toxicological and epidemiological studies in industrial and business environments. These are traditionally published in scientific journals in which article selection is determined by reviewing committees under the control of peers. The reason for this is that these journals represent elements (admittedly fragmentary elements) that serve to draw the attention of public authorities towards the nuisance studied. This supposes both identification of the likely effects (and of the mechanisms involved in these effects) on the individual at work.

- Prevention engineering which aims to supply prevention products relying on advice which is itself dependent on forward-looking technical and socio-technical methodologies. In this context, it is a question, after identification of potential dangers, of suggesting how undesirable effects on individuals in the workplace might be diminished. Work in this field typically involves the integration of prevention principles from the design stage onwards, the development of cleaner and more reliable alternative processes in the workplace and finally the elaboration of collective or individual forms of protection.

- Communication channels are extended in such cases to include aid in bringing products up to national and international standards including European certification, patents, relations with partners in business and industry and technological valorisation.

The different grey areas in the "quantifiable" circulation of information are well enough illustrated by the above three domains in which INRS operates. To this might be added the presence of an underlying, less immediately visible world but one which is, nevertheless, extremely important. This involves advice given directly to prevention departments connected to regional health insurance funds and more generally to the world of public service, notably to the French Ministry

of Employment. This apparently "thankless" task is *de facto* one of the best channels in the construction of relations between the INRS and its "clients".

For the institute, the information generated by research should not simply be stored up in data banks! The goal of such knowledge is not the construction of a personal research *ethos* but above all the furthering of general well being. Given the complexity of the systems and phenomena to be dealt with, it is possible that at least a part of the problems encountered in the world of work can be overcome by depending on the researchers' expertise (without this necessarily involving research activity).

Close links with the actual world of work activity prevents the partners in this sphere from feeling that the expression of their own point of view has been precluded by the presence of an expert, the "only" ultimate decision maker because the only one in possession of the necessary competency. However what, it might be asked, does expert opinion amount to in a new field which the expert has not yet investigated on a scientific basis (need for research activity)?

To quote E. Morin once again, this time in *Science avec conscience*:

> "Specialisation does indeed include enhanced competency, as progress is built into the organisation of work which, in turn, allows for the development of knowledge. However, it also involves regression as the fragmented or unconnected forms of information, which thus emerge represent the development of mutilated forms of knowledge and such mutilated knowledge necessarily leads to mutilated forms of practice."

In this light, it is possible to argue that individuals involved in companies and prevention activity serve, if needs be, to send researchers back to their copy books. This requirement is partially fulfilled by contacts involving advice and training.

Hence, in the general context of the links between science and society at large, the INRS makes use of different media. Concretely, these involve:

- Scientific journals, which emphasise the scientific quality of INRS, research without this necessarily involving a link to practical application in the world of work;
- Journals specialising in prevention for specialists in the domain. INRS publishes two journals, the *Cahiers de Notes Documentaires* published quarterly with a circulation of 10,000 copies, *Documents pour le Mèdecin du Travail*, published in collaboration with the French Ministry of Employment under the same conditions but with a higher circulation of 11,000 copies. These two sources of information represent the "everyday" activity of the Institute's scientific and prevention departments and as such serve as useful bridges between research and all those who are directly concerned by the prevention in the occupational safety and health domain.
- Journals designed for the world of work: *Travail et Sècuritè* with a monthly circulation of 67,000 copies, *Prevenir les Risques du Métier* of which 210,000 copies are published and delivered to numerous companies.

These publications, backed up by technical manuals or guides, posters, video films, CD-ROMs and so on, represent a possible link between the context in which knowledge about prevention is generated and the world in which it is applied. Uncertainty is to be found here, once again, in connection with the difficulty of integrating the full range of knowledge required in order to meet the needs of companies and workers. This is accentuated by the risk of diluting information in order to render it accessible to the general public.

The classical debate, in other words, between the quality of the expert's research and confidence in published work in professional and risk and hazard prevention domains continues.

To quote E. Morin writing in *Science avec conscience* for the third time by way of conclusion to this section: "Progress in scientific certainty leads to a progress in uncertainty". This problem remains fundamental to research into the improvement of our links with society at large!

II – And Tomorrow?

The factors presented above illustrate that a generally appropriate structure is already in place in so far as relations with the environment of the everyday working world are concerned. Nevertheless, two remarks, from which the necessity of further progress can be inferred might be made. They correspond – on one hand, to the definition or otherwise of the strategy to be adopted in reaction to public concern – even to the development of a certain "ethics of fear" and – on the other hand, to the improvement of our ties with the different individuals involved in risk and hazard prevention and the world of work.

J. Adams in *Risk* states that

> "everyone is a genuine expert, in the original sense of the term, when it comes to questions of risk. Practice and experience represents a form of 'risk management'. The process of trial and error by which we learn to crawl, then walk and talk involves decision-making in the face of uncertainty. In our motor development, we progressively refine techniques for the taking of risk."

The company employee is concerned at a personal level, for his or her part, by the risk he is supposed to master outside of the working environment.

The intuitive understanding that each of us possesses must transform itself into relevant information. Such information should have undergone as little distortion as possible (problem of adapting research to the public at large) as this represents a necessary condition for an open, democratic society. Nevertheless, the suspected presence of a risk sometimes generates contradictory studies concerning the same subject. The result is perplexity in a world of work where unambiguous solutions are evidently preferable.

The inability of the scientist to give firmly affirmative replies or to cover the whole field he is confronted with – coupled to the multiplication of new factors to

be taken into consideration, some of which might appear alarming – tends to heighten public concern. As I have already argued, in this modest essay, science can often but grope in the dark and any news item which satisfies the media's appetite for sensationalism is quickly snapped up. What is to be done?

First of all, in the absence of a crystal ball enabling the prediction of accurate information about the future, it is necessary to negotiate a broad consensus within society at work concerning the strategies to be adopted. Indeed, there are limits to what can be achieved in industrial or professional environments orientated towards finding rapid solutions to immediate problems and which are, as a result, eager to have answers to questions that have hardly yet been put into words. It is advisable to make it clear to individuals in companies and in risk and hazard prevention sectors what ends we are aiming for and above all how we intend to achieve what we set out to do.

Similarly, in so far as this little corner of the universe working in risk and hazard prevention is concerned, it is necessary to state clearly what will *not* be attempted due to lack of time, means and personnel. This strategy of controlled limitation of goals should be made explicit and explained. It depends on the hierarchical organisation of activities into priorities of descending importance coupled to the making of unambiguous and responsible choices. Dialogue, negotiation, alliance, confidence are key words, therefore. They provide the very basis to effective communication. This, however, is easier said than done given the size and shifting character of the field to be explored.

Another strategy consists in laying down the grounds to co-operation with other research organisations: centres devoted to basic research, INRS counterparts elsewhere, technical research centres etc. This allows for the widening of the horizons available for potential action. The development of European networks is a possible means of generating such useful synergies.

Nevertheless, co-operation of this sort is only possible if joint action can be undertaken in such a way as to ensure operational efficiency. Indeed, if small-sized research teams in each comparable organisation act in harmony, it will be necessary to overcome cultural differences alongside difficulties arising from geographical distance even if Internet will probably make communication easier.

The building up of such networks represents a fundamental factor in enhancing transparency if the actual effectiveness of research groups organised in this manner remains, on average, far from optimal. As a result, the restructuring of activities implies the ability to function relevantly at a national level. At the same time, the harmonisation of well-structured key sectors – and the necessary support that this entails – is alone likely to produce the conditions under which the timely synergy involved in useful risk prevention research and information is made possible.

Hence, the change of scale, the shift from France to Europe, should undoubtedly be accompanied by the reinforcement of national specialisation, a move that cannot be achieved by simply clicking one's fingers. However, it can serve, no doubt, as a means of avoiding the simple accumulation of published work as this

represents a possible danger of side-tracking the system when it is not a factor in the system's increasing entropy.

The place of the "client" is another subject for reflection in what is in effect the negotiation of a contract, a contract to be made clear to society at large and defined by mutual agreement between INRS and the world of work. The client's role should not be situated at the end of the chain so that he or she simply gives the thumbs up or the thumbs down to the propositions and work offered by INRS.

The institute should not attempt to construe this contract as a *carte blanche* or an alibi, but must rather constantly interact with its "client partners" with an aim to obtaining feedback on the quality of its products and to diminishing, in so far as possible, the uncertainty (the gap), which characterises its relations with industrial and business environments.

Such a perspective represents an opening up of research so as that it corresponds more directly to social requirements. Courses of action undertaken should have a marked sense of social utility (what else could be their justification!) and hence they should be at once open to scrutiny, they should be quantifiable and subject to validation including validation by the media.

Working from a "photo fit" picture of its clients – the "consumers" of the research generated by INRS – it is necessary that an intermediary provides feedback to both partners (downstream $\leftarrow\rightarrow$ upstream). This feedback involves the progress made – as this often implies multidisciplinary factors – in the solutions offered to the felt requirements of business and industrial environments. Such organisation also necessitates, besides the multidisciplinary aspects, the internal resolution of human relations and organisational and managerial questions. This is roughly what is expected of the project leaders appointed by INRS in order to further applied research in those domains concerned by risk and hazard prevention.

In the course of their professional activity, they are (and will increasingly be) brought into possession of an ever deeper understanding of the range of influences which allow for the achievement of an objective. This necessary integration of knowledge and know-how (including information and communication) allows researcher's to adapt their communication strategies to meet demand more directly. However, it will no longer be possible to publish such developments – the result of a global and strategic perspective with regard to causes and effects – according to scientific discipline, as it is unlikely that such orientations will attract the attention of most scientific journals. Instead, communication will be orientated towards other channels more directly adapted to the actual problems encountered in the workplace.

The considerable changes outlined above necessitate harmonisation between a relatively high number of operators (including information specialists, trainers, experts, researchers etc.). The intensification of activity and transparency that this entails will probably simultaneously imply a diminished number of risk and hazard prevention subjects to be covered. This development, associated with national, European or even international co-operation, should also be negotiated with the representatives appointed by society at large.

The assumption of publicly declared responsibility for only a partial cover of the prevention field to be explored – in agreement with the various different partners – is no doubt a factor tending towards the reinforcement of public confidence. It corresponds effectively to a "contract" between the institute and society at large in a framework governed by openness and transparency. The activities "negotiated" correspond to the "risk mastering" concept and as such represent, by and large, general agreement as to what constitutes an acceptable as opposed to an indemnifiable risk.

As F. Ewald writes:

> "Precaution refers to the attitude of someone who is informed that beyond the risk he controls and he can measure, he must take into account a degree of risk that he is not yet aware of but which, in the future, might well come to light under a changed state of scientific development."

The institute does not actively commit itself to this notion. Indeed, it represents displacement of problem-solving approaches associated with technical or socio-technical domains towards "political prudence". It is thus an aspect of the media introduced imbalance discussed above coupled to the difficulty of supplying the professional environment with appropriate information in relation to the full range of its requirements.

Nevertheless, clear public declarations of the institute's strategy, a certain degree of specialisation, the reinforcement of the institute's ties with concrete workplace situations and the development of exchange programmes (particular in the European framework) are all significant elements in building up satisfactory levels of confidence in the institute's activity.

The INRS' desire that such strategic research plans give rise to useful methodologies and results should be made clear to society at work. Hence, the changes rapidly sketched in above should be converted into concrete modifications in modes of thought and action. Naturally, this also involves – in association with information and communication specialists from the outset of the programme – mutations in the channels of communication employed in the publication of research results.

Finally, changes in modes of action and "production" imply a potential strengthening of our ties with European counterparts and the European Agency in Bilbao – centre for the dissemination of occupational safety and health information – in particular.

III – And After?

Good intentions are not enough if the exploration of the concrete reality of phenomena linked to the world of work is to be furthered. Active commitment to change is necessary.

Nevertheless, even if confidence is built up at a local level through the experience acquired as a result of the encounter between the researcher and industrial and business environments – as this allows for self-correction – it remains the case

that long term strategy must still be worked out in a field characterised by deep uncertainty.

