

Aerospace technology
Biotechnology
Energy and sustainability
Information and
communications technology
Maritime Technology
Materials technology
Medicine and health
Microsystems technology
Nanotechnology
Optical technologies
Production technology
Security
Services

Summary of the results achieved in 2007 in the project *Innovation with Norms and Standards (INS)*, funded by the German Federal Ministry of Economics and Technology

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At the Hanover Fair in April 2007, Dr. Torsten Bahke, Director of DIN, hands over the final report on the projects undertaken in 2006 to Norbert Barz (r.) of the Federal Ministry of Economics and Technology.



Foreword

The German Federal Government has spotlighted standardization as an important means of attaining its economic goals. The »High-Tech Strategy for Germany« approved in the summer of 2006 states that »the success of German high-tech products on world markets must be supported with a vigorous standardization strategy. Giving standardization early consideration in the research process and when translating research findings into high-tech products and services creates competitive advantages for Germany.«

A key element in the implementation of this standards policy was created in mid-2006 by the Federal Ministry of Economics and Technology in its long-term project **Innovation with Norms and Standards (INS)**, coordinated and conducted by DIN, the German Institute for Standardization. The Ministry's financial support clearly shows that the Federal Government has recognized standardization's potential as a strategic instrument for accessing markets.

The challenges which the INS project is helping to meet include the identification of the market potential of new technologies, the harmonization of interfaces between different technological sectors, the fast and effective reaction to technological changes on the market, and the optimization of the process of bringing innovative products to the market.

In addition to the rapid dissemination of innovative technologies on the market, another primary aim of **Innovation with Norms and Standards** is to sensitize all innovation

players who up to now have not been involved in the standardization process. A particular focus is being placed on small and medium sized enterprises (SMEs), which are being encouraged to integrate the instruments of standardization into their business strategies in order to increase penetration into existing and new markets.

Incorporating standardization in the research and development process at an early stage is a further INS objective. The Federal Ministry of Economics and Technology is committed to placing greater emphasis on standardization in future when awarding and evaluating public research contracts. It is acknowledged that appropriate standardization promotes the translation of research findings into marketable products, strengthens and prolongs the positive effects of funding research, and helps German businesses gain easier and, above all, quicker access to markets.

Considering the challenges of global economic competition and the need for the German economy to continue to meet these challenges, the results of the project **Innovation with Norms and Standards** are contributing to the long-term success of German businesses as leaders in the global economy.

MinR NORBERT BARZ

GERMAN FEDERAL MINISTRY OF ECONOMICS AND TECHNOLOGY (BMWi)

Preface to **Preface**

The programme **Innovation with Norms and Standards (INS)**, initiated by the Federal Ministry of Economics and Technology, presents DIN both with a great challenge and a great opportunity. The opportunity lies in the numerous ongoing projects which raise and reinforce DIN's profile among researchers and others involved in knowledge transfer. The concrete results generated by these projects will make it easier to demonstrate standardization's role as a tool for the efficient transfer of innovations. The challenge lies in the fact that we now must deliver concrete, meaningful and convincing results, as the expectations of businesses, researchers and politicians alike regarding the efficiency and effectiveness of standardization in the innovation process have risen markedly.

We have demonstrated that we can fulfil these expectations. At the start of the programme in Spring 2006 DIN's standards committees developed and implemented proposals on an impressive number of subjects at very short notice. In the programme's second year, 2007, we were again pleased to see a large number of new projects submitted by the stakeholders and, as the following collection of project summaries shows, these have been carried out with great success. And many more proposals, suggestions and ideas for new and innovative projects have already been submitted to us for 2008. To provide an objective basis for project selection, the Presidial Board has created the special committee »Research, Innovation and Development« (SO-FIE) to support the internal evaluation and management of the INS projects. In selecting projects DIN follows the same approach as that adopted in the Federal Government's »High-Tech Strategy for Germany«, keeping the benefits for the German economy in the foreground.

The basic research projects – which elucidate principal aspects of standardization – have provided us with significant input for directing our own future course. This includes the development of a new standardization concept, the identification of future topics for standardization, and a more effective involvement of small and medium-sized enterprises (SMEs) in the standardization process. In this manner standardizers, the Federal Government and German business and industry all gain mutual benefits from the project results.

DR. TORSTEN BAHKE
DIRECTOR OF DIN

Basic research

Basic research Effective and efficient European standardization processes and structures

Rapid technological developments, technological convergence, global competition and a need for greater marketability are the challenges facing European standards organizations today. In conjunction with rapid technological change, the convergence of technologies leads not only to greater market opportunities but also to greater challenges to the organizational structure of standards work.

European standards work is currently divided into three sectors: CENELEC is responsible for electrotechnical standardization, ETSI for standards in the telecommunications sector, and CEN for standardization in all other areas. The steering and working committees of these three organizations make all organizational and standards policy decisions in their respective areas, and each body has its own infrastructure for the initiation, administration and monitoring of standardization activities. At present recommendations for intra-organizational cooperation are made by the Joint Presidents Group on a case-by-case basis.

The present INS project involved a survey carried out by means of a questionnaire with the aim of clarifying the extent to which close cooperation can help these European standards organizations meet the above-mentioned challenges. Since CEN and CENELEC have comparable structures, the survey focussed on these two organizations.

