Participatory design of work equipment : lessons learned and suggestions for future actions

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Introduction

As part of a TUTB-SALTSA joint project on integrating users' experiences into the standardisation process, a particular project examined case studies on end-user participation in development of work equipment.

The aims were :

1. To justify the need to apply participatory methods when designing equipment and demonstrate the added value of incorporating end-users' experiences from the workplace.
2. To suggest ways and systematic models for collecting end-user data from different sources across Europe.
3. To suggest changes in the formal procedures, either via current legislation or the standardisation process to provide opportunities for end-user data to be incorporated into future standards.
4. To review the reported methods of participatory ergonomics projects within Europe to develop the level of understanding of participatory ergonomics approaches and consider whether a European guidance document would be needed.

This project examined 38 case studies drawn from seven countries (Finland, France, Germany, Portugal, Sweden, The Netherlands, United Kingdom), supplied by a number of national authors. Lessons from these case studies, and from the literature on participatory design and participatory ergonomics in general, have been integrated into an overall report.

Participation can have a number of levels, from one-off design interventions in the workplace or for equipment, through a series of multiple interventions (at its best a process of continuous improvement), to a full participatory management programme. Also, certain aspects of training and job support can be regarded as part of participation.

In fact participatory design has been defined as : "The involvement of people in planning and controlling a significant amount of their own work activities, with sufficient knowledge and power to influence both processes and outcomes in order to achieve desirable goals" (Haines and Wilson, 1998).

Participatory design

There has been considerable growth in participatory design since the 1980s, partly because of regulatory requirements, and partly because it matches newer management philosophy and workforce and trade union expectations. In some national economies, it is also regarded as the right way to go about things in industry or at work, as well as being an effective way of achieving design, implementation and organisation. The various reasons for applying it might be summarised as need, greed or vision, with it matching industrial democracy and social democracy in Scandinavia, a philosophical approach and reflective practice in France, a pragmatic solution-driven approach in The Netherlands and Germany, and having an economic basis in terms of reduced costs in the UK.

The potential gains for participation have long been explained, and may be summarised as direct gains and systemic or more indirect gains. Briefly, these comprise:

- Direct gains
  - solution ownership
  - commitment to change
  - better design process
  - earlier learning/training
- Systemic gains
  - devolved skills
  - people involvement
  - spread of interest

A substantial body of opinion in the ergonomics and related literature suggests that participation by end-users in the design of work equipment and workplaces will lead to better design, as these solutions are developed using their expertise and practical experience (St Vincent *et al.*, 1997 ; De Looze *et al.*, 2000). At the workshop as part of this project it was noted that there is a need to clarify what is meant by better design ; depending upon the product, the context or the participants this can mean different things. For example, a better design may mean one that is safer, is healthier to use, is more usable, is better at the task for which it is required, is more acceptable to use, is more obvious as to what is should be used for or that may be used by more people.

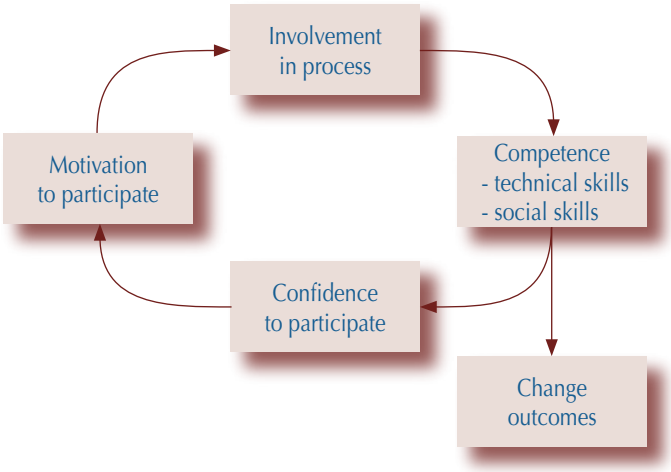
As well as a "better" solution, the second main advantage of participatory processes is said to be the greater acceptability of these solutions for the stakeholders (Van der Molen *et al.*, 1997 ; De Jong & Vink, 2000). The reasoning is that if people (or their peers) have been involved in generating a solution or a change then they are likely to be more committed to making the change work, to be less resistant to change and to be more satisfied as a result. If all this is so, and given that we expect a better-designed

The full text of the **national reports** on case studies collected by the national authors can be viewed on-line at http://tutb.etuc.org/uk/dossiers/dossier.asp?dos_pk=2. (Reports from : Finland, France, Germany, the Netherlands, Sweden and the United Kingdom.)

solution also, more fit for purpose, then the implementation of change should be more effective and of higher quality.

Other benefits from the use of participatory ergonomics in workplace design have been improved industrial relationships (Lanoie & Tavenas, 1996), improved productivity (Brown, 1994 ; De Looze *et al.*, 2000) and a reduction in the reporting of accidents and musculoskeletal discomfort due to work activities (Kuorinka *et al.*, 1997 ; Nygaard *et al.*, 1997).

Some of the possible gains for participation can be summed up in the participation cycle shown in the diagram.