In principle, such long-term strategy entails familiarity with the world of work, with the requirements of this world and the recognition of the social utility of previous propositions and courses of action. However, the limits to such a strategy and the grounds to a heightened sense of responsibility are found in accepting that none of us have a crystal ball which enables us to make certain predictions about what will take place in the future.

First of all, mutations arising from accidental or pre-programmed events in the social or political spheres may lead to transformation of the strategies adopted. These depend on the institute's personnels' good will and capacity for action, something, which might limit the dynamism of development with regard to the world of work (problem of reaction time).

Even if the perspective, that this opens up, is imperfect – defined by real understanding of the problems involved, by inductive experience, chance factors and unexpected encounters – it nevertheless remains the case that negotiation with society at large cannot be by-passed. However, agreement will only be achieved on the basis of principles and procedures enabling *current* interests to make their voice heard. Shows of strength in an effort to gain recognition for these interests are inevitable.

E. Kant claimed in *Fundamental Principles of the Metaphysic of Morals*

> "in moral matters, human reason, even when considered from the point of view of common sense, can easily be brought to a high degree of certainty and perfection."

In such a framework, Pascal's wager is inevitably won and the proposed measures always go in the sense of *long term* developments.

However, social development is a highly complex system which is particularly sensitive to initial conditions (cf. the "butterfly wing paradigm", the notion that the beating of a butterfly wing's can produce significant climatic turbulence). In developing within an ethical framework, periodically validated by others, improvement of knowledge about the world of work can have an extremely important impact on the place of individuals in the industrial and business environments. This supposes a cumulative effect (memory) if it remains the case that it is quite possible that, in the process, there is considerable drift away from what had initially been envisaged.

H. Jonas claims in *Le principe responsabilité* that

> "the future has no group to represent it, it is not a force which can be enrolled on one side or another in a debate. What does not exist has no lobby and those who have not yet been born have no power".

How are the sometimes chaotic, sometimes obscure developments of the world of work to be approached from the point of view of a redefinition of risk and hazard prevention objectives? Will an intuitive attitude to values be enough to form a

bridge between the present and the future? In this respect, is it possible to define an ethics of the future?

These digressions would seem to have taken us away from the central core of the subject at hand: the communication of results in the sphere of health and safety at work. In a world characterised by rapidly changing socio-economic factors – the creation of the European Union, globalisation, modes of work organisation – the setting up, at an informal level, of a watchdog body is something to be seriously envisaged. Such a body will make greater finesse in decision making more practicable whilst offering, if needs be, re-orientation with regard to previous actions. In short, it is a question of sharing engagements made in the domain of professional risk and hazard prevention research in a complex and varied environment in which industrial and business factors are of prime importance.

Such communication must be worked out in joint collaboration with the currently available media and their different modes of functioning. Can our choices be invested with a greater sense of direction in this emerging world?

Acknowledgements

> "Intelligent people often resist confronting certain problems head on or envisaging certain solutions coolly and rationally if they break with their convictions or feelings. Most people prefer to prove that they are right rather than they aim for lucidity."
>
> P. Lecomte de Nouy

Brief Bibliography

Latour B. *Le métier de chercheur; regard d'un anthropologue*. INRA Ed., Paris (1995).

Gagnepain JJ and André JC. *Les savoirs de l'ingénieur*. In: Barbier JM, Puf (Ed). Savoirs théoriques et savoirs d'action", Paris (1996).

André JC. *Et si la pluridisciplinarité n'existait pas?* Report to CNRS, 109 pp. (1995) and references therein.

Morin E. *Science avec conscience*. Fayard Ed, Paris (1990).

Morin E. *Introduction á la pensée complexe*. ESF Ed., Paris (1996)

Steele LW. *Gérer la technologie.* AFNOR Gestion Ed., Paris (1990).

Lagadec P. *Etats d'urgence; défaillances technologiques et déstabilisation sociale*. Seuil Ed., Paris (1988).

Salomon JJ. La Science et ses malaises *Futuribles* 236, 25 ñ 38 (1998).

R. PROST Ed. "*Concevoir, Inventer, Créer - réflexion sur les pratiques*" LíHarmattan Ed., Paris (1995).

F. EWALD "L'acceptabilité du risque au seuil du XXIème siècle: de nouveaux modes de régulation s'imposent" *Passages*, 93, 22-24 (1998).

Medium Term Research Plan. INRS, 1998 - 2002.

Genelot D. *Manager dans la complexité*. INSEP Ed., Paris (1992).

Sicard M. *L'annèe 1895 – L'image écartelée entre voir et savoir: Collection "les empêcheurs de penser en rond.* Paris (1994).

Vynck D. *Sociologie des sciences*. A. Colin Ed., Paris (1995).

Salomon JJ. *Le destin technologique*. Balland Ed., Paris (1992).

Caro P. *L'oiseau jardinier: la science est-elle un humanisme?* Belfond Ed., Paris (1986).

Bonnot G. *La vie c'est autre chose; les hommes malades de la science*. Belfond Ed., Paris (1976).

Prades J . *La techno-science: les fractures des discours*. L'Harmattan Ed., Paris (1992).

Bachelard G. *La formation de l'esprit scientifique.* Vrin Ed., Paris (1972).

Gusdorf G. *De l'histoire de la science à l'histoire de la pensée.* Payot Ed., Paris (1977).

Cara Costas P and Muldur U. *La société ultime frontière.* UE – OPOCE Ed., Luxembourg (1997).

Revel JF. *La connaissance inutile*. Grasset Ed., Paris (1998).

Badiou A. *L'éthique.* Hatier Ed., Paris (1988).

Godet M. "*Emploi: le grand mensonge*. Fixot Ed., Paris (1997).

Lecompte du Nouy P. *L'avenir de l'esprit*. Gallimard Ed., Paris (1941).

Jonas H. *Le principe Responsabilité.* Flammarion Ed., Paris (1990).

Kant E. *Fondements de la métaphysique des moeurs*. Delagrave Ed., Paris (1934).

"Ideology lies in wait on the edges of science at each point at which scientific rigour falters but also at that extreme point at which current research reaches its limits."

L. Althusser

"Transparency does not indicate where the good is, but it pushes back the evil."

F. Guiraud

"Never before has society had so much information at its disposal and never before has it been in possession of less certainty."

J. Voge

4. Dissemination, receipt, utilization, and impact of information

P. A. Schulte
PhD, Director of Information and Education
NIOSH, Cincinnati, USA

Today I will describe the dissemination efforts at the National Institute for Occupational Safety and Health (NIOSH). NIOSH is both a research institution and a public health institution. We conduct a wide range of programs–from etiologic and intervention research to dissemination of our materials. These activities are summarized in our vision: "Delivering on the nation's promise: safety and health at work for all people through research and prevention."

NIOSH publishes more than 200 journal articles and documents each year.

Figure 1. NIOSH Publications
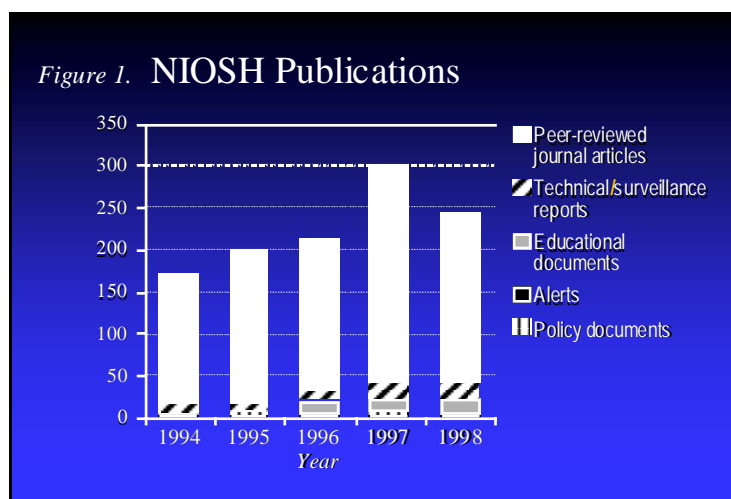
Most of these occur in peer-reviewed scientific journals. However, some are technical reports, educational documents, various kinds of health and hazard alerts, and policy documents. Our materials are directly disseminated through peer-reviewed journals, patents, research partnerships, and databases. NIOSH policy, technical, and educational documents are disseminated in paper and electronic versions. They are also mounted on the NIOSH Web site and are available for downloading. NIOSH has a number of databases that we share with the public through the NIOSH Web site and other sources. These include NIOSHTIC and the Registry of Toxic Effects of Chemical Substances (which is the largest toxicologic database in the world) and various surveillance databases that pertain to a wide range of topics such as traumatic fatalities, injuries, blood lead levels, and sentinel health events.

Direct dissemination:
- ♦ Scientific journals
- ♦ Hazard evaluation reports
- ♦ Patents
- ♦ Research partnerships
- ♦ Databases;
  - • NIOSHTIC
  - • RTECS
  - • NTOF, ABLEs, NEISS, SENSOR

The effort to address a broader understanding of our materials (known in this meeting as "vulgarisation") includes the use of a telephone helpline, the Internet, NIOSH Alerts, brochures, worker notification, our exhibit program, and curricula for workers, employers, and occupational safety and health specialists.

Vulgarisation:
- • Telephone helpline (800#)
- • Internet
- • Alerts, brochures
- • Worker notification
- • Curricula for workers, employers, OSH specialists
- • Exhibits

We receive more than 130,000 telephone calls annually on our telephone helpline, and increasingly we are receiving inquiries through the Internet. The number of hits on the NIOSH Web site has grown almost exponentially in the last few years, and we expect that this number will continue to grow. The Internet is becoming a primary way of accessing NIOSH information. We have no systematic appraisal of who does and who does not use the Internet. However, during this transitional period of technology, it is important not to assume that everyone will be turning to the Internet at the same rate. We also need to determine where there are pockets of workers or employers who are less likely to access our materials and to whom other channels of communications are very important. Hits for the NIOSH Internet site have been doubling each year, with 7 million hits in 1998 (Figure 4).

Figure 4. Hits on the NIOSH Web Site
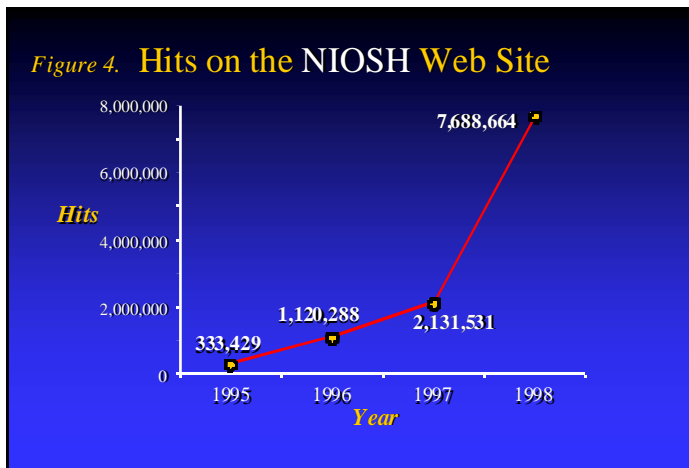
We are now evaluating our Web site to determine how to improve it. We believe that the Web site is actively used by those who serve as mediators between research information institutes such as ourselves and the workers.

In the NIOSH dissemination pathway, "valorisation" is the development of materials available to enhance decision making and prevention activities for safety and health.