The questionnaire asked participants how satisfied they are with CEN and CENELEC and the extent to which they feel the aims of these organizations are achieved and how efficiently they function. Furthermore, the participants were asked to rate their satisfaction as regards significant factors such as effectiveness, competence, timeliness, redundancy and cost. A large section of the questionnaire asked for an assessment of new standardization structures and future forms of cooperation.

An analysis of the survey results showed that there is considerable room for improvement as regards goal achievement and efficiency. In a regression analysis, effectiveness, competence and timeliness were identified as being the three most significant factors influencing standards work.

Participants' responses to the questions regarding eight characteristics of future structures for cooperation showed that they feel the European standards organizations should work closer together. In all, five recommendations for action can be drawn from the survey. When implementing these recommendations, the major factors influencing satisfaction, efficiency and goal achievement identified in the survey (effectiveness, competence and timeliness) will need to be taken into consideration.

Any measures taken should accordingly be reviewed in the light of their impact on these factors. Formulating a concrete plan of action based on the results of this survey is the next step towards achieving more effective and more efficient European standardization processes and structures.

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→ To obtain a detailed summary of survey results, contact presse@din.de or download the »Study on Convergence of Technologies: Management Summary« at www.din.de (under »Publications«).

Basic research

Identifying new areas for standardization (follow-up project)

The timely identification of future topics for standardization helps Germany in more ways than one. The competitiveness of German industry is strengthened by the possibility of exerting considerable influence on international standardization, and hence on international markets, through corresponding national initiatives. German researchers also benefit from being able to cooperate effectively in formulating new concepts for fundamental research topics or proactively setting measurement and testing standards. Until now, however, the formal standards organizations have not systematically undertaken the identification of such promising subjects for standardization.

Initiated in 2006 under the umbrella of the INS programme, this basic research project involves the development of a scientific method for identifying new areas for standardization.

On the basis of a statistical analysis of innovation indicators, promising scientific and technological fields are being identified in which Germany can play a leading role and in which standardization will also be required. In 2007 the list of basic indicators in science and technology – such as scientific publications and patent applications – was updated, and new indicators – such as regulatory activities and the acceptance levels of new technologies – were surveyed. These last were then evaluated in terms of their suitability for assessing future topics for standardization. Because traditional indicators such as publications and patent application are of lesser relevance to the services sector, foreign trade statistics were also reviewed and analyzed.

Taking all of these indicators into consideration, an online survey using the Delphi method was carried out in 2006 and 2007 to identify the first subject areas for consideration. Publications in technical journals, European patent and trademark applications and registrations, and relevant databases and networks were all used as a basis for identifying potential experts for participation in the survey. Researchers in public and private organizations were approached, particularly those evincing significant activity in scientific publications and patent

applications, as well as representatives of relevant social groups such as environmental and consumer organizations, professional associations and trade unions, as well as regulatory institutions who are generally not yet involved in the standardization process.

Topics which have been the focus of the study since its inception include nanotechnology, security technology, medical technology and biotechnology. The second round of the survey on these topics was concluded in Spring 2007. Two rounds of surveys on resource efficiency and maintenance services were also conducted in 2007.

The experience gained in the surveys on the initial topics carried out in 2006 and 2007 (nanotechnology, security technology, and medical technology and biotechnology) was used to refine the methodology for the next surveys on resource efficiency and maintenance services. For these topics the first round was conducted as an open survey in which experts could name the subjects they considered most relevant for standardization, while the second round involved a detailed evaluation of some of the subjects that had already been named. The experts were asked to assess the topics in terms of their priority for standardization, the significance of standardization for various dimensions of the subject, the types of standard needed, and the regional level of standardization required. This Delphi survey resulted in priority lists of standardization topics earmarked as being relevant and urgent and which could possibly lead to new standardization processes or new types of standard.

Besides serving to gather information on future standardization topics, the surveys have also raised awareness of the benefits of standardization, especially among scientists and business persons, motivating them to take part in future standardization activities. Besides serving to coordinate the input of new standardization topics with those responsible in the standards committees, the survey results are also being used to win over interested scientists, researchers and innovative businesses to the idea of standardization.

In the nanotechnology sector, the methodological experience and information gained in the studies have also been used to develop a roadmap for international electrotechnical standardization at IEC, the International Electrotechnical Commission. This shows how the investigation results can effectively and efficiently strengthen Germany's position in European and international standardization.

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Basic research
Market access and market approval with norms and standards (follow-up project)

Over the past few years, increasingly rapid innovation has considerably broadened standardization's core task. The marketability of innovations must now be addressed at an early stage and purposeful action taken. Especially in the light of the continuing globalization of markets, norms and standards can help innovative products gain market access.



The aim of this study was to determine the significance of norms and standards for market access and market approval. A second aim was to illustrate the benefits of standardization for trade relations as well as for internal business operations. The investigation differentiated between small, medium and large companies, and considered the extent to which each company participates in standardization.

Building on the 2006 project results – which had confirmed that large companies are more aware than SMEs of the strategic importance of standardization – a survey of a broad spectrum of industry was carried out in 2007. Surveys in different sectors asked participants to elaborate on statements made in the previous year and to discuss the application of standards in their organization (i.e. the use, implementation and management of standards, and participation in standards committees). Particularly interesting aspects were dealt with in depth in supplemental interviews.