As people get involved in the process they develop greater competencies – technical and social – that not only lead to a beneficial change but give them more confidence and thus motivation to participate in future.

At the same time, we must be aware of the problems and disadvantages for participation, in order to address them in any general advice or in particular cases.

These might be summarised as :
- Seen as a "threat"
- Seen as too slow
- Participants not (perceived as) competent or motivated
- Insufficient support or resources
- No buy-in from peers
- Possible poorer designs

Lessons from earlier cases

Bearing in mind these potential problems, but also the advantages, cases carried out up to the time of the current project taught us a number of lessons about the ability of participatory design to resolve differences and generate solutions, particularly if there are agreed parameters (including budget) at the outset. There is also a definite sense of transfer of ownership, but this can be difficult when the change agent departs. The best cases show continual improvements, a broadening of the effort and actual embedding of participation within the company. On the other hand, even in organisations with good will, there are often blocks - of time and personnel, even more than money - on participatory processes being properly maintained. Also previous experience shows that real evaluation is difficult.

Lessons from TUTB / SALTSA project cases

We identified a number of lessons from the 38 cases collected by the TUTB / SALTSA project. At a top level, there are a number of apparently favourable outcomes from the cases but the evidence is not particularly convincing in terms of good science and good research. It could well be that there is a selection bias in both reporting cases (only the successes get reported) and even earlier than that in the selection of problem focus. It is quite possible that participatory processes are only implemented where it is known that the situation has a good chance of being addressed and problems solved through participation.

Table 1 : Key factors for the success of participatory projects

Commitment
■ A champion to support and or facilitate the process
■ A sense of urgency - reason why
■ Clear definition of actors and their role - who will be involved
■ Structures to support the process - how will the participation be managed
■ Appropriate levels of knowledge for all participants
■ Previous good experience
■ Trade union involvement
■ Involve end-users in all stages of equipment design
■ Preferably involve manufacturers from the beginning of the process
■ Keep the project simple - well-defined and well-targeted
■ Keep the client's needs in focus

It is certainly true that there are many more published cases on participation applied to workspace design than to equipment design, probably because this is more amenable for people to make decisions and choices on, and for them to be able to visualise and coherently come up with new ideas. It is a more concrete aspect of work than even the equipment people use, and certainly than the jobs and roles they fill. Also, we found limited connections between the cases and the production of standards, but this does not mean to say that this linkage is not possible.

In looking through all the cases, a number of success factors common across them have been identified and these can be defined under the headings Involvement, Commitment, Climate, Management and Resources.

Table 2 : Success factors in participation cases

Involvement	■ Partnerships of stakeholders – especially for standards ■ Manufacturer involvement ■ TU involvement ■ User and user-company needs-driven ■ Multi-disciplinary ■ Participants at all design stages
Commitment	■ Commitment of all stakeholders ■ Real support from senior management ■ A champion with change agent skills ■ Clear perceived need ■ Urgency
Climate	■ Appropriate knowledge levels amongst the stakeholders and whole company ■ Previous good experiences of related initiatives ■ Acceptable industrial relations ■ Open, communicative organisation
Management	■ Clearly defined actors and roles ■ Structured process which matches organisation structures ■ Clear, single, simple, well-defined project
Resources	■ Clear identification of availability of resources : time, money, people, equipment etc. ■ "Rich" information from "real" users

New research

A number of potential new research directions were identified, and these were divided into those to do with participatory process, those to do with participation methods and those to do with the transfer of participation into standards.

For the process, research should be :

- A deep examination of the cultural influences (national, organisational, industry, history etc.) on the readiness for participatory processes and on the success of their outcomes.
- A study of a number of different cases to examine the real gains to be made. The efficiency of the process, the quality of the solution and the degree of acceptance of the solution in the real organisation should all be examined.
- Guidelines should be developed for the use of participatory approaches and how to promote these with trade union officials and support staff, to train in the application of participatory approaches in the workplace.
- Build and develop the network of people who use participatory approaches within their area of work, to allow the ongoing collection of case studies and the development of appropriate guidance to organisations.

For the methods, research should be :

- A study of the participatory session processes to examine what methods are used and whether some appear to be of more value than others. Methods need to be appropriate for the context of the work and some methods may be easier to adapt than others.
- Study of the use of visualisation and virtual reality tools to support participatory design.
- Study of effectiveness of participation when carried out by distributed or virtual groups. Possible tools are a web-based forum, collaborative virtual environments or a variety of virtual team information and communication technologies.
- Development, and study into the use, of personal digital assistants and other wearable or mobile technologies to gather use data and user opinions of existing equipment and personal protective devices.

For incorporation into standards, research should be :

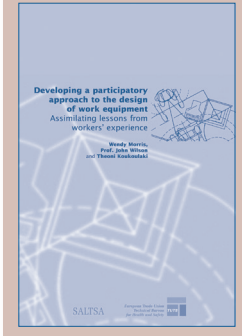
- Structured study of the production of standards with and without participatory processes, across three or more European countries.
- Review of the requirement to collect and utilise end-user data as part of the ongoing process of updates to standards for equipment and machinery.
- Review of the format of standards to review whether the end-user is able to understand and interpret the information they contain.
- Pilot studies to include end-user perspectives on research that is undertaken to support the standardisation process and report on the effectiveness of such an approach.