Valorisation:
- Criteria Documents
- Hazard Reviews
- Current Intelligence Bulletins
- Best Practices Conferences
- Curricula developments
- Skills standards
- Policy development
- Technology transfer

These materials are aimed at specialists or more technically prepared individuals. Valorisation is accomplished through the development of criteria documents, hazard reviews, Current Intelligence Bulletins, best practices conferences, curricula, skill standards, policy development, and technology transfer. We have found that in both the vulgarisation and the valorisation efforts, it is often difficult to get research scientists to participate. Their focus is usually on a research, and the translation and dissemination of their information is often not a primary area of interest. NIOSH has made great strides in finding ways to support cross-divisional, cross disciplinary, and cross organizational interactions for the production of these information materials. Developing documents that translate our materials for all levels of the population is an important priority. But it is still difficult to build positive internal incentives for conducting such activities. This challenge is faced by all organizations such as ours. Nonetheless, as the statistics
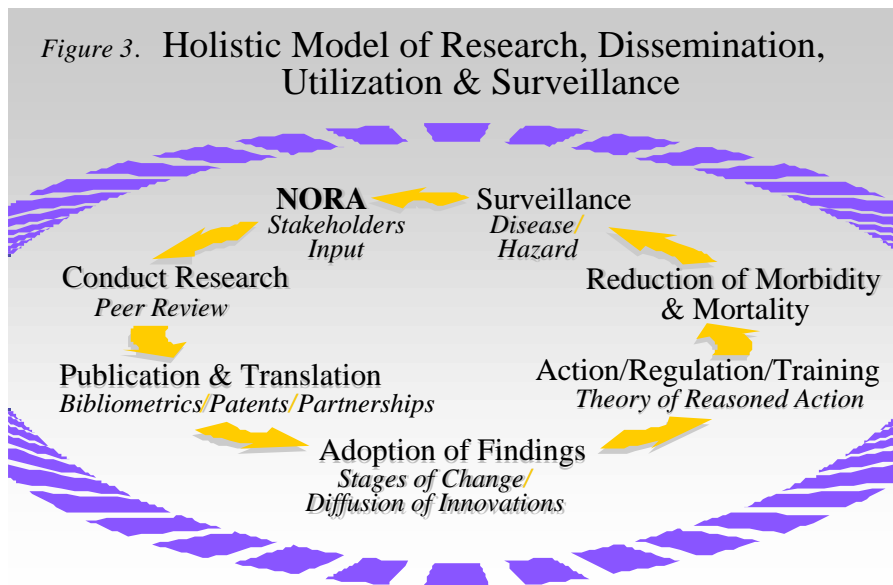
34

show, we have increased the number of various documents that we develop over the years.

Critical in the dissemination of information (and ultimately in the receipt and use of information) is the adoption of approaches that involve both the sender and the receiver.

Old Model	New Model
• One-way	• Social marketing/Audience segmentation
• Broad reach	• Electronic medium
• Paper medium	• Interactive, *"just-in-time"*
	• Focus on small business
	• Easy to read
	• Target decision makers

Under the traditional model, most of our communications were one way – from us to workers, employers, and professionals in the occupational safety and health community. They were broad in their reach, targeted to reach many different audiences at once, and they essentially used the paper medium. We now have a newer model, which we have been working on over the last few years. This model involves adoption of the principles of marketing, as they are applied to public and occupational health. Known as "social marketing", this model uses techniques such as "audience segmentation", which involves assessing an audience for differences within it, and looking for subgroups with common interests and needs, and targeting communications to these subgroups to achieve a better response. In addition, we are increasingly switching from paper to electronic media, and we are moving toward media that allow interaction and provide information when a person needs it. Such information is known as "just-in-time information." In addition, we hope to focus more on small businesses – an area that has never been a direct target of the occupational safety and health community and appears, in fact, to be in critical need. We also want to focus more on making our material user-friendly—that is, we want to produce documents that are easy to read, easy to access, and easy to use. Finally, we need to think holistically about dissemination and about the ways in which new information can be adopted and used. This approach requires, in part, the use of theories about organizational and social change, the stages of change, and the implementation of innovations that have been well known to social scientists and communicators and can be applied to the occupational environment as well (Tinker et al., 1998; Geisler, 1996).

Consider a circular model, with the direction from the conduct of research moving toward the reduction of morbidity and mortality (Figure 3).

Figure 3. Holistic Model of Research, Dissemination, Utilization & Surveillance

NORA
Stakeholders Input

Surveillance
Disease/ Hazard

Conduct Research
Peer Review

Reduction of Morbidity & Mortality

Publication & Translation
Bibliometrics/Patents/Partnerships

Action/Regulation/Training
Theory of Reasoned Action

Adoption of Findings
Stages of Change/ Diffusion of Innovations

Downstream from the conduct of research are the publications – translation of materials – as one major area. The publications are followed by the adoption of findings and the promulgation of actions, regulations, and training – all leading to the reduction of morbidity and mortality. This reduction is determined through various kinds of surveillance programs. However, it may often be impossible to link a particular piece of research directly with a particular rate reduction. Hence, surveillance for the health outcome may not be the best way to evaluate the impact of research. It might be better to have surveillance for a particular hazard or for some intermediate state. To set priorities for the conduct of future research, the surveillance data must be fed forward and intermingled with other stakeholder input such as the National Occupational Research Agenda (NORA) (NIOSH, 1996). Which brings us back to the beginning of the cycle.

As we look at the dissemination pathway, we can identify a number of types of research that could be conducted. With regard to scientific and other publications, bibliometric analysis (citation analysis) is one approach that we are using to access the use and impact of NIOSH research publications (Cozzens, 1997). In addition, we are conducting a variety of intervention research studies to assess the effectiveness and efficacy of various types of interventions, including communications.

The type of research that involves the adoption of new information should be theory driven. Two theories that may be helpful involve the *diffusion of innovations theory* and *stages of change theory*. With regard to the adoption of new findings, we clearly are interested in the adoption of recommendations at the group level. But within that level we are interested in the adoption of NIOSH recommendations by decision makers and the groups they represent.

Finally in moving from adoption to action, there is a need for research that could be conducted on enabling factors. This need includes research that identifies barriers to taking actions, research that identifies problems people face (including

safety and health considerations in conjunction with economics restraints) and research on compliance with recommendations. What fosters compliance? This type of research could be quite profitable in the occupational safety and health field. Although new occupational safety and health problems continually occur, many are due to long-known problems, and even to long-known solutions that have not been appropriately applied. In the model that I have been discussing, all the research on dissemination is expensive and needs to be thought of as bonafide and important. Such research should be given a high priority and the appropriate financial and staffing resources. In my opinion, the greatest problem in the occupational safety and health community has been the lack of appropriate emphasis on the research involved in dissemination, adoption, and utilization of information. This workshop is a step in addressing that problem.

References

Cozzens SE. The knowledge pool: measurement challenges in evaluating fundamental research programs. *Evaluation and Program Planning* 1997;20:77-89.

Geisler E. Integrated figure of merit of public sector research evaluation. *Scientometrics* 1996;36:379-395

U.S. National Institute for Occupational Safety and Health. *National Occupational Research Agenda.* U.S. Department of Health and Human Services, DHHS (NIOSH) Publication No. 96-115, 1996.

Tinker TL, Pavlova MT, Gotsch AR, Arkin EB, (eds). *Communicating risk in a changing world. Ramazzini* Institute/OEM Press. Beverly Farms, MA, 1998.

5. How the media covers R&D

Lars Grönkvist
Marketing Director
National Board of Industrial and Technological Development, Stockholm,
Sweden

Most people do get their impressions and information about research and development (R&D) via the media – by reading in the press, by listening to the radio, and by watching the TV.

Thus – media is their only and main contact with scientists, and with what is going on in this rapidly changing field. Very few get such information through education, training or through their own experiences. Journalists and their "news criteria" filter most of the information about R&D.

In general, R&D are not frequent issues on the news agenda – in Swedish media, for instance, there are very few "science journalists/reporters". Less than twenty Swedish journalists have experience of research, or any deeper knowledge about scientific methods – or any inside information about researchers' everyday life and their "working conditions".

Only the two biggest morning newspapers have a "science reporter" and they produce about one page a week in the section of entertainment, the state-owned broadcasting company has one programme every day of about half an hour.

Thus - the coverage in media is sparse. One explanation – and probably the most important – is that the "potential" target group of readers, listeners and TV-watchers is too small. To be straightforward – today, there is very little return in covering R&D.

It happens that "science news" is presented on the front page. One criteria of the selection is the ending "-est", such as the biggest or the smallest; the fastest or the slowest; the hottest or the coldest – or the newest on the globe. In addition, bad news sells often better than good news – or the riskier, the better. In conclusion – hell is more profitable than heaven. These simplifications, dichotomies, serve as signals to journalists and editors.

Media's coverage of science

Let us focus on what kind of science the media usually cover. During the 90's there has been an improved coverage of R&D. However, journalists have been focusing on specific themes or fields, such as biotechnology and space technology. In the field of biotechnology there has been a large coverage on cloning and genetic manipulated pigs/sheep – the presently most "risky" or "dangerous" technology.

More attention has also been paid to global issues, such as the greenhouse effects, other environmental problems, international economic development and

growth. In general, technology-related problems regarding quality of environment and public health will become more and more in focus.

I am sorry to have to say: "Occupational health and safety news has not a very high priority on the news agenda." A Swedish investigation about the Media and the Power in the Society – made just a few years ago – showed that even environmental problems were not ranked on the media ten-top-list. Occupational health and safety was not mentioned at all!

The media attention is very closely related to the business cycle; in a growing economy occupational safety and health related risks will have a higher ranking, while in a recession they will decline.

The meeting between a journalist and a scientist

A meeting between a scientist and a journalist might be very dramatic – at least the first time, since the prerequisites are not so favourable. Scientists mistrust journalists – and journalists mistrust scientist. At the same time they need each other.

The scientists need publicity to get more funding, especially in the field of applied research – because the political demand is much more outspoken. On the other hand, the journalist need scientists to cover this field of news – and very often to comment on events, such as accidents, new technologies, or, for instance, reports on dangerous substances.

The reciprocal mistrust may to some extent be explained by lack of knowledge about the professional context. Scientists in general know very little about news coverage and editorial priorities. The process from the interview – from writing, editing, editorial judgements by the news desk, layout, including choice of pictures and headline – to the printed article is not very well understood. Step by step, the article could be changed in such a way that the scientist does not recognise his own statements – and, of course, the reaction can be very negative, and reinforce the mistrust. Therefore, scientists need to know more about editorial processes and judgements in order to prevent mistrust and misunderstandings.

On the other hand, as I mentioned before, journalists have very limited information about scientific methods and judgements. Many journalists are guided by one theory – the theory of conspiracy – to mistrust authority, and, of course, this approach also colours their perspective on research. Therefore, there is a need of education and training among journalist covering R&D.

However, as a scientist or an expert you could never know how a journalist would use your information. There are several possibilities – as users of scientific knowledge journalists do not act very different from other users, such as policy-makers or decisions-makers. Scientific knowledge could, for instance, be used to:

- look for new ideas, concepts or trends,
- dress down a "unknown" opponent presented in the article or in the programme,
- legitimate a "thesis" in the article or in the programme.

This table may illustrate a meeting between researchers and journalists:

Researcher	Journalist
- abstract	- concrete
- principles	- events
- theoretical	- practical
- public: Colleagues	- public: The Public
- detailed	- the most interesting
- no time press	- time press
- careful	- speculative
- method directed	- results directed
- what we know	- what we can do

Source: Lindboe O. Dissemination of research (Formiddling af forskning 1984).

A journalist want concrete information, rather a CASE than a general message. As all of you know – the scientist will prefer abstract information. Researchers want to improve theories and methods whereas journalist are interested in results – to which extent results may be applied, to whom the results concern – and of course if results have any negative impacts. Two very important key words are "HOW MANY" – how many it concerns. To some extent, it determines what is newsworthy.

If you are wondering whether you have any newsworthy news or not – use the scheme below as a checklist. The more of the following criteria that are fulfilled, the bigger the chance it will be newsworthy in the media:

- Politics, economy, crime and accidents
- within short geographical or cultural distance
- with events or preconditions
- that are sensational or surprising
- and are about single elitist persons (very important people VIPs?)
- but are described in simple terms
- and are important and relevant
- and happen during a short time but as part of a theme
- and have negative parts
- and where the source are elitist people (VIPs)

If the message fulfils the first six criteria, you will probably find it as top news in the media.