The questionnaire used was divided into five sections to take account of the different points of view in different departments. The first, more general, section addressed questions relating to the company as a whole, while the remaining four sections dealt more specifically with purchasing, design and development, sales and standardization.

An evaluation of the responses shows a marked difference between small, medium and large organizations. For instance, smaller companies rarely participate in standards work and review the validity and currency of their standards collections only at long intervals. Among the different departments there were also differences of opinion as regards the application of standards, for example where the use of a standard is not required by contractual conditions. The approach to standards varied among departments and according to company size in other aspects, as well.

Investigations into familiarity with quality marks and test marks showed that there is a great need for information in this area. There was also a wide range of opinions regarding the extent to which such marks promote or are even necessary for market access.

Many companies see a need for general changes to the structure of the standards themselves. For instance, many feel that European Standards are too complicated and should contain descriptions of solutions for specific cases. To make standards easier to understand, abstracts should include more detailed and clearer explanations of the standard's purpose and its relationship to other standards.

The survey responses and interviews were evaluated to develop recommendations for action. Ideas were developed on how to interest companies in standards and standardization, provide more information on these subjects, and conduct seminars on standardization. Ways of motivating smaller firms to participate more in standards work were also described.

The implementation of these recommendations and finding a means of promoting a wider acceptance and application of standards will be dealt with in further INS investigations that will focus on SMEs.

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Aerospace technology

Aerospace technology

- **SMEs in the aerospace industry** (follow-up project)

Although the European aerospace industry relies on the use of standards more than almost any other sector, small and medium-sized enterprises (SMEs) in this industry meet with structural barriers when it comes to European standardization.

This investigation built on the results of the 2006 project, which presented empirical results regarding the structure of the French and German aerospace industry's participation in standardization with a particular focus on SMEs. The 2007 follow-up project extended this investigation to the rest of Europe, drawing up specific recommendations for action for the national standards bodies and the industry with the aim of improving the incorporation of SMEs into the standardization process.

Norms and standards are crucial drivers of innovation, particularly with respect to their function in the opening up of new markets. Cooperative development and formulation of the content of norms and standards tops the list of the most important motivations for participating in standards work. Organizations having a mature structure of mutual cooperation seem to profit the most. Standards have a positive impact on export activities, the interoperability of supplied parts, and cooperation between suppliers and purchasers. Those who are active in standardization appear to gain the greatest benefit from standards, especially in terms of their export structure.

Among the main recommendations for action were raising the industry actors' awareness of the strategic benefits of participating in standards work, strengthening the negotiating position of SMEs by intensifying cooperation particularly among direct competitors, and directing the standards bodies' attention to the untapped potential of internationally active and research-intensive small companies.

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- **Standardized decision-making aids for assessing the readiness level during a product's life cycle**

This INS project developed concepts which will be published in a draft standard describing a standard method for assessing the maturity of a technology on the basis of NASA's system of Technology Readiness Levels (TRLs). This method will be applicable at all project phases and valid for all TRLs and project stages.

An overall process, the »TRL Evaluation Process«, was defined which involves both a TRL and an Integration Readiness Level (IRL) identification method. These methods can be used throughout the project time axis to establish the TRL/IRL rating of a technology that describes its implementability and integration capability in terms of project requirements. A description of the overall process and of the two readiness level identification methods will be the focus of the future draft standard.

As a rule, a technology should only be introduced when it has reached the necessary level of maturity. The assessment method developed as part of this INS project allows the systematic and targeted determination as to whether a technology is ready to be introduced or whether it needs further development to the necessary readiness level.

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- **Standardization of membrane bioreactor (MBR) technology used in European municipal wastewater facilities**

(follow-up project)

Membrane technology, a combination method for the treatment of municipal and industrial wastewater, involves activation and membrane filtration. A large number of membrane bioreactor (MBR) products have been developed and are being sold on the European market. However, the variety of products available – which differ largely in terms of their geometry, capacity and operation – is hindering the acceptance of this new technology as state of the art. Furthermore, the European MBR market is currently dominated by two non-European manufacturers.

The aim of this project is to accelerate the development of competitive European products by standardizing the MBR method while at the same time increasing acceptance by reducing investment and operational costs. This INS project is based on a study carried out as part of the EU project AMEDEUS (= »Accelerate Membrane Development for Urban Sewage Purification«). At a workshop held in November 2006 in Berlin it was confirmed that there is a need for membrane technology standardization. In 2007 a CEN Workshop Agreement (CWA) on this subject was initiated, which together with the project report is expected to be published in mid 2008.

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- **Treatment of water used in bathing facilities by ultrafiltration as in DIN 19643-6** (follow-up project)

The costs of water treatment and disinfection often present a financial hurdle for operators of bathing facilities. Ultrafiltration, a special type of membrane technology, reduces costs while maintaining levels of quality and safety. Standardizing this technique will give it a verifiable basis, leading to improved market transparency and fairer competition.

In 2006 the current state of technology and standardization in this field was evaluated by experts and a need for further research identified. A research project carried out in 2007 helped clarify essential technical details involved in this new method. The results will be incorporated in a new standard, DIN 19643-6 »Treatment of water in swimming pools and baths – Part 6: Combined method: Flocculation – adsorption – ultrafiltration – chlorination«.

