

# Science meets Practice – driving forces behind applied OSH research

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## 1. Why does the German Social Accident Insurance conduct OSH research?

The German Social Accident Insurance is a part of Germany's social insurance network. With a budget of €11.1 billion, it is one of the smaller branches of the social insurance system (see Fig. 1). In 2009, prevention activity accounted for 9% of expenditure, rehabilitation for 33.7%, and compensation for 54.7% (1). For over a century, a small part of the prevention and rehabilitation expenditure has been invested in research into OSH and rehabilitation. Nine accident and two occupational disease clinics are maintained. These not only employ modern diagnostic and therapeutic techniques to international standards, but also conduct medical research. The German Social Accident Insurance conducts OSH research through three larger prevention research institutes. In addition, some €4 million is spent each year on the funding of external research projects. The accident insurance institutions' research mandate is now set out in German acts and ordinances, particularly the German Social Code VII.

Research conducted by the German Social Accident Insurance is geared to practical needs in the field. It exploits findings from occupational and commuting accidents, occupational diseases and trends in work-related exposure. It is closely linked to other instruments such as regulation, training, testing and certification, preventive health monitoring, curative treatment and rehabilitation, and makes use of these instruments in order to ensure that the findings are transferred swiftly and efficiently in the field (2).

In a large-scale project conducted between 2004 and 2008, the prevention services of the German Social Accident Insurance were studied with regard to their mutual influence and quality assurance. OSH research was found to be the driving force behind prevention services.

## 2. Research as a driving force behind the prevention services of the German Social Accident Insurance

In the research projects mentioned above, which studied the efficacy and cost-effectiveness of the industrial statutory accident insurance institutions' prevention services, Sub-project 2 of a total of 14 sub-projects examined the mutual influences between the various prevention services. The aim was to identify not merely the different mutual influences, but also the services exerting or subject to the greatest influence upon or from other services. The mutual influences were analysed in detail with reference to three examples (noise prevention, the prevention of latex-induced allergies, and trends concerning the accident insurance of private care workers). From among the ten prevention services in total, 45 pairs of services were identified with a potential mutual influence. For each pair, the active and passive mutual influences were studied, resulting in ninety relationships in total. Estimates of the mutual influences for each service were made in workshops, with the involvement of all sub-project managers. In the course of these estimates, it was found that the mutual influences could be systemized both qualitatively and quantitatively. The result of the qualitative estimates is shown in Fig. 2.

Correlation analyses revealed significant correlation between the services in which

people are involved. The services in question are the personal prevention services. Additional interviews with experts confirmed the correlations between the personal prevention services. They also identified the reason behind these correlations, namely: the personal prevention services are generally conducted by persons with multiple functions. This group of persons is also that with the highest number of staff in the prevention departments of the accident insurance institutions, i.e. the prevention department. In the technical prevention services, a crucial role is played by the "expert committees", which are organized on sectoral lines. Within the expert committees, which draw heavily upon the services of the accident insurance institutions' research institutes, the technical services, encompassing certificates, accident prevention regulations, and the results of research and development, are also performed by staff with multiple functions. Analyses of the influences identified the services driving innovation within the prevention network. These were generally found to originate not in the services delivered by the prevention service to companies, but in the services performed by the members of the expert committees and at the research institutes. For example, research activity conducted by the accident insurance institutions is a major driving force behind the other prevention services. The actual research results however do not find their way directly into the OSH activity conducted within companies, since the reports on the results and the scientific publications are rarely read directly by the individuals responsible for in-company OSH activity. For this to happen, transfer points are required. This function is performed primarily by consultancy, information, communication and training. Subject-matter from other services is incorporated into these services and adapted for user-friendly implementation directly within companies. The services in question are generally conducted by the prevention department of the accident insurance institutions. The function of Sub-project 12 of the research project described above was that of channelling the influential services, such as the results of research and development, more concertedly into the transfer points.

### 3. Quality indicators for OSH research

A literature analysis was conducted in which the following quality criteria were identified for research and development projects: scientific reputation/implementation of project targets in a suitable concept (expertise); flexible organization and completion/scope for influence by the project initiator upon its progress (co-operation); value for money/satisfaction with handling of the project (overall satisfaction); prior sectoral experience/benefit of the project in consideration of its targets (relevance to the field); adherence to deadlines/appropriate time to project completion (time management); and visibility in Germany and abroad/dissemination of the project results in the sector at national level (publication). The terms in brackets constitute important indicators for research projects. In order for these general quality criteria to be examined in consideration of the results of OSH research, 161 projects completed between 1999 and 2001 for the industrial statutory accident insurance institutions were analysed. The interval of several years since completion of the research projects was chosen deliberately, in order to permit evaluation of their success and effectiveness.