Risk communication

An information officer, employed at R&D institute in field of OSH, has several times a month "risk information" which may attract the news agenda. However, from an information point of view, it is, if anything, a threat more than an opportunity. To some extent a more adequate problem is to how to avoid headlines and placards.

I will refer to two "cases" covered by media. One is about electromagnetic fields and cancer, and the other one is about hypersensitivity to EMF.

A Swedish epidemiological study showed that exposure to EMF from power lines might increase the risk of cancer, for instance brain tumours, especially among children. Epidemiological studies in the US supported the Swedish findings. The relationship was significant – but experimental studies did not verify the epidemiological findings. One assumption was that EMF could be a promotor – a factor, which promotes, but not starts the process of cancer.

The added risks due to EMF for a child to develop a brain tumour were, however, very low, and to suppress the findings was not an acceptable strategy – but in order to communicate the findings *in a proper setting* we tried to refer to other risk factors, for instance, smoking and traffic accidents. Hence, we were prepared to deal with a front page story. But we were disappointed, since at the same time the negotiations between the government and the non-Socialist group about a comprehensive reformation of the Swedish tax system was completed during the night before our press conference. Therefore, the EMF story was moved to the inside pages of the newspaper. The story also got little notice in the broadcasting and TV.

However, a few weeks later we saw this new's placard in Stockholm "**400 000 at risk of cancer!**" This is an example of "junk news". 400 000 – how come that the journalist did publish this number??

In Sweden we have registers of property and the population. Therefore, it is very easy to estimate how many people, who live close to power lines. The journalist's conclusion was, of course, that all of them were at risk. As I said before – if "how many" is THOUSANDS, the ranking on the news agenda will be very high. After that "power lines, EMFs and cancer" was a recurring story in newspapers, boulevard press, radio and TV.

The second case was based on the fact that "hypersensitivity to EMFs" was a frequent – and an increasingly – reported problem, particularly in Sweden, but also in Denmark, Finland and Norway. There was no "scientific evidence". The symptoms were self-reported and the findings of experimental studies were negative – which means that no causal relationships were verified.

"Hypersensitivity to EMF" was exploited by the media as a "soap opera". Hundreds of suffering people were reported in newspapers, trade union magazines, radio and TV.

The scientists were appointed as the "bad" guys, and the sufferers as the "good" guys. A typical news item: Outside the TV-studio a woman, suffering from hypersensitivity to EMF, was sitting in a dark caravan without electricity – and with a candle on the table. And the anchorman, the hero, was watching the truth.

Suffering people were exploited as entertainment. The intensive attention paid to the symptoms may have caused even more reactions – which means that the more people read or heard about it, the more people reported the symptoms they have read about.

However, researchers and national authorities were forced to "relevant" actions, such as further research, hearings and documentation. Suddenly, hypersensitivity

disappeared from the news agenda even before the results from the research was published.

Finally very briefly a third "case" shall be presented. In the beginning of the 90's the government – in order to stop tax evaders – introduced a coloured diesel, "green diesel", which was more expensive than the diesel used in agriculture work or in heating of houses. In a few weeks a lot of people, for instance lorry and taxi drivers, reported allergic symptoms. "Green diesel and allergy" were hot news in the newspapers, radio and TV. But – behind closed doors – the Director General of the National Board of Occupational Safety and Health said: "They are not allergic to diesel – they are allergic to taxes!" However, the National Board of Health and Welfare had to produce a scientific document – where no causal relationship was verified.

Of course, after this description you are wondering why I still am working as a research information officer/press officer. The answer is very simple – it is very difficult to deal with risk information, but a big challenge to try to be honest and be successful in the risk communication.

I think that mass media can be a useful tool in the dissemination process, but rather in a complementary way than as the main channel. Of course, the media can force politicians or trade union people to put an issue on the agenda. The media can inform readers, listeners or TV-watchers in general about a specific topic, but can hardly change the readers' attitudes and their behaviour. The mass media are appropriate to simple and general messages.

Some tip-offs for being successful when you meet a journalist:
- try to learn and understand more about journalistic judgements and their "production process",
- be well prepared,
- choose one – or two – main messages,
- try to tell a story – to give a face to your message,
- do not make any comments on other researcher's findings, particularly not during a phone call,
- do not lie – journalists love to hunt, and expose, a liar!

6. Education and Training as a Tool for Research Dissemination

Gisela Kiesau
Director, Professor, PhD
Bundesantalt für Arbeitsschutz und Arbeitsmedizin,
Dortmund, Germany

Given the rate of technical innovation and changes in the world of work, it is no longer possible to react to every new hazard with a new regulation. Those responsible in companies and administrations will in future have to tackle the problem themselves and, in collaboration with the employees, design safety and health protection in accordance with the circumstances prevailing in the specific company. Personal initiative and co-operation are the order of the day in company occupational safety and health, and this is in the basic interest of the companies and administrations concerned. Consistent precautionary measures also help ensure the durability of company-rendered services and their quality.

If, in the context of this workshop, I talk first about the funding possibilities available in the Federal Republic of Germany, I am doing this from the point of view of the Federal Institute for Occupational Safety and Health (BAuA), an authority directly responsible to the Federal Ministry of Labour and Social Affairs.

You will know from your practical work that in the Federal Republic of Germany there is a comprehensive policy framework for occupational safety and health which specifies the conditions for government and corporate action and which lays down the tasks and duties of the protagonists.

The world of work is currently undergoing a phase of thorough-going change, which can be characterised among other things by the following trends:

- the globalisation of markets,
- the growing importance of the service sector,
- a growing proportion of the workforce accounted for by small and medium-sized enterprises,
- ageing workforces,
- changes in employment conditions
  (e.g. temporary part-time working, telework),
- customer orientation and quality management.

Our society is on the way to becoming the communication and knowledge society.

Companies wishing to offer high-quality products and services under these framework conditions need employees who are healthy, highly motivated and

qualified to absorb and use innovations. Occupational safety and health protection are, in this connection, indispensable conditions for an economically successful company. Accidents mean disturbed production and work-related health hazards may reduce the employees' working efficiency. The preventive organisation of working conditions is a basis for rendering effective services in modern work organisation.

Companies which promote safety and health at their workplaces thus cut sickness-related costs and increase productivity. The result is a healthier workforce with greater motivation, enhanced work morale and an improved working atmosphere.
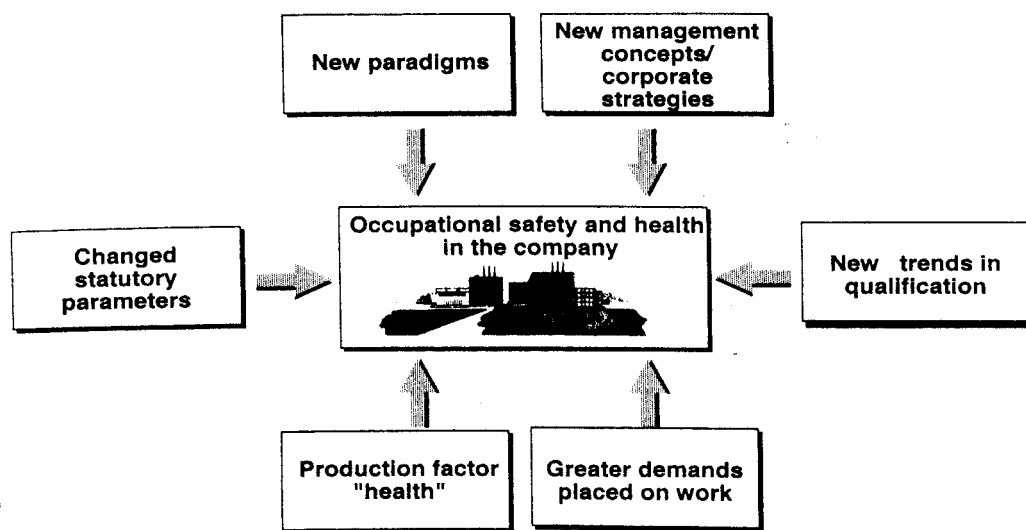
Figure 6.1. Changed Environment for Occupational Safety and Health in the company.

The comprehensive changes taking place in the world of work involve new requirements and new tasks for employees and therefore also mean life-long learning and ongoing further training (i.e. life-long new learning and relearning). This means that the qualification and competence of employees determine the efficiency, innovative power, product and service quality and the competitiveness of a company.

They constitute, alongside the production factor of health, an additional production factor of education. With the change in society and the structural transformation of the service society the goals and requirements in initial, in-service and further training for the domain of safety and health have changed. This concerns both the education system and corporate practice. In addition to the influencing factors arising from corporate practice, the "philosophy" of safety and health protection and the future development of the world of work for initial and in-service training in occupational safety and health,

There are also trends emanating from initial and further training which make it necessary to modify the "qualification processes in occupational safety and health".

Ladies and Gentlemen, research and research application will continue in future to play a major role in making up for shortfalls in knowledge, transfer and organisation. And that brings me to the funding possibilities and the tasks of the BAuA.

> "The Federal Institute for Occupational Safety and Health (BAuA) develops solutions to problems by applying safety-related, ergonomic and other knowledge from the work sciences. To fulfil this task it conducts research to necessary extent itself or it awards research contracts to third parties."

This is how the Federal Government's 1998 budget puts it. About DM 6 million is earmarked in the current year's budget of the Federal Institute for Occupational Safety and Health to fund "research and implement it for the purpose of occupational safety and health" (chapter 1104, Title 544 01).

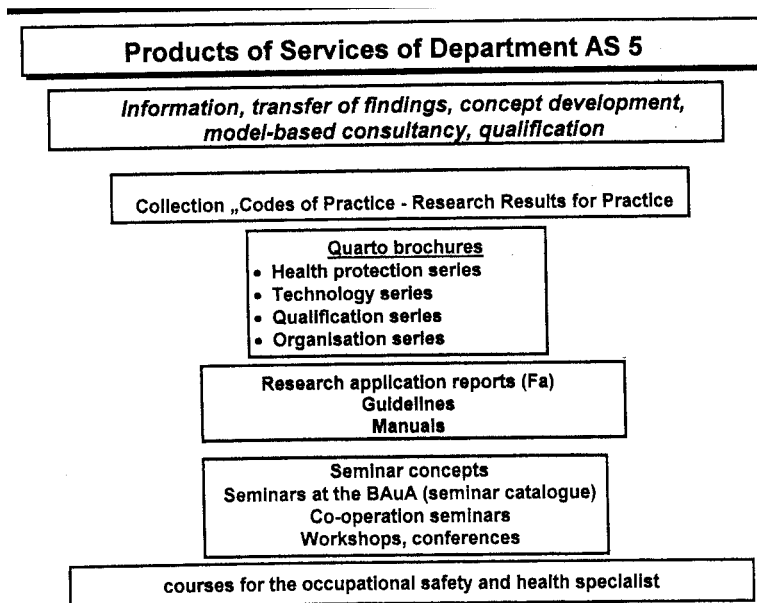As regards assistance for research application, funds are available under two budget headings of the BAuA.

Figure 6.2. Products of Services of Department AS 5.

This involves the compilation of "Codes of Practice", the compilation of seminar concepts and the conduct of seminars to support third parties, especially bodies responsible for further education, including the conduct of workshops, expert meetings and similar events, and as a third instrument model-based corporate consultancy.

Ladies and Gentlemen, I would now like to give you a brief description of these three instruments for research application, which have existed for 18 years – although they have been developed further over the years:

In order to compile and publish Codes of Practice on the implementation of research results assistance is given to projects whose objective is to process in practical terms results from government-funded occupational safety and health or – expressed perhaps more comprehensively – work and technology research.

By publishing the loose-leaf collection "Codes of Practice – Research Results for Practical Purposes" the Federal Institute for Occupational Safety and Health met the wishes expressed to them vigorously by companies in all sectors of industry for years. 139 publications of the loose-leaf collection have already appeared and they have proven an effective link between science and corporate practice. The research results represent an extract of major scientific knowledge obtained from a large number of research reports.