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Energy and sustainability

Energy and sustainability

- **Concepts for explosion protection for fuel cells**

Fuel cells are increasingly being used in numerous fields, e.g. as energy suppliers for transportable equipment or as power sources for vehicles such as buses or water craft. The proliferation of fuel cells has led to an urgent need for a comprehensive explosion protection concept and hence the specification of a high level of safety.

This INS project involved pre-standardization research into how the explosion protection measures laid down in the standards series DIN EN 13463 and DIN EN 60079 might be implemented for fuel cells. The objective was to develop standardizable requirements for the explosion protection of cells containing different types of fuel used in various applications on the basis of existing standardized explosion protection concepts.

Research activities and the pooling of expertise have laid the foundation for future standards work and the implementation of the results obtained in this INS project.

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Information and communications technology

Information and communications technology

- **Digitalization and long-term preservation of digital documents** (follow-up project)

»Persistent identifiers« (PI) are essential to the long-term preservation of digital resources. Being permanent addressing mechanisms, persistent identifiers have an advantage over the URLs (Uniform Resource Locators) commonly used on the Internet. A PI remains the same regardless of the resource location, thus ensuring long-term traceability and referencing. A number of PI schemes are being used internationally, each with its own resolving mechanism (e.g. URN, DOI, Handles, PURL). However, it is difficult for users and institutions to assess the long-term interoperability and reliability of these various systems.

In this INS follow-up project various approaches to standardizing PI systems were developed, the focus being on reliability and interoperability. One result was a criteria catalogue for PI system reliability. Case studies were carried out to gather specific experience among archives and libraries. The »N2T« (name-to-thing) persistent identifier resolver developed in the USA was taken as the basis for an approach to interoperability which allows document access on a superordinate level regardless of the PI system used.

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•• E-government networks (follow-up project)

Over the past few years, public authorities in Germany have made great endeavours to embrace e-government, mindful of its role in enhancing the country's position as an attractive business location. But current solutions are too oriented towards individual administrative needs rather than those of business and the private citizen. A fully integrated e-government requires more interoperability of solutions through standardized interfaces, as well as a consistent design of administrative processes involving various partners in public administration.

This project, initiated in 2006, continued in 2007 with the workshop »Business process management for further development of the portal and process library« held at DIN in June 2007 with the broad participation of the »virtual community«.

Numerous ideas for project work were developed that were put into action as follows:

- Integration of a process database and improvement of the European services ontology
- Cooperation at European level, particularly in the CEN/ISSS eGovernment Focus Group and eGovernment Resource Network (eGRN)
- Definition of criteria for semantic interoperability between eGRN and the process database
- Organization of network administration
- Exemplary business process modelling as a method for tailoring web services

These actions served as starting points for the standardization of integrated e-government networks, which will be carried out in detail in 2008.

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••• Integration of the DIN Properties Dictionary in cross-industry systems (follow-up project)

Use of the standardized, precisely defined properties contained in the DIN Properties Dictionary leads to considerable improvements in data quality. Precise definitions provide an exact description of each property, thus reducing misunderstandings and resulting error or rectification. However, only a small group of people professionally concerned with properties know of the DIN Properties Dictionary and its actual use in companies is very limited. This project aims to identify measures for increasing industry acceptance of the Dictionary.

A study of how the DIN Properties Dictionary can be used for master data management in cross-industry systems was carried out. In addition, the interrelationship between the Dictionary and other relevant property classification systems was presented to potential users. The following organizations and projects were reviewed: eCI@ss, proficlass, ETIM, VdZ, VDMA and PROLIST.

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Finally, the web portal www.DINsml.net was expanded to include essential functions for the simplified searching of properties and classes which are standardized in the Dictionary or are available as drafts. Now users with no previous knowledge can obtain a rapid overview of the Dictionary's contents. Functions for simplified online requests for properties and classes were also developed and integrated.

••• International product description database and catalogue certification service

Electronic product data exchange is playing an increasingly greater role in the corporate context owing to the globalization of markets and continual technological development. Businesses are being faced with increased pressure through competition and time constraints, while supplier information has to be obtained and provided to customers ever more rapidly. Through the widespread use of the Internet, data can be accessed worldwide in no time at all. The main limitation is the quality of the data itself – multilinguality and misinterpretation of data are major factors contributing to this problem.

Use of the standardized, precisely defined properties contained in the DIN Properties Dictionary leads to considerable improvements in data quality. Precise definitions provide an exact description of each property, thus reducing misunderstandings and resulting error or rectification. The DIN Properties Dictionary is based on the information models in ISO 13584-42, which can also be used to develop properties in-house. These customized properties – which for business policy reasons are not to be divulged in the open standardization process – can thus be managed in an internal properties dictionary.

As this information model is being increasingly used in industry, not all structural information is stored by the users themselves, and so the web service associated with the DIN Properties Dictionary, DINsml.net, enables that structural data (e.g. the definition of a property in French) to be automatically accessed from the appropriate server – this web service conforms to ISO 29002-20 (currently at the »new project« stage).

As this project progressed, work continued on the preparation of ISO 29002-20 and a prototype of the web service for the DIN Properties Dictionary was implemented. A PC application was developed for the functionality of the web service and a presentation drawn up describing its benefits to industry.

•••• Preliminary study: A standard library of descriptions for facility management

Facility management is a hot topic these days, and facility services have also gained increasing significance due to the current interest in sustainability. Nevertheless, the standardization of data exchange and texts used in tendering procedures in this sector is still in its infancy.