The analysis essentially confirmed the quality indicators found in the literature. The indicators of time management and relevance to the field were extended by the following aspects: clarity of the schedule and remit of a research project; incorporation of the results into other prevention services, in association with services and products of relevance in the field; and swift leverage of the research and development results. The indicator of expertise was extended by specific quality criteria which cannot necessarily be applied to all research projects: the adoption of new scientific approaches and topics, and holistic interdisciplinary and international management of research and development

projects. For the indicator of publication, the benefit of the research and development results as a basis for other projects, for example in relation to the development of methods, was identified as a particular criterion. For the indicator of co-operation, it was found that the third-party funding of research projects generally led to more stringent project execution and clearer documentation of the results (3).

As the analysis shows, the identified quality indicators attach particular importance to the dissemination and practical relevance of the OSH research. This will be illustrated below by three examples.

#### 4. Examples of successful applied research

##### 4.1 Working conditions in call centres

Between 2000 and 2002, a large project aimed at improving working conditions in call centres was conducted jointly by a total of 10 partners, including four universities. The project was funded by the German Federal Ministry of Labour and Social Affairs (BMA). Based upon the working conditions in call centres observed by the study, characteristic stresses and strains were examined and model measures developed for human-centric design of these new types and forms of workplace. The focus of the work lay upon the work equipment (software and hardware ergonomics) and general furnishings, the working environment (light, climate, area and acoustics), the work organization (tasks, procedures, structures), and personnel (resources, training, qualifications) (4). In over 100 call centres, characteristic strains were analysed, model concept solutions for improvements to daily working practices were implemented, and the identification of concrete design measures was evaluated. The work was supported by a targeted public information campaign whilst the project was still in progress. A website was set up at [www.ccall.de](http://www.ccall.de) and the results were published in the form of clearly structured and readable guides, reports and tools. The project was geared to sustainability from the outset. Eight years after the project's completion, the site still receives some 5,000 visitors and a little under 2,000 document download requests each month. The hotline that was set up is still manned by three people who are able to answer enquiries.

If this successful project is considered with reference to the quality criteria stated above, the following characteristics can be demonstrated: the project initiator was involved in project management from the outset, and by the inclusion of the employees in call centres, the actual intended target group was also involved. The project design was sustainable and interdisciplinary from the outset and was used to address the topic of call centres holistically. The results of the project were transferred to the field by a number of prevention services. Worthy of particular mention are consultancy, training, information and communication, and also surveillance. External funding necessitated strict project management and completion of the individual tasks to schedule. The results were implemented during the project or immediately following its completion. Via the website, which is still being maintained, the results are being made available both sustainably and in the long term to the affected parties and thus for application in the field.

##### 4.2 Safe communications systems for machine guarding

Information technology entered the realm of machine guarding in the 1990s. Whereas up until that point, electronic and computer controls had had to be excluded from safety-related applications, numerous research and development projects and ultimately

worldwide standardization work resulted in electronics and information technology becoming established within safety engineering. Demand therefore grew towards the late 1990s for communication systems to be used for safe interconnection of the individual safety-related units, particularly in more complex manufacturing systems such as those in the chemical or automotive industries. For this reason, the German Social Accident Insurance launched a project for the development of measures for safe communications systems. A survey within this area very quickly revealed that preliminary concepts were already in use in railway signalling. These concepts were transferred to the area of machine safety engineering in close consultation with the industry concerned. The idea was pursued of exploiting the standard communications systems (field buses) and their protocols for safety transmission purposes (5). A "safety layer" programmed in safe technology at the transmitter and receiver enabled safe communication to be achieved even over unsafe hardware. For this purpose, the standard protocols were used for transmission of the additional signals in the safety layer. Should communication be disrupted, this solution enables both the receiver and the transmitter to bring about the safe state. The underlying concept was published early at the beginning of 2000 and formulated in a standard, initially at national level. Certification procedures conducted in conjunction with all leading field bus manufacturers have resulted in this principle now being used throughout the world and in a safety function being added to all standard field bus systems.