They offer solutions to corporate problems, solutions which result in wide-ranging easements and improvements in the world of work, thus enhancing the efficiency and related competitiveness of the company. First, before a start was made with the holistic procedure and systematic examinations, single strain factors, from noise, lighting through to climate, were researched and the research results were put in the form of "Codes of Practice".

All those involved in company matters, those responsible for company procedures, and also those operating in the "preparatory phases", e.g. designers, planners, scientists and those concerned with inspection tasks (supervisory personnel from the statutory accident insurance bodies, labour inspectorate officials) rely on information relating to the latest knowledge from work and technology research to enable them to take practical action.

It is necessary to obtain "quick" information providing data on the strains and loads present at the workplaces, on work organisation, the organisation and results of in-company occupational safety and health and on the effects of technical and organisational changes etc.

The "Codes of Practice", which have been published now for nearly 20 years, has something of the character of the English "Code of Practice".

Bearing in mind the process of European unification, the BAuA is considering how to orient this implementation instrument in terms of its content and its form so that it can be used in future beyond the borders of the Federal Republic of Germany in the European area to disseminate research results and positive organisational solutions.

The increasing co-ordination and collaboration on a European level, which has for example been based for years in the IVSS, and the establishment of the European Agency for Safety and Health at Work in Bilbao, Spain, plus an expansion of Internet facilities, make it necessary to translate the "Codes of Practice" so that they can be disseminated accordingly. Use should be made here of modern information technologies to create transparency and to facilitate effective working. At the same time, however, we intend to look for new media and their special features when it comes to reaching different target groups.

Over the past 20 years we have regarded the implementation of organisational knowledge for occupational safety and health as an essential field of work in which, for example, the specific instrument of "Codes of Practice" should be used to open up new transfer paths, which should then be followed. Extended approaches, such as the development of software further to research and research application projects, should be developed and specified. Implementation always takes place in the conflict-laden area between theory and practice. Just as scien-

tific methods and practical conditions change, so implementation, its instruments and its strategies must also change.

In brief: from the individual solution to the package solution. The creation of the Single European Market and the harmonisation of social legislation in the context of the European Union with its implementation in terms of German occupational safety and health law represent at the same time a challenge and a chance; namely to expand "Codes of Practice" thematically beyond their previous mode of presentation by adding new areas of application and new dissemination routes, as well as to open up new fields of action in the European area; this concerns areas of Article 100 and Article 118a of the EC treaty.

It is well known that in-company organisation of this field is integrated in a complex overall task, encompassing technical-organisational, economic, humane, social, health-related and ecological sub-goals. These have to be seen in the overall context. Entrepreneurs in small and medium-sized enterprises (SME) in particular must be afforded the capability of tackling and fulfilling their tasks in such contexts (see EC Council framework directive on occupational safety and health 89/391/EEC dated 12.06.1989, Art. 6, Par. 3, Item a), Sentence 1: Risk evaluation and Art. 7 "Organisation of Occupational Safety and Health").

With regard to crafts the advisors of craft organisations present an ideal target group for qualification measures on the subject of occupational safety and health. They come into the companies on a daily basis, they have direct access to the entrepreneur and they know the technical, organisational and business situation of their companies, as well as their possibilities and weaknesses.

Economic common sense demands that the inevitable statutory requirements which small and medium-sized enterprises can expect with the implementation of EU occupational safety and health provisions in German law be satisfied at an early stage with minimum effort.
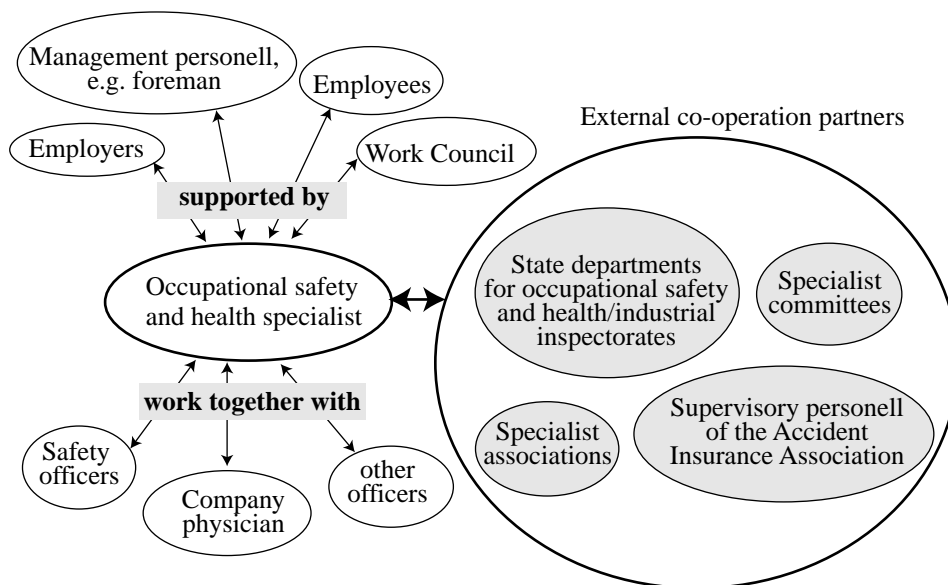
Figure 6.3. Co-operation Partners for the Occupational Safety and Health Specialist.

With this in mind and on the basis of the 1996 Occupational Safety and Health Act (ArbSchG) and the amended Occupational Safety Act (ASiG) there is a chance of improving the in-company organisation of occupational safety and health, as already documented in a series of positive examples. This includes the incorporation of safety and health protection in guidelines laying down the corporate philosophy. Involved here is the possibility of developing flexible, comprehensible and transparent occupational safety and health programmes.

In this context discussions are currently in progress in many companies on the introduction of systematically developed and assessable management concepts for the different areas. With regard to the development of quality and environmental management systems there are international standards (standards of the series ISO 9000 and ISO 14000).
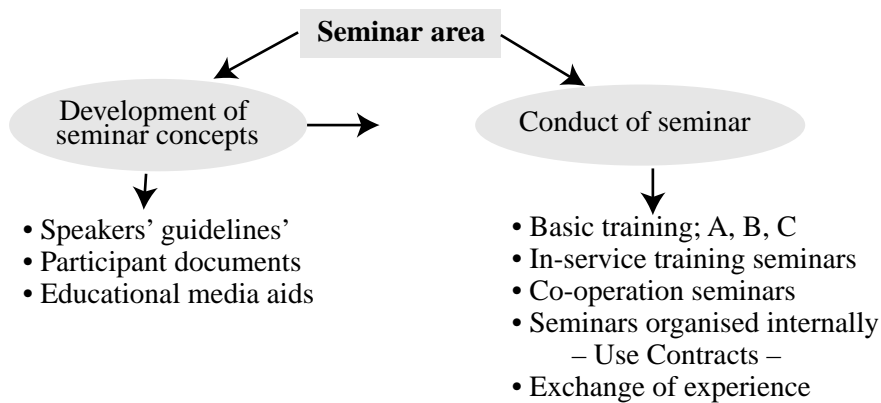
The knowledge thus gained from the research activities and committee work of the BAuA is also of essential importance for the setting up of occupational safety and health management systems and their ongoing accompaniment in terms of work science and implementation. Occupational safety and health management systems (OMS), i.e. systematised and formalised management systems, are an effective instrument for continuous improvement processes – related to the organisation and quality assurance of company occupational safety and health.[1] OMS provide companies with means for ensuring improved organisation for the planning, implementation, monitoring and continuous improvement of the necessary occupational safety and health measures. Taking due account of para-meters, such as the consideration of the special conditions prevailing in small and medium-sized enterprises and the avoidance of unnecessary administration, the voluntary nature of the application of such systems in companies, the lack of obligation to conduct external audits and the lack of mandatory certification, plus the economically reasonable proportion of input and result, OMS are an appro-priate means indirectly for helping to improve the quality of products and services and corporate environmental conditions. They can also help create a greater transparency both "internally and externally", and hence influence the corporate culture and image in a positive way.

Using Federal Government funds, materials are being prepared, in collaboration with the respective target group, which can be used on a company level without major expenditure of effort and money. In other words: the individual company can normally profit free of charge from what is made available in terms of Federal funds to all companies, specialist associations, chambers and guilds etc.

This also applies – in a somewhat modified form – for the second instrument of research application, the "drawing up of seminar concepts and the conduct of seminars and similar events on the implementation of research results".

---

[1] See "Gemeinsamer Standpunkt des BMA der obersten Arbeitsschutzbehörden der Bundesländer, der Träger der gesetzlichen Unfallversicherung und der Sozialpartner zu Managementsystemen im Arbeitsschutz", in: BArbBl. 9/1997, pp. 85f.

```
                        ┌─────────────┐
                        │ Seminar area│
                        └─────────────┘
                      ↙                 ↘
        ╭─────────────────╮       ╭──────────────────╮
        │  Development of  │  →   │ Conduct of seminar│
        │ seminar concepts │      │                   │
        ╰─────────────────╯       ╰──────────────────╯
                 ↓                          ↓
```

• Speakers' guidelines'
• Participant documents
• Educational media aids

• Basic training; A, B, C
• In-service training seminars
• Co-operation seminars
• Seminars organised internally
    – Use Contracts –
• Exchange of experience

Figure 6.4. Seminar area.

This involves
* the development of seminar documents on new focal topics,
* the conduct of seminars, exchanges of experience, expert meetings, workshops,
* the creation of new education media aids,
  and much more.

With reference to empirical values it can be said that the preparation of a seminar concept on a new topic or group of topics by expert third parties under contract to the BAuA according to the BAuA quality standard costs about DM 200,000. This amount is fully covered by assistance funds. The end product, in other words a tried and tested seminar concept (speaker guidelines, participant documents, educational media aids such as videos, transparencies etc.), can be used in two ways.

The first possibility is to conduct co-operation seminars as offered in the BAuA seminar catalogue and are held in situ at companies, chambers, guilds, further education bodies, specialist associations etc.

The precondition for this is that the co-operation partner provides at least 15 participants and contributes to the total costs of the seminar by covering the following expenses:
* participant recruitment and other preparatory expenses,
* costs incurred by release from work, wages and salaries during the time of the seminar,
* travelling expenses,
* room rental etc.

If the co-operation partner contributes to a reasonable degree the BAuA will pay speakers' fees and provide the seminar material.

The second possibility is for a company to utilise BAuA seminar concepts to conduct its own training sessions. I will deal with this in detail later.

Ladies and Gentlemen, organisational approaches must meet the needs of the practical situation. For research application the holistic approach means organising systems as can be found in practice in the form of, for example, work

systems. While we – as already indicated – have geared research to individual factors for many years, the concern now is to establish multi-factor relations. These multi-factor relations between causes (strains), effects (loads) and measures can best be reproduced by the model of a work system, as the BAuA has practised for a long time under the heading "holistic organisation". I intend to highlight the way there – from research to application – by taking the example of office work/ VDU work:

In the EC framework directive and the EC VDU directive "thinking in work systems" is already linked with a possible procedure for the workplace analysis:

In Article 6 (2) (g) of the EC framework directive mention is made of a general obligation on the part of the employer to "plan hazard prevention with the aim of coherently linking technology, work organisation, working conditions, social relations and the influence of the environment on the workplace" (see Article 4 "General Principles" of the Occupational Safety and Health Act of 21.08.1996 BGBl I p. 246).

Consideration of a wide range of strains and loads on the one hand and of multiple strains on the other hand indicates the multi-factor cause-and-effect relations which are typical for many workplaces. Measures taken or planned are also part of this network of relations. A measure may develop various effects with regard to different hazards.

New office communication technologies have spread steadily over the past 20 years. This has led – and will continue to lead – to far-reaching changes in office and administrative work.

The Federal Institute for Occupational Safety and Health (BAuA) as the body responsible for the project "The Humanisation of Working Life" of the then Federal Ministry of Research and Technology already recognised in the 70's the need to conduct extensive research projects to record the strains and loads connected with the emerging changes and involved in handling the new technologies in offices and administrations. They also recognised the need for solutions involving humane work organisation.