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The »Preliminary study of the possibility of a standard library of descriptions for facility management« involved an analysis of the »StLB-Bau–Dynamische BauDaten«, an online version of the German library of descriptions of building works (StLB). The format developed by GAEB, the joint committee for information technology in building and construction, which is the national standard for building contract data exchange, was also examined, the aim being to establish whether a similar system could be developed for facility services. This work involved a review of solutions by, and discussions with, facility management associations such as GEFMA, IFMA, and Real FM.

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Results included organizational recommendations and the formulation of the following objective, which is significant in light of the increase in electronic tendering and digital building records: The creation of a universal system, free from changes in medium, featuring standardized structures and data formats, with data being entered only once for all building construction and management processes.

..... **Realization of an online platform for accessing full-text documents**

Technical rules, laws, regulations and directives form a complex of interdependent documents necessary for implementing safety requirements, participating in the European Internal Market and succeeding in the global market. Accessing this wealth of information is often difficult and time-consuming, especially for SMEs, and the currency of documents is often hard to recognize.

With this in mind, the INS project aimed at realizing rapid, effective access to standards, other technical rules, and regulatory documents by means of a simplified yet comprehensive data pool. Taking the general development of a neutral IT tool as a basis, a concrete product concept was mapped while keeping possibilities for other uses in mind, such as Beuth Verlag's »Virtual Library« and the DIN web site.

The result was presented as the online service »Safety of machinery« (www.maschinensicherheit-online.de). This online platform allows full-text searching of documents, access to editorially or automatically generated hyperlinks, and a new navigation system.

»Safety of machinery« incorporates the entire body of knowledge on the safety of machinery in Europe and its legal aspects. This online service implements the project's objective of collating various documents on a common topic for comprehensive, universal use. The service links EU Directives with DIN Standards, comments, sample solutions and guidelines for implementation. Users of the service gain fast, targeted access to information that will give them an informational edge and a competitive advantage. In 2008 this online technology will be used for product development in further INS projects.

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••••• Speech dialogue systems

Computers play an increasingly important part in both work and leisure time activities. Until now, humans communicated with computers using written language, with a keyboard for input and a monitor for output. Today, many applications involve communication with computers and other IT systems via spoken language. These are often interactive applications such as electronic customer service systems, telephone banking applications, passenger information systems, mobile telecommunications services and speech recognition devices.

The goal of this INS project was to establish a basis for an International Standard on speech dialogue systems. The intent is to ensure a smooth dialogue by means of spoken language, thus improving communication between the user and electronic systems. It is particularly necessary to ensure understanding without misinterpretations and as few follow-up queries as possible.

The project results were fed into international standardization activities.

Maritime Technology

• Ballast water management

International shipping traffic gives rise to the introduction of nonindigenous biological species to marine areas, one of the greatest threats to the world's ocean and coastal region ecosystems. Seagoing vessels require ballast water to ensure stability, structural integrity and manoeuvrability under all loading conditions. Sea water is introduced into, or expelled from tanks, as liquid ballast; the amount of ballast water is adjusted during loading and unloading procedures. Aquatic organisms are taken in with the ballast water and let out when the water is discharged.

Seagoing vessels are involved in more than 80% of the world's commercial traffic. The problem of the dissemination of exotic species through the dumping of ballast water has been recognized by the International Maritime Organization (IMO). Because there are so many different methods of treating ballast water, the IMO's Marine Environment Protection Committee (MEPC) has issued several resolutions specifying the on-board treatment of ballast water and giving limit values. A combination of measurement and controlling equipment, with which specified parameters and limit values can be monitored and controlled, is necessary for the proper operation of ballast water treatment systems.

The requirements for such systems and relevant tests were developed as part of the INS project »Ballast water management«. This included a water sampling method which will ensure reproducible and comparable test results. A draft of the first part of a three-part series of DIN Standards has already been published, while drafts of the remaining two parts are expected to be completed in the coming months.

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Materials technology

Materials technology

• Classification of textile concrete reinforcement in terms of its suitability as structural reinforcement

In textile-reinforced concrete (TRC) high-module fibres are used to form open mesh structural textiles. These can be flat fabrics or 3-dimensional spacer fabrics which are designed for specific component shapes and cross-sections, and for certain concreting methods. Because the textiles are often manually embedded in the concrete formwork it is important to be able to manipulate and position the textiles in the formwork. Usually, extensive investigations are needed to identify a suitable textile product.

Textiles and Textile Machinery Standards Committee (Textilnorm)

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To improve the current situation for users of TRC, this INS project identified and analyzed relevant parameters for textile reinforcement structures such as fabric firmness, compressive rigidity, and dimensional stability. Various methods of determining these structural parameters were developed and tested using experimental equipment. As a result, the prerequisites for classifying textile concrete reinforcement in terms of its suitability as structural reinforcement were created.

•• High strength fibres and textiles for concrete

Textile-reinforced concrete (TRC) is an innovative field which has seen much activity at both the national and international level. TRC is a composite material having an increased tensile strength that is not achieved through conventional steel reinforcement but through high-strength materials such as alkali-resistant glass fibres (ARG fibres). These are worked into an open mesh 2D or 3D reinforcement structure and then embedded into the concrete matrix.