Conclusions

The conclusions of this project are that there is a growth of participatory design across Europe, but that the cases we have found and the programmes are to some extent both context-specific and also embedded in different national, regional, industrial and historical cultures. There is far more participatory design on the workplace than on work equipment, but there have been very successful cases of participatory equipment design. In general, favourable outcomes are reported in the general and professional press, especially where there is high acceptability by participants, but the evidence in the scientific literature at least is quite limited. Better, well-thought-out evaluations are needed. There is a need to develop participatory processes and guidance at a macro or organisational level as well as at a micro or case study, one-off level. This guidance should include better understanding, together with frameworks and method advice.

As regards feed-in to standards, there is considerable potential, but reports of changes to standards as a result of the case studies were hard to find. Those case studies that had been able to make a difference to standards were those that involved a large number of different participants (authorities, organisations, trade unions, researchers etc).

Developing a participatory approach to the design of work equipment.
Assimilating lessons from workers' experience
Wendy Morris, Prof. John Wilson and Theoni Koukoulaki



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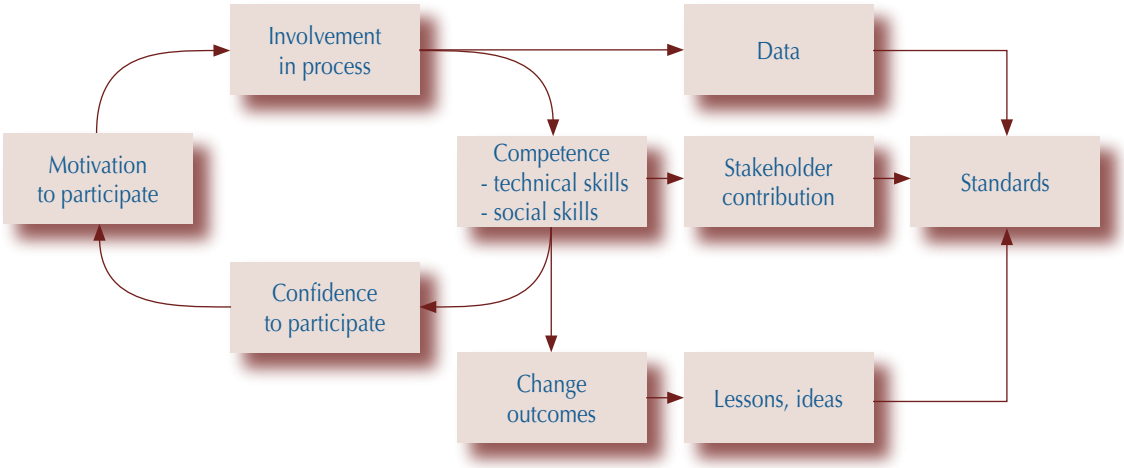
In such cases, some of the participants were also existing members of standards committees or had links with representatives on such committees. The standards process is complex and confusing. The ability of researchers and/or organisations to influence the standards process therefore depends upon an initial awareness and understanding of the process, resources in terms of time and finance to attend committees, and the ability to gain support from other committee members to support any proposals. These factors can present considerable hurdles to individuals and organisations and may indicate why so few cases were found where the outcome of participatory projects had influenced new or existing standards.

With reference to the earlier cycle of participation, some extra stages can be seen that enable participatory processes, and data from participation, to be integrated into the standards system. ■



PARTICIPATORY DESIGN OF WORK EQUIPMENT

How end-user data can be integrated into the ISO and CEN systems

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Introduction

In 1973, the International Ergonomics Association (IEA), which currently represents some 19,000 ergonomics scientists and practitioners world wide, proposed to the ISO to start standardization work in the field of ergonomics (Parsons & Shackel, 1995). The ISO established TC 159 "Ergonomics" to start this process in 1974, and published the first ergonomics standard in 1981 as ISO 6385:1981 *Ergonomics principles in the design of work systems.*

The pace of standards production increased rapidly thereafter, and now more than 150 ergonomics standards have been published by ISO and CEN on a variety of topics. The best-covered topics are machine safety, workplace and equipment design, and visual information and computer operation.

Most of these standards were developed by ergonomics scientists and professionals, and the large number of standards produced has helped to develop and bring into its own right the discipline of ergonomics over the past 30 years. The IEA can be pleased with that result.

Users of ergonomics standards

This prompts the question, who are the users of ergonomics standards ? According to the definition of ergonomics, approved by the International Ergonomics Association, ergonomics deals with human-centred design of products and processes in order to **optimise human wellbeing AND system performance**.

Therefore, ergonomics has both a **social goal**, which is important for the users of products and processes (including work products and work processes which are important for the workers), as well as an **economic goal**, which is important for the management of an organization. This means that not only workers and other parties with interests in the social aspects, but also those with interests in the economic aspects of products and production processes, may have a