Initially questions of the specific strains and loads arising from VDU work were central to the research activities. Actual BAuA research projects were concerned with the adaptation of VDU workstations to the physical and mental mode of functioning of human beings and the ergonomic design of VDU workstations. These research results were already prepared and published in 1980 in the form of a "Code of Practice" entitled "Design of VDU workstations" (AE 2/79).

Within the Federal Institute researchers and implementers were already considering at that point what should be initiated in the way of new research topics in the office and administration domain and what there was in the way of existing knowledge which could be prepared for practical application.

For this purpose an interdisciplinary working group crossing the boundaries of organisational units was formed in-house in 1995. In its several years work up to 1989 it identified focal points for research and implementation in the field of "information and communication technologies", taking account of the research activities of the body responsible for the "Humanisation of Working Life" project.

Once research had been conducted into individual design questions, such as VDU ergonomics, CAD ergonomics, word processing, mixed work, lighting, work seats and much more, a large number of individual results were available which were compiled in a research application project entitled "Collection of Examples of Humanisation in Offices and Administrations". At the same time they were elaborated to form a design grid by analytical systematisation.

This created the basis for preparing research results to form design knowledge in a way that was oriented towards target groups and problems. At the same time procedures, processes and instruments were identified to enable the knowledge thus prepared to be implemented in corporate practice in the form of design measures.

In dialogue with the representatives of the target groups "company doctors" and "occupational safety and health specialists" (Sifa) media were developed for everyday corporate practice.

Within the framework of the project, which was conceived as a film script, the following media were developed:

- a concept for the collection of examples in office ergonomics in the form of a model file for a possible loose-leaf collection[2]
- a concept for the collection of examples in office organisation in the same form[3]
- a brochure on the subject of "Office Types and Ergonomic Problems"[4]
- brochures on the subject[5]
    - older employees and office work
    - forms of organisation for occupational safety and health, and
    - occupational safety and health media for company doctors and occupational safety and health specialists

These materials represented excellent preparatory work for the imminent incorporation of the EU VDU directive in national law.

In view of the requirement laid down in the 5th individual directive for employers to conduct a workplace assessment, a research application project[6] "Working System for VDU Work" was contracted in 1994. It was intended to give comprehensive design instructions for the working system for VDU work. In

---

[2] Dipl.-Soz. Annegret Köchling et al. Gesellschaft für Arbeitsschutz und Humanisie- rungsforschung mbH Volkholz und Partner (GfAH), Dortmund. Federal Institute for Occupational Safety and Health (Ed.) Loose-leaf collection: "Beispielsammlung Büro- Ergonomie", Beispielsammlung Büro-Organisation' Dortmund 1992.

[3] As above.

[4] Dipl.-Soz. Annegret Köchling et al, GfAH, Dortmund. Federal Institute for Occupa- tional Safety and Health (Ed.), Publications of the Federal Institute for Occupational Safety and Health. Quarto brochures "Qualification" Nos. 5, 6, 7, 8, May 1994.

[5] As above.

[6] The project results have been published in: Hahn H, Köchling A, Krüger D, Lorenz, D. *Arbeitssystem Bildschirmarbeit.* Publications of the Federal Institute for Occupational Safety and Health, Research Application Report Fa 31, Dortmund 1995.

a systematic approach this project represents a concrete aid for checking and designing VDU workstations.
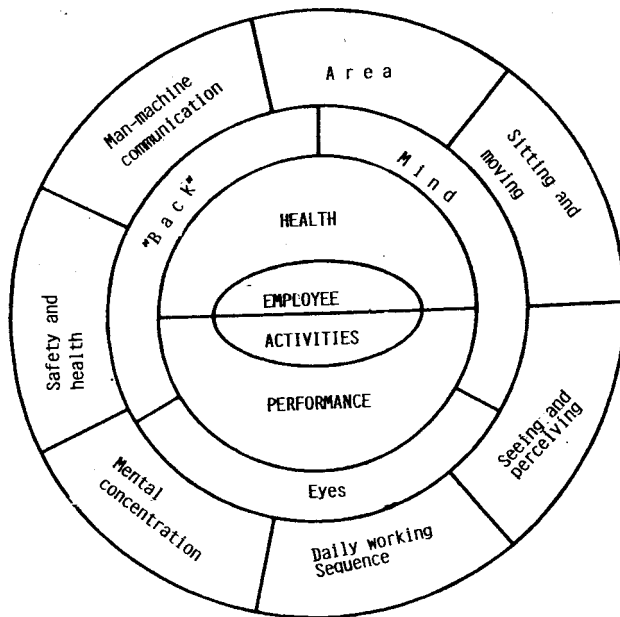
**Figure 6.5**. The working system for "Work at VDUs".

Parallel to this project further new "Codes of Practice" have been drawn up and implemented in a number of research application projects. Under the headings of "movement ergonomics with information-processing services" and "mixed work in offices and administrations", the following main objectives are pursued:
- the close interlinking of work organisation and health promotion,
- the integration of movement-promoting elements in working sequences, and
- the planning of appropriate office equipment.

Since the new knowledge and approaches were to be developed further up to readiness for practical application, systematic study of VDU work was initially tried out in a number of workshops with representatives of the government labour inspectorate and occupational safety and health specialists.

In five sessions with a study group the holistic concept of systematic workplace analysis in the practical situation was disseminated. The 300 participants reached in these sessions will certainly have acted since as multipliers in their function as departmental and organisation managers, human resources managers, board members, occupational safety and health specialists etc.
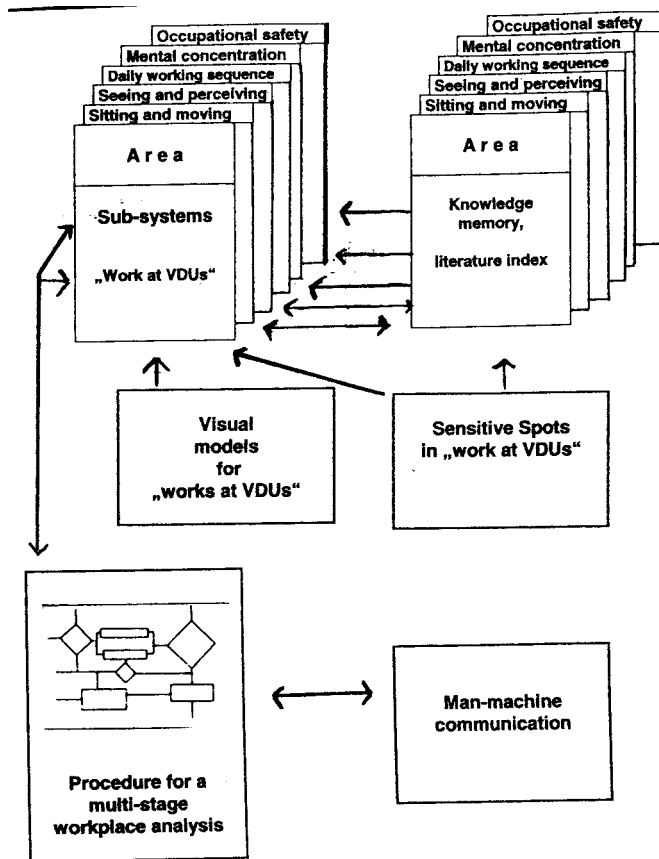
Figure 6.6. Structure of the report on Working System for VDU Work.

It was found that both published research results and partly also knowledge, which had been prepared with a view to implementation are not sufficiently self-explanatory to enable practitioners in companies to use them as concrete aids to action. So what more have we done to make up for this deficiency?

First we have drawn up a working aid for occupational safety and health specialists from the available material and the experience gained, and in October 1997 we published this. With the help of office furniture manufacturers and installers, who contributed to the printing costs, we have to date distributed about 10,000 copies.

Secondly, parallel to this we have ordered the development of a seminar concept aimed at familiarising those addressed – namely occupational safety and health specialists, office planners and installers, architects, office furniture manu-facturers and many more – with the instruments for the systematic assessment of VDU work. This is intended to render the independent application of such instruments in companies possible.

Thirdly, we have drawn up a "Code of Practice" and a brochure on the subject – also in parallel. Both "products" are currently being published.

Fourthly: When the first results were published in 1995, it was not only found that there was a lively demand for the research application report, but in a short time there was also evidence of interest on the part of 20 domestic and foreign

companies in the rights of use to the available results for their own purposes. One company, for example, very soon developed and marketed an user-friendly software on the basis of the report.

To date more than 200 individuals, companies or institutions have acquired the rights of use.

Fifthly – and this should be seen in the context of the point just described: 30 companies, institutions and individuals who have put the results of the research application project "Working System for VDU Work" into practice met in 1997 to exchange experiences. It was found that at the present time more than 160 office furniture manufacturers, further education bodies, management consultants and non-company-based safety services use the "systematic approach" developed in the BAuA for their marketing.

On this basis the users of this approach have developed not only company-related assessment approaches, but also software programs, manuals and teaching concepts.

By way of summary, it was found that with the "Working System for VDU Work" there is a concept which gives companies assistance in implementing the new VDU work regulations and the risk evaluation it requires, and it also helps to ensure safety and health protection for employees and, in the last analysis, efficient company management.

Ladies and Gentlemen, I would like to leave you with these five points. I think the example of VDU work has made clear how the Federal Institute for Occupational Safety and Health prepares and disseminates research results. I wish to highlight in this connection the linking of implementation packages: printed media, such as Codes of Practice, brochures, check lists etc, are not only published and distributed, but they are also used in seminar concepts and seminars, workshops and similar training sessions.
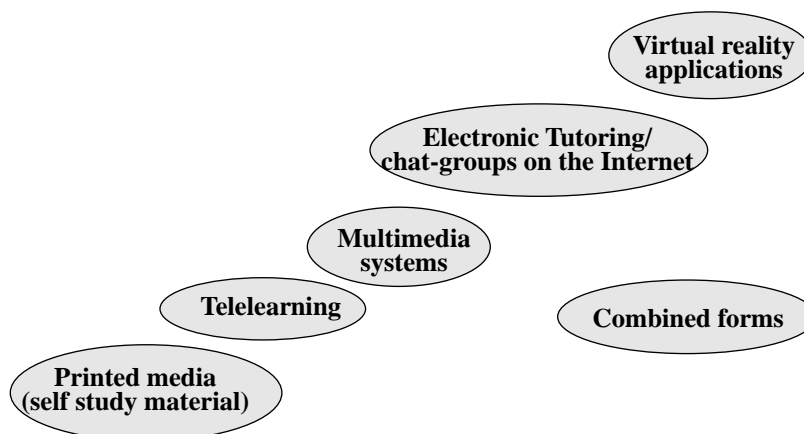
Figure 7. Different Forms of Self-Learning.

The seminar concept itself is structured in terms of content and educational method, in such a way that a skilled third party can conduct seminars with this

concept independently. That is why seminar concepts are invariably offered to external parties for their use. For this purpose it is necessary to conclude a contract of use with the BAuA.

It provides not only for payment of a one-off fee of DM 120.00, but also requires the user to report in writing once a year to the BAuA what and how many addressees he has reached with the seminar concept, or whether he wishes to make changes or additions to the existing seminar concept. The Federal Institute thus maintains a process of updating and improvement of practical suitability.

The BAuA operates in other subject fields in a similar way to that shown by this example.

Table 6.1. Use Contracts Concluded Seminar concepts for research application.