Textiles and Textile Machinery Standards Committee (Textilnorm)

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In this INS project, a standard test method was drafted for establishing the mechanical characteristics of the textile products concerned and then submitted as a standardization proposal. The goal is to create a basis for the reliable and comparable testing and verification of building components, particularly as regards the product liability of structural components. This will pave the way for a wider use of the promising innovative material »textile-reinforced concrete«.

••• Selecting textile reinforcement for high-strength concrete components

Currently, textile reinforcement for concrete components is planned, designed and prototyped on a case-by-case basis, depending on the application and structure to be reinforced. Often the concrete mixture is also adjusted to the concreting method and yarn and textile structure used. Strength is then determined in a series of complicated investigations and the number of layers and textile structure adjusted in iterative steps until the component achieves the required strength.

Textiles and Textile Machinery Standards Committee (Textilnorm)

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The objective of this INS project was to develop a computerized tool for pre-designing textile reinforced concrete structures. To this end, widely-used fine concrete mixtures and textile reinforcement structures were identified. In addition, their relevant mechanical characteristics were determined, described in detail and then compared. Simple concepts for designing textile reinforced concrete components were also described and illustrated by means of examples.

◆◆◆ Standardization of thermally modified timber (TMT)

(follow-up project)

Thermally modified timber is one of the most significant recent innovations in the timber industry. »Thermowoods« are less affected by changes in humidity than is untreated timber, and are much more durable.

The first part of this INS project on TMT addressed the equilibrium moisture content and fire behaviour as critical aspects for standards on modified timber. The follow-up project investigated the use of TMT in windows and floors. The wood's fire behaviour was examined and the suitability of colorimetric measurements for classifying this type of wood was verified. It was shown that the L*a*b* colour space system is a suitable method for characterizing TMT that produces reproducible results.

Results of the »small flame test« carried out in accordance with DIN EN ISO 11925-2 showed that the fire classification widely used for untreated wood is also acceptable for thermally modified wood. Thus, TMT can be classified either as Euroclass E material or as a class B2 material (»flammable«) in accordance with DIN 4102-1.

**Timber and Furniture
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Medicine and health

• **Drug-coated vascular implants** (follow-up project)

Drug coating is a promising method which benefits patients in many ways, for instance in the form of drug-coated vascular implants. Such combination products involve an overlapping of medical and pharmaceutical technologies. This applies to both technical and legal/regulatory aspects in the development, approval and marketing of the products concerned.

Since legal restrictions on medical and pharmaceutical products are not uniformly regulated at international level, and since the various parties involved (e.g. manufacturers, approval bodies) occasionally proceed on the basis of very different assumptions, there is a considerable level of uncertainty when it comes to planning and development. This can lead to disagreements as to the scope and type of testing, substantiation and documentation needed.

To improve the current situation, the following measures were carried out in this INS project:

- Organizing the kick-off meeting for the ISO working group »Vascular device/drug combination products« (ISO/TC 150/SC 2/WG 6) founded in connection with the previous INS project, with Germany holding the secretariat.

**Optics and Precision
Mechanics Standards
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- Supporting German leadership in the formulation of a working document by this working group in preparation for an ISO work item proposal.
- Coordinating various interests in the project by including international approval bodies, particularly the FDA in the USA.

As planned, the ISO proposal »Implants for surgery – Cardiovascular implants – Vascular device/drug combination products« will reach the voting stage by the end of this project.

•• Electronic patient records

An electronic patient record (EPR) contains all clinical and health-related data for an individual throughout his or her lifetime, regardless of time or place, and contains information for all those participating in treatment (including the patient), presenting this information as and when needed.

EPRs use an internet-based client-server architecture and are accessible via the Internet at any location. Because patients have sole rights to the record and hence to their medical data, they are the only persons who can decide who else may store or change what data in their record and who may view and use the information it contains.

Since EPRs are the key application in eHealth environments, they have to be compatible with nearly all available health information systems for all sectors of the health system and all modalities applied there (data, texts, graphics, video, audio, signals).

In this 2007 INS project all relevant EPR specifications, standards and standardization projects were analyzed, as were national EPR programmes in the countries leading in EPR technology. The analysis showed that none of the documents reviewed met the requirements set by the project. The next step will be to compile services and specifications and formulate requirements for the standards and models (including processes) which are necessary for the national EPR solution that is strived for. The intention is to develop a DIN Standard on the basis of this work.

**Medical Standards
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••• Innovative lighting technology

This project involves a close interdisciplinary cooperation among lighting industry research institutes, lighting designers and architects to determine the biological effects of light on humans. Biological, medical and chronobiological technologies are being addressed, taking occupational ergonomics and psychological factors into consideration. Translating the results of this project into innovative lighting products and using this knowledge to update existing standards will considerably improve lighting systems in Germany in line with user needs.

**Lighting Technology
Standards Committee (FNL)**

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In 2007 the project kicked off with the first DIN forum on the effects of light on humans. Leading lighting experts attended the ten lectures and subsequent podium discussion in which a high-level exchange of knowledge took place. Two reviews of existing literature and a scientific study were published as a result; the study was carried out by the University at Ilmenau in cooperation with the Charité University Hospital in Berlin.