With this project, too, it was a valuable advantage for the target group to be involved from the outset. Implementation of the ideas in commercial products lay at the heart of the activities from the very beginning. Sustainable transfer in the field thus became the task of the product manufacturers. Once again, numerous prevention services were involved in transfer during this project: in this particular case, consultancy with manufacturers, the certification of products, standardization, information and communication. International co-operation was regarded as a given from the outset. Once again, the perseverance of the initiators was rewarded in this project by thorough implementation in products. Major reservations voiced at the beginning of the project had to be overcome; this was achieved by numerous workshops, conferences and publications, which generated the necessary market pressure.

#### 4.3 Improvements to ergonomics at sewing workplaces

Industrial sewing activity may give rise to disorders of the musculoskeletal system. Possible causes are highly repetitive and in some cases one-sided stresses upon the muscular systems of the hand, arm and shoulder, and a posture with excessive forward inclination. The consequence of these stresses is a relatively high rate of unfitness for work. A number of insurers therefore approached the IFA in 2002 with the request that it analyse and systematically improve the ergonomic design of sewing workplaces. A research project involving a workplace analysis was first conducted. In a holistic approach encompassing six sub-phases, prototypes of improved sewing workplaces were subsequently developed in conjunction with an engineering consultancy, an ergonomic actual/target comparison was conducted, and the results obtained from this were adapted for practical application. Analysis of the stresses was conducted in eight companies and focussed upon posture analysis by means of an adaptation of the CUELA system for hand-arm stresses, measurement of muscle activity, physical forces and the working environment (e.g. noise and lighting), and subjective assessment of the stresses. The new sewing workplace designs were evaluated in four companies by means of pre/post measurements. Over the six years since completion of the project, the engineering consultancy has completed an ergonomic redesign of forty workplaces. The costs are around €1,500 per workplace. Days lost owing to unfitness for work were

reduced by 16% with an accompanying 15% increase in productivity. These figures result in a 100% return on investment within only a few months. The project won the 2007 European Best Practice Award in MSD Prevention from the European Agency for Safety and Health at Work in Bilbao (6).

This project also involved the project initiator (several accident insurance institutions) in project management from the outset. The target group was likewise involved from the outset. An interdisciplinary and holistic project design promoted implementation in the form of the new sewing workplace. Transfer to the field was assisted by various prevention services including consultancy, training, investigation, and also information and communication. Implementation was assisted by involvement of the engineering consultancy during the project phase, and highly sustainably by the conversion of numerous sewing workplaces.

## 5. Summary

In this paper, three very successful examples have shown that criteria exist for the successful design of OSH projects. Facility for practical application, adherence to deadlines and also support for companies beyond the project's completion are among the key characteristics of the successful transfer of OSH research results on the ground. Not all research projects satisfy these criteria, even at the German Social Accident Insurance. Systematic improvement of this situation was the objective of the research project referred to above. The criteria have been made part of the research management of the institutes of the German Social Accident Insurance, and have been monitored regularly since 2009.