Nr.	Seminar topics	Number
SK 14 (2)	Hazards with the use of heavy goods vehicles	3
SK 24	Hazards and strains during in-house transport and traffic	4
AK 33	Chemical exposure at the workplace	58
SK 34 (2)	Safety-appropriate design	2
SK 37	Risk characterization and risk evaluation of hazardous substances	30
SK 39	Shift work and dwelling	1
SK 43	Design of workplace for disabled and performance impaired persons	7
SK 50	Noise reduction in companies	12
SK 52	Safe working on ladders	6
SK 53	The safety dialogue – consultancy meetings on occupational safety and health	13
SK 56	Lighting and lighting technology	18
SK 59	Chemical exposure in wood and plastic processing	13
SK 60	Night and shift work – strains and design possibilities	4
SK 61	Geräuschemissionswerte von Maschinen	1
SK 63	Humane work organisation in community catering facilities	6
SK 64	Safe design of factory shop entrances and exits	1
SK 69	Dialogue-oriented procedures and methods for safety and health in companies	5
SK 71	Training and motivation of entrepreneurs in the automotive industry	1
–	Hazards and strains during in-plant transport and traffic in foundries	1
–	Model paper on machine acoustics	1
	Total:	**187**

In the time available I have only been able to show you only the most important tools for implementing research. Daily practice from research through to companies and administrations or through to the minds and hearts of the occupational safety and health protagonists and employees has many more facets. Staying with the above example of offices and administrations, I could link it to the develop-

ment of a competence and demonstration centre, to the formation of networks or the development of case studies within the framework of the new concept for the training of occupational safety and health specialists.

Where does the road lead? What are we now planning for the future?

Demographic developments – I already mentioned this at the beginning – will confront us increasingly in the next few years with the problem of ageing workforces in offices and administrations as well. We need research, we need practicable results, we need suitable tools for implementation to enable us to recognise risks and opportunities arising in connection with new information and communication technologies and new forms of work, such as tele-work, call centres, microcompanies etc., for older, performance-impaired or disabled employees in the office and administrative domain. Such tools should also enable us to offer answers in the form of design solutions.

7. From research to practice
– The Swedish Hand Tool Project

Lena Sperling
Professor, PhD
Department of Ergonomics and Aerosol Technology, Institute of Design Sciences,
Lund University Institute of Technology, Lund, Sweden

Background

In Sweden, a multidisciplinary research programme on hand tool ergonomics was carried out during 1984-1991 (Kilbom 1991a, b), supported by the Swedish Council for Work Life Research. The overall aim of the project was to reduce the prevalence of work-related diseases in which hand tools caused or contributed to injury of hands and arms (Occupational Injuries 1985).

During the programme, extensive knowledge was gained about workers use, tacit knowledge and acceptance of hand tools (Dahlman et al 1991). Further, quantitative and qualitative methods for evaluation of hand tools were developed and applied (Kadefors et al 1993, Sperling et al. 1993). Criteria for design and selection of hand tools were also presented (Wikström et al 1991, Sperling et al 1993).

About 1990, it was well known that ergonomically inferior hand-tools were frequently used within Swedish manufacturing industry. However, it was at that time very difficult to convince central actors of user companies, manufacturers and distributors about the importance of good hand ergonomics. At Volvo, improved hand tools for women were focused on (Sperling 1990). Concept studies of improved hand-tools were carried out at Volvo's anthropocentric plant at Uddevalla. The resulting prototypes of user-friendly products were at that time not commercialised, as hand tool manufacturers regarded the market as too small.

A temporary Swedish foundation (the Swedish Working Life Foundation, SWLF) made it financially possible to put research into practice in a large scale development programme, The Swedish Hand Tool Project (SHTP). It was started in 1992, directly after the end of the research programme. Six of the largest Swedish mechanical engineering industries made a joint application and received a grant. The companies were:

- ABB
- Samhall
- SAAB
- SCANIA
- Volvo Car Corporation
- Volvo Truck Corporation

Aims

The aims of the SHTP were:
- To apply in a practical way research results on at least ten new user-friendly non-powered hand tools, and to make these tools available to the users at the end of the project.
- To generate acceptance and understanding of the improved qualities of the tools in the whole chain of actors in the Swedish hand tool industry.

The aim of the present paper is to describe the progress and effects of the SHTP, with special reference to research dissemination.

Actors on the hand tool arena

Traditional tools of the pre-industrial period were hand-made by or made in close co-operation with users. Their shape was adequate for the needs of users. Today, modern materials and production methods offer better possibilities to provide hand tools of ergonomically appropriate shape and design. However, products of poor ergonomics and low quality dominate the market, as manufacturers are remote from users and their expert knowledge. A gap often exists between knowledge and its practical application.

In order to bridge the gap between users and manufacturers, several groups of actors were involved in the SHTP. Users, purchasers of the engineering industries, hand tool distributors, and manufacturers as well as researchers, participated in the project and were also represented in the project board. In the group of researchers, persons from the preceding research project were involved. By means of active participation of central groups of actors, the production as well as introduction of improved products were to be strongly facilitated.

The process of the SHTP

The SHTP was carried out in three phases: (1) Inventory and specifications; (2) Product design and education activities; and (3) Manufacturing, marketing and implementation. The first two phases were financially supported by the temporary SWLF foundation and the user companies.

User requirements were the starting point as well the mainstream throughout the project, in accordance to modern quality work.

Phase 1. Inventory and specifications

The project started with a kick-off meeting, to which a great number of persons from the above groups of actors were invited and took part. At the meeting, the project plan was discussed in detail. With guidance by researchers, consensus was gained about the definition of problem tools, to be identified in the project. Nine categories of problems were formulated at the meeting and then rated by the

researchers (Table 7.1). The risks off occupational accidents and injuries were given the most emphasis.

Table 7.1. Criteria for identification of problem tools and rating of severity.

Type of problem	Rating	Comments
Accident risk	5	
Risk of occupational disorder	5	
Awkwardness	3	Awkward tools handled at high frequency
High frequency of use	2	will most probably cause an occupational disorder.
Inefficient	1	
Low quality of work	1	
Low quality of materials	1	Might result in accidents or skin injuries.
Unattractive design	1	Might reduce the feeling of pride at work.
Other problems	1	Noise, vibrations etc.

As next activity, problem tools were mapped by hand tool users in representative workshops of the participant industries. Users discussed their problems in local groups and selected their worst tools. A form was used were problem tools were to be specified and commented by means of the above criteria. Questions based on criteria of the research programme (Sperling et al 1993) were also included. Users were urged to attach photos of their problem tools, *en face* and at typical situations of use.

More than 400 forms with descriptions of problem tools were returned to the project. 140 forms concerned powered hand tools and were left aside for the future. A gross list of about twenty frequent non-powered problem tools was presented for further measures.

The engineer's hammer (Figure 7.1) was ranked highest, being a problem tool that is used in many different workshops, by many users and with high risks for occupational accidents and disorders (Occupational Injuries 1985).

Figure 7.1. A conventional engineer's hammer.

In a field study, researchers, together with users, investigated problem tools at use in the workshops. At each factory, group discussions were as far as possible held about problem solutions. Manufacturing engineers, designers and personnel from the occupational health service joined the discussion.

The results of the inventory and the field study of problem tools were transformed into qualitative specifications – user requirements – of improved hand tools. User requirements for the engineer's hammer were, among others:

- Improved balance
- Extended grip surfaces
- Comfortable *surface material*

At the end of phase one, press releases were also sent to daily news papers, trade union journals, house magazines and professional journals. A great number of articles appeared about the SHTP.

Phase 2. Product design and education activities

Before product development, a survey of catalogues from manufacturers and distributors was carried out in order to find alternatives to replace problem tools. Tool candidates were discussed at a consensus seminar were users and researchers

took part. Some problem tools could be excluded from the gross list of project tools by introducing already existing but up to now relatively unknown products. A final list of ten project tools was proposed for product development (Table 7.2). The researchers, transforming qualitative requirements into quantitative terms applicable for product design then elaborated ergonomic specifications.

Hand tool manufacturers were offered financial support by the project. After negotiations with Swedish and foreign manufacturers, the development of ten project tools started, on basis of user requirements and ergonomic specifications. As far as known, authorised Swedish industrial designers took part in the development of eight out of ten project tools. Industrial designers had been previously involved in the research program or in an affiliated research project, all of whom representing the Swedish socio-technical tradition of user-centred product development (Bobjer et al 1994).

A training programme was carried out and evaluated in co-education of some of the hand tool manufacturers, distributors and purchasers. Hand tools were discussed in terms of ergonomics and total economy.

Test models (pre-prototypes) of ten project hand tools were evaluated by means of a set of methods previously developed and verified in the research project (Kadefors et al 1993). Professional subjects were recruited from the participant user companies. Qualitative as well as quantitative methods were included. User requirements of project tools were focused in the interviews. For instance, the users welcomed the qualities of the engineer's hammer, and properties to be further improved were identified.

A process of quality declaration of hand tools – Tool Facts – was applied on one of the project tools (Sperling et al 1994, 1995). Results of technical, ergonomic and qualitative evaluations were compared with scientifically based design criteria, and the degree of fulfilment was communicated in terms of acceptable (green), conditionally acceptable (yellow) and non-acceptable (red) level. Each target group (manufacturers, distributors, purchasers and users) was to be informed in the most efficient way.

At the end of Phase 2, in March 1994, a concluding seminar was held, to which the same persons were invited as to the kick-off meeting of the SHTP. Hand tool prototypes financially supported by the project were presented as well as the Tool Facts concept.

Phase 3. Manufacturing, marketing and implementation

After modifications based on the laboratory evaluation, manufacturing of several project tools was prepared (Table 7.2). The ergonomically improved engineer's hammer, T-BLOCK, was launched in 1996 (Figure 7.2). User requirements were reflected by its different qualities:
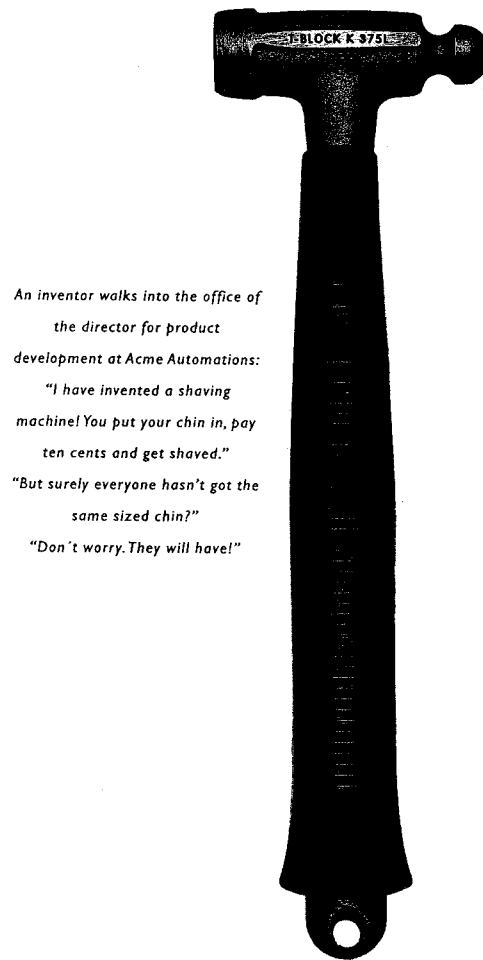- Counterbalanced head
- Vibration absorbing
- Smooth grip surfaces

61

- Extended handle/grip surfaces for different grip possibilities
- Different handle sizes (system tool)
- Attractive shape

Table 7.2. Project tools of the Swedish Hand Tool Project (Status 1998).

Project tool	Available in Sweden	To be adopted by manufacturer
Engineers hammer	Hultafors/Tor	
Engineers Knife	KJ Tools	
Crimping tool	Pressmaster	
Ratchet	Sandvik Belzer	
Set of hex keys	American Tools/Bondhus	
Wire brush	Nässjö Borst	
Stripping pliers		X
Wrench		X
Steel band cutter		X
Plate shears		X

In product folders and other presentation material, the manufacturer describes the ergonomic improvements of the hammer as well as advantages for the user (Product brochure, 1996).

An inventor walks into the office of
the director for product
development at Acme Automations:
"I have invented a shaving
machine! You put your chin in, pay
ten cents and get shaved."
"But surely everyone hasn't got the
same sized chin?"
"Don´t worry. They will have!"

Figure 7.2. The ergonomically improved engineers hammer (T-BLOCK).