A draft preliminary standard was developed in the responsible working committee at DIN. On its web site (www.licht.de) the Fördergemeinschaft Gutes Licht, an association of lighting organizations working together to increase awareness of the importance of »good lighting«, will also be giving recommendations for biologically effective lighting. The project will be continued in 2008.

••• Proton therapy accelerators – Structural radiation protection

Despite involving expensive apparatus, the use of proton accelerators is an accepted form of tumour therapy because the tumour tissue can be efficiently treated with a minimal effect on healthy tissue. This is particularly advantageous where the normal tissue immediately surrounding the tumour is extremely sensitive to radiation or needs special protection.

Because proton therapy involves the generation of high-energy ions resulting in highly penetrative secondary radiation, the necessary structural shielding measures are relatively complex and expensive.

Until now there have been no relevant standards on structural radiation protection in medical particle accelerators. This gap will be filled, at least for proton therapy, by PAS 1078 which has been developed as part of this INS project. The specification describes a uniform method for calculating the necessary thickness using standard building materials, taking as a basis all geometries widely available in practice.

**Radiology Standards
Committee (NAR)**

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•••• Tissue-engineered implants (follow-up project)

Despite wide media coverage, innovative surgical implants developed on the basis of tissue engineering have not sold well over the last few years. One reason is the fact that these are radically new products involving living cells (provided either by the patient or by a human donor). Another major problem is the great variety of regional regulations regarding market approval.

In 2007 this INS project involved preparatory work for the development of a standard covering the handling, risk assessment, marking and documentation of tissue-engineered implants. The intensified support of national experts enabled an ISO working group on this topic to be set up under German leadership. Thus, the standardization of assessment criteria for the approval of medical products using tissue and cells is taking place directly at international level. This standards work was brought to the attention of companies active in the field, several of whom are now active in the national mirror committee. As planned, a working

document on the risk management of viable and non-viable human tissues is in preparation which will be submitted with the German proposal for a standard to ISO for voting.

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In 2007 the project also involved participation in the partnering event »Intelligent implants – Bioactive implants« hosted in Freiburg by the German Association of Biomedical Engineering (DGBMT), as well as in the international biomechanics and biomaterials conference held by the clinic and outpatient department for orthopaedics at the Technical University in Munich.

Microsystems technology

Microsystems technology

• **International terminology for chemical micro process engineering**

Chemical micro process engineering encompasses the development, manufacturing and use of miniature chemical apparatus. Microreactors make it possible to produce very small amounts of difficult substances not only on-site and on-demand, but also at low cost and low risk as compared to conventional production methods. Currently, micro processing equipment is always one-of-a-kind, designed and constructed for a specific manufacturing process. A more rapid dissemination of micro process engineering in the chemical and pharmaceutical industries would need more efficient communication among researchers, engineers, manufacturers and users – this requires a standard vocabulary in several languages.

This INS project prepared the ground for the organization and formulation of a future European and international terminology standard which will define chemical micro processing terms in German, French and English. The necessary working groups have already been set up in the international standards committee ISO/TC 48 and the European committee CEN/TC 332. A mature work item proposal, capable of achieving consensus, has been drawn up in English and German. It is expected that a draft International and European Standard will be published in 2008. To ensure a broad, international acceptance of the standard, project results will be presented atACHEMA 2009, the International Exhibition-Congress on Chemical Engineering, Environmental Protection and Biotechnology.

**Laboratory Devices and
Installations Standards
Committee (FNLa)**
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•• **Measurement methods for assembly in microsystems technology** (follow-up project)

During microsystems assembly operations, measurement problems arise that cannot be solved by means of conventional mechanical or optical measurement techniques. Edges, edge profiles and surface quality must be measured during assembly using non-destructive methods. The INS project work has contributed to greater comparability, providing more reliable and unambiguous methods of measurement which will help accelerate and support contract negotiations. To reach this goal, the following measures were taken in 2007:

- Presentation of 2006 project results and activities planned for 2007 at the Hanover Fair and at the Microsystems Forum there in order to bring our work to the attention of potentially interested parties
- Participation at the »MiNaT«, a trade fair for microsystems and nanotechnology held in June 2007 at the new trade fair centre in Stuttgart
- Hosting the discussion round »Standardizing microassembly technology – Risk or reward for SMEs?« together with the VDMA at the user's forum at the MiNaT fair
- Preparation of and decision to submit the work item proposal »Production equipment for microsystems – Determining the effect of materials on uncertainty of measurement in optical and tactile dimensional metrology«
- Foundation of ISO Working Group WG 16 »Production equipment for microsystems« of ISO/TC 39 »Machine tools« so that national standards can be adopted at international level

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Thanks to this INS project, the circle of active experts and the spectrum of discussions has broadened considerably. In addition, the awareness among experts of the Committee's work has also increased.

Nanotechnology

• Identifying nanoparticles and nanotubes in cells and tissues for risk assessment

Nanotechnology is generally considered as one of the key innovation sectors of the 21st century which has enormous economic potential. In fact, products with functional nanoparticles are already on the market. Legislation has not specifically dealt with the health and environmental aspects of nanoparticles, however, as the risk potential of this technology is not yet known. For instance, many fear that – due to their extremely small size – nanoparticles could penetrate to cell nuclei, with mutagenic effects.