6. Illustrations:

Figure 1: Direct social benefits in Germany in 2009

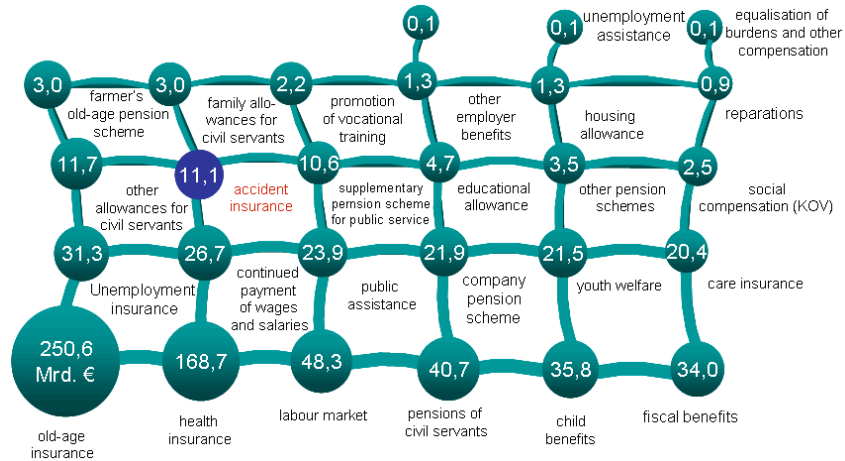
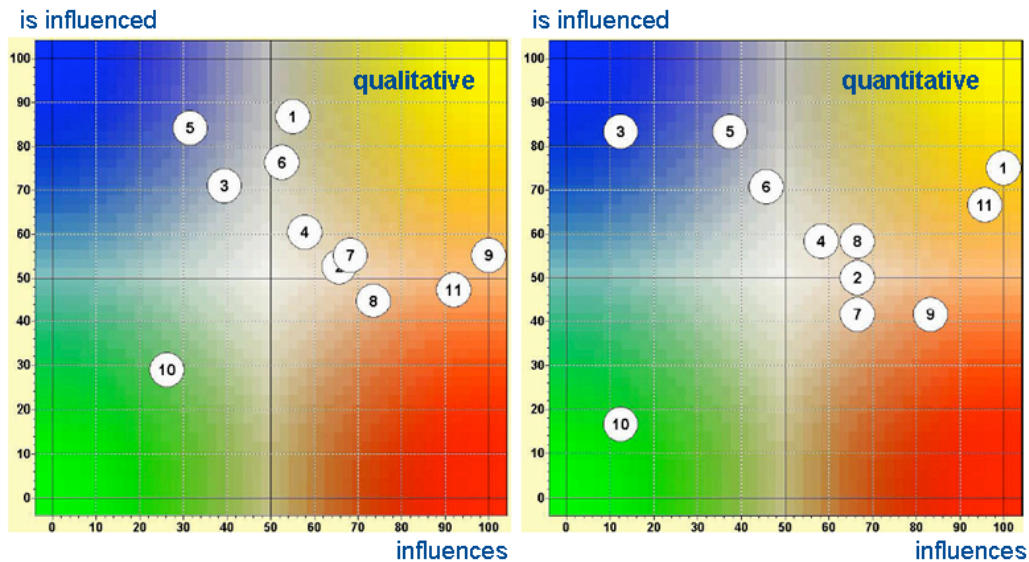


Figure 2: Research as a driving force behind other services



1 – Consulting, 2 – Investigation, 3 – Company medical support and guidance on safety technology, 4 – Inspection, 5 – Training, 6 – Information and communication, 7 – Accident prevention regulations, 8 – Certification, 9 – Research and development outcomes, 10 – Incentive schemes, 11 – External factors

## 7. References:

- (1) DGUV 2008: DGUV statistics 2008. Figures and long-term trends.  
<http://www.dguv.de/inhalt/zahlen/documents/dguvstatistiken2008e.pdf> on 24.09.2010
- (2) Kohstall, Thomas: Final Report. Quality in Prevention – Effectiveness and Efficiency of the Prevention Services of the Social Accident Insurance in Germany.  
[http://www.dguv.de/iag/de/forschung/forschungsprojekte\\_archiv/qdp/qdp\\_abschluss\\_documento/qdp\\_komplett\\_en.pdf](http://www.dguv.de/iag/de/forschung/forschungsprojekte_archiv/qdp/qdp_abschluss_documento/qdp_komplett_en.pdf) on 24.09.2010
- (3) Reinert, Dietmar; Eva Flaspöler: Project: "Qualität in der Prävention". Sub-project 12: "Forschungs- und Entwicklungsergebnisse"  
[http://www.dguv.de/iag/de/forschung/forschungsprojekte\\_archiv/qdp/qdp\\_abschluss\\_documento/qdp\\_ab12.pdf](http://www.dguv.de/iag/de/forschung/forschungsprojekte_archiv/qdp/qdp_abschluss_documento/qdp_ab12.pdf) on 24.09.2010
- (4) Benninghoven, A.; Bindzius, F.; Cramer, J.; Ellegast, R.P.; Flowerday, U.; Genz, A.; von der Heyden, T.; Pfeiffer, W.; Schittly, D.; Schweer, R.; Stamm, R.: CCall - Healthy and Successful Work in Call-Centres. In: International Journal of Occupational Safety and Ergonomics (JOSE) 11 (2005) No. 4, pp. 409-421
- (5) Reinert, D.; Schaefer, M.: Sichere Bussysteme für die Automation. Hüthig, Heidelberg 2001. ISBN: 3-7785-2797-5
- (6) Ellegast, R.P.: Redesign of a sewing workplace. Work-related musculoskeletal disorders: Prevention report. p 45-49, Ed.: European Agency for Safety and Health at Work. European Communities, Luxembourg 2008. ISBN: 978-92-9191-162-2