Research dissemination during and after the Swedish Hand Tool Project

Research results can be utilised to different target groups, in various ways and with different levels of exploitation. For the workshop the definitions dissemination, vulgarisation and valorisation of research information were used, which can be used to summarise the activities during and after the SHTP. The following explanations were found in the breif of the workshop (Lagerlöf 1998).

Dissemination includes the direct dissemination of research through international journals. The target group is usually other researchers or those who want an in-depth knowledge about a certain research topic.

Vulgarisation includes the translation or recasting of research in other forms, such as press releases, brochures, popular-scientific articles etc. The target group might be the "enlightened public" but is better suited for specialists who will get new ideas from the results and for future applications. For decision-makers this type of information can inspire to decisions and to get new or more in-depth knowledge.

63

Valorisation includes the provision of "best practice" and the exploitation of research, either as action-oriented or, for instance, by producing products. The best practices can be based on intervention research but could as well be based on "a good solution" from a research-based development project. The use of an interpreter or a broker can be needed, as in education and training. Target groups are experts, sector experts and end-users.

The SHTP provided unique possibilities to put research into practice and is a most interesting example of *research valorisation*. Ergonomically improved products were produced and, consequently, research results reached the end-users as hard-ware.

The participatory process of the project *per se* constituted an education activity and was also supported by specific co-education seminars. Target groups as end-users, purchasers, distributors and manufacturers of hand tools were involved in the learning process together with researchers from the preceding project, at project meetings as well as practical project activities such as inventories, field studies and evaluations of products. The Tool Facts concept of ergonomics quality declaration of hand tools is also regarded a true valorisation tool but was not welcomed by Swedish manufacturers and distributors of hand tools. However, product brochures of manufacturers reflected scientific knowledge communicated during the project, thus verifying its valorisation effects. As the project concept was regarded as successful by the participant industries and the temporary foundation, an additional and similar project on powered hand tools was economically granted, based on problem tools coming up in the inventory. The project made it possible to further application of research on concept machines (Bäck 1995). In the latter project a training kit for hand ergonomics was developed and provided to the user companies (Garmer and Sperling 1996), as a further example of research valorisation. The engineer's hammer was later honoured by the yearly Swedish Award of Excellent Design, increasing its visibility.

Specific information activities were included in the SHTP, such as press releases resulting in several papers in different publications, which is defined as *research vulgarisation*. Articles communicated problems related to ergonomically poor hand tools and the challenge to realise research knowledge in improved solutions. The project process was documented in a popular publication (Kardborn 1995). The project was also supported by external information activities, as it was regarded a good example of how research results can be put into practice. In a series of articles the story of the worst hand tools was reported and the demands that should be made on them were considered (Grönkvist 1993).

The SHTP disseminated research results but was also subject to *research dissemination.* During and after the project, researchers presented project processes and results at various international scientific conferences (Sperling et al 1993, Sperling et al 1994, Sperling et al 1997). After the project, the intra-organisational participation process of the SHTP was analysed, focusing critical events during the project (Kardborn 1998).

Concluding remarks

Research results of a successful programme on hand tool ergonomics were put into practice in the Swedish Hand Tool Project. The SHTP has produced ergonomically improved and commercially available products and expanded both knowledge and markets for hand tools. The impact of the research programme canalised by the product development project was supported by various means of dissemination, vulgarisation and valorisation.

References

Bobjer O, Kadefors R, Kilbom Å, Sperling L. *The user's viewpoint as a tool.* In Dahlin T, Mazcanzoni D, Rosell G, Svengren L (Eds.) The Human Dimension. Svensk Industridesign, Stockholm (1994).

Bäck, J. *Handmaskinsprojektet i svensk verkstadsindustri.* (The project on powered hand tools in Swedish engineering industry). Institutet för Verkstadsteknisk Forskning, Mölndal, Sweden (In Swedish).

Dahlman S, Wikström L, Kadefors R, Öster J, Areskoug A, 1991. *Tools and hand function: requirements of the users and the use situation. Novices and/or professionals as trial persons in experiments with plate shears.* In Quéinnec Y and Daniellou F (Eds) Designing for everyone, Taylor & Francis London (1991)173-175,.

Garmer K, Sperling L. *A hand ergonomics training kit: A support for improved awareness of ergonomi hand tools and a bridge between research and application.* In manus, 1996.

Grönkvist L (Ed), 1993. *New tools for better working conditions.* English edition. Forskning & Praktik, Swedish National Institute of Occupational Health, Solna, Sweden (1993)3

Kadefors R, Areskoug A, Dahlman S, Kilbom Å, Sperling L, Öster J. *An approach to ergonomics evaluation of hand tools.* Journal of Applied Ergonomics 24(1991)203-211.

Kardborn A, 1995. *Handverktygsprojektet – rapport.* (The Swedish Hand Tool Project – Report. Art. No. 7201, Arbetarskyddsnämnden, Stockholm (1995). (In Swedish)

Kardborn A. *Inter-organizational participation and user focus in a large-scale product development programme: The Swedish hand tool project.* International Journal of Industrial Ergonomics 21(1998)369-381.

Kilbom Å. *Hand held tools - design with regard to optimal hand-arm function and performance.* Summary from The Swedish Council for Work Life Research (No.1475)1991

Kilbom Å, Fransson C, Byström S, Sperling L, Kadefors R, Areskoug A, Öster J, Landervik E, Dahlman S, Wikström L, Liedberg L. *Tools and hand function: Design selection and use of hand tools with regard to optimal hand-arm function and performance.* In Quéinnec Y and Daniellou F (Eds) Designing for everyone, 1991 Taylor & Francis, London (1991)173-175

Lagerlöf E. *Brief for Workshop on Research Dissemination.* NIVA, Helsinki, Finland, 1998.

Occupational Injuries, 1985. Information system on occupational injuries. National Board of Occupational health and Safety, Sweden, 1985.

Product brochure, 1996. Tors Hammare, Hultafors Co., Hultafors, Sweden.

Sperling L, Dahlman S, Wikström L, Kilbom Å. *A cube model for the classification of work with hand tools and formulation of functional requirements.* Journal of Applied Ergonomics 24(1993)212-220.

Sperling L. *The ergonomics of the female hand. Grip function and requirements for hand tools.* In Swedish. AB Volvo, Göteborg, Sweden (1991).

Sperling L, Kardborn A, Sundström L, Kadefors R. *Better hand tools for Swedish industry.* In Nielsen R and Jörgensen K (Eds), Advances in Industrial Ergonomics and Safety V, Taylor & Francis, London (1993)651-657,.

Sperling L, Kardborn A, Kadefors R. *Tool Facts – an approach to ergonomics quality declaration of hand tools.* 12th International Ergonomics Association Congress, Toronto, 1994

Sperling L, Kadefors K, Areskoug A. *Handverktygsprojekt i svenskt näringsliv. Verktygsfakta – handverktygsprojektets elfte verktyg. En preliminär modell för provning av och information om handverktyg.* Arbetarskyddsnämnden, Stockholm 1995.

Sperling L, Kadefors R, Forsman M. *The Swedish hand tool project – a follow up.* In Seppälä P, Luopajärvi T, Nygård C—H, Mattila M, editors. From Experience to Innovation: Proceedings of the 13th Triennial Congress of the International Ergonomics Association, Tampere, Finland. Finnish Institute of Occupational Health, 1997:249-51.

Wikström L, Byström S, Dahlman S, Fransson C, Kadefors R, Kilbom Å, Landervik E, Liedberg L, Sperling L, Öster J. *Kriterier vid val och utveckling av handverktyg.* Undersökningsrapport Arbetsmiljöinstitutet, Solna 18 (1991),

List of participants

Markku Aaltonen
European Agency for
Safety and Health at Work
Gran Via 33
E-980 09 Bilbao
SPAIN
Tel. +34 94 479 43 70
Fax +34 94 479 43 84

Jean-Claude André
INRS
Avenue de Bourgogne
F-54501 Vandeuvre Cedex
FRANCE
Tel. +33 3 83 50 20 00
Fax +33 3 83 50 20 97

Veronique de Broeck
PREVENT
Rue Gachard 88/Bte.4
B-1050 Brussels
BELGIUM
Tel +0032 2 643 44 92
E-mail: v.debroeck@prevent.b

Michel Claessens
DGXII/AG6
Rue de la Loi 200
B-1049 Brussels
BELGIUM

Kevin Gardner
DG III
Rue de la Loi 200
B-1049 Brussels
BELGIUM

Marc de Gref
PREVENT
Rue Gachard 88/Bte.4
B-1050 Brussels
BELGIUM
Directeur Général
Tel. +32 2 643 44 51
E-mail: m.degreef@prevent.be

Richard Ennals
Kingston University
Kingston Hill
Kingston upon Thames
GB-Surrey KT2 7LB
GREAT BRITAIN

Dr. Lars Harms Ringdahl
Inst. för Riskhantering
och Säkerhetsanalys, IRS
Bergsprängargränd 2
S-116 35 Stockholm
SWEDEN

Kristina Kemmlert
National Board of
Occup. Safety and Health
S-171 84 Solna
SWEDEN
Tel. +46 8 730 9100
Fax +46 8 730 9881

Gisela Kiesau
Bundesanstalt für Arbeits-
schutz und Arbeitsmedizin
Friedrich Henkel weg 1-25
D-441 49 Dortmund
GERMANY

Bengt Knave
NIWL
International secretariat
SE-112 79 Stockholm
SWEDEN
Tel. +46 8 619 6700

Irja Laamanen
Finnish Institute of
Occupational Health
Topeliuksenkatu 41 a A
FIN-00250 Helsinki
FINLAND
Tel. +358 9 4747 2383
Fax +358 9 4747 2490
irja.laamanen@occuphealth.fi

Elisabeth Lagerlöf
NIVA
Topeliuksenkatu 41 a A
FIN-00250 Helsinki
FINLAND
Tel. +358 9 4747 2499
+359 9 4747 2497
elag@occuphealth.fi

Dr. Joachim Lambert
BIA
Alte Heerstrasse 111
D-53 754 Sankt Augustin
GERMANY

Ms. Gillian Lowe
Research Strategy Unit
P.O. Box 1064
GB-Scheffield S3 7HQ
GREAT BRITAIN
Tel. +44 114 2892365
Fax +44 114 289 2400

Jean Muller
INRS-Centre de Recherche
Ave. de Bourgogne-BP 27
F-54501 Vandoeuvre Cedex
FRANCE
Tel. +33 3 83502028
Fax +33 3 83502183

Jan Nielsen
National Institute of
Occupational Health
Lersø Parkall, 105 ™
DK-2100 Copenhagen
DENMARK
Tel. +45 39 16 52 00
Fax + 45 39 16 52 01

Dimitrios Politis
European Found. for Impr.
of Living & Working Cond.
Loughlinstown House
IR-Shankill. CO. Dublin
IRELAND
Tel .+35 312043100
Fax +35 312826456
dimitros.politis@eurofound.ie

Dr. Catherine Schlombach
Bundesanstalt für Arbeits-
schutz und Arbeitsmedizin
Nölderstrasse 40-42
D-10317 Berlin
GERMANY
Tel. +49 30 515 48250
Fax +49 30 515 48170

Paul Schulte
NIOSH
Div. of Educ. and Inform.
4676 Columbia Parkway
Cincinnati, OH 25226
USA
Tel .+1 513 533 8481
Fax +1 513 533 8588

Marc Sapir
TUTB
Blvd E. Jacmain, 155
BE-1210 Brussels
Belgium
Tel. +32 2 22 40 560
Fax +32 2 22 40 561

Kari H. Skollerud
Head of Education Dept.
National Institute of
Occupational Health
P.O. Box 8149 Dep
N-0033 Oslo
NORWAY
Tel. +47 23 19 51 00
Fax +47 23 19 52 00
kari.h.skollerud@stami.no

Lena Sperling
Lindholmen Development
PO Box 8714
S-402 75 Göteborg
SWEDEN

Hannu Stålhammar
Ministry of Social
Affairs and Health
P.O. Box 267
FIN-00171 Helsinki
FINLAND