Materials Testing Standards Committee (NMP)

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This INS project is supporting current research in this field on the basis of which standards on risk assessment will be developed. To this end, in 2007 a workshop on the topic was held, a network of experts was developed, and approaches to implementation were discussed. The project will continue in 2008.

•• Nanoelectronics (follow-up project)

The central element of the German nanoelectronics standardization strategy is the creation of a consistent system of individual standards that will facilitate the production of high quality and highly reliable nanoelectronic products. To achieve this, the key control characteristics for production are being defined. In 2007 a nanotechnology standardization roadmap was developed as a German contribution to international standards work at IEC. This work, begun in 2006, was successfully continued in 2007 with Germany not only holding the secretariat for IEC/TC 113 but also assuming leadership of a new working group, WG 3 »Performance of Nanomaterials for Electrotechnical Components and Systems«. The first project for this working group is based on a German proposal drawn up in 2007, »Guideline for carbon nanotubes specifications for electrotechnical applications« which was submitted and approved at the second meeting of IEC/TC 113 in Singapore.

DKE German Commission for Electrical, Electronic & Information Technologies of DIN and VDE

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••• Textiles with nanocomposites (follow-up project)

A number of competitors in the textile industry are blurring the difference between high and low quality and confusing the market by labelling conventional textiles as »nano« products. These textile producers benefit from the current lack of suitable measurement methods, e.g. for identifying textiles with self-cleaning surfaces.

To protect this innovative industry – and the consumer – this INS project has begun developing standard test methods for quantifying »superhydrophobic« (extremely water repellent) surfaces and verifying the durability of this characteristic. In 2006 an analysis of various properties was carried out, which served as a basis for a series of interlaboratory tests performed and analyzed in 2007. As a result, suitable test methods were identified which will form part of an overall standardized testing concept.

Materials Testing Standards Committee (NMP)

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The aim is to develop a German, European and/or International Standard specifying a test method which will promote the necessary market transparency.

Optical technologies

Optical technologies

- **Geometric fusion** (follow-up project)

Single-sensor measurement has reached its limits in terms of accuracy and hence of the applicability of its results. One innovative method of obtaining more reliable geometric and radiometric data is the fusion of data from an ensemble of different types of digital sensor into the more comprehensive data output from one »logical« or »virtual« sensor.

This technology is used in high-resolution cameras, laser scanners, hyperspectral scanners, radars, and InSAR (Interferometric Synthetic Aperture Radar) systems in airplanes and satellites. Such sensors are used to improve resolution, combine aerial information with digital imaging (orthophotography), and for pan sharpening and object tracking.

However, until now there have been no criteria for evaluating results obtained by the fusion of data from different sources. This INS project has recognized the need for standardization in this area which would provide manufacturers and users with concrete specifications on the quality of end projects, with a view towards the international market. In 2007 sensors and methods for potential fusion products were introduced and discussed, and a standard proposal containing requirements for geometric fusion methods was developed on the basis of the discussion results.

**Building and Civil
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- **LEDs and LED systems** (follow-up project)

LEDs (Light Emitting Diodes) are superior to conventional light bulbs in terms of size, mechanical strength and durability. Over the last few years the efficiency of LEDs has also increased, making them now roughly comparable to halide lamps. The revolution in lighting technology has begun, but it has found little resonance in photometric standardization.

The dynamic increase in LED applications shows that there is a need for technical rules, e.g. on the measurement and evaluation of lighting and colorimetric characteristics in LEDs and LED systems. These are often determined using new equipment and methods such as near-field/far-field goniophotometry. This INS project is organized into three working groups dealing with LEDs in general, near-field goniophotometry, and measurement uncertainty with the aim of formulating German ideas and interests and integrating them into European standards work.

Coordinated standards work (using working plans, or »roadmaps«, for instance) began in 2006. Following one of these »roadmaps«, the first work item proposal was presented in 2007 and discussed at a meeting. The responsible working group was asked to expand on the proposal so that a draft standard can be prepared in 2008.

**Lighting Technology
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•• Microoptics

Microoptics and diffractive optics allow the implementation of innovative photon solutions in which new design strategies can be combined, such as micro- and nanotechnology, precision machining, and conventional methods of optical production. For this reason microoptical and diffractive-optical elements are increasingly found in optical systems used in laser forming, mobile telephones, photocouplers and biophotonics. In telecommunications applications, for instance, microoptical components and structures allow the coupling of macroscopic optical elements with microscopic opto- and nanoelectronic circuits, representing a successful combination of photonics technology with nanoelectronics.

Standardization has a special significance for this sector in that optical components and systems are increasingly being bought-in by manufacturers who have little optical knowledge. The aim of this INS project was to support German businesses and researchers in the competitive implementation and marketing of optical products by providing a relevant collection of standards covering the necessary microoptical and diffractive-optical system components.

The project made a major contribution to the communication among manufacturers, customers and users of one of the most highly innovative products in this sector today, the fast axis collimating (FAC) microlens. An agreement was made as to the uniform presentation of specifications in product data sheets, an essential basis for the comparability of products. The standard that will be published based on project results will also contain requirements for the information to be provided with the products.

**Optics and Precision
Mechanics Standards
Committee (NAFuO)**

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••• Short and ultrashort pulse lasers (follow-up project)

Germany is well-known as a leader in the laser technology market. Being a »gentle« technique, ultrashort laser technology – still very new – is particularly advantageous for use in materials processing, medical technology and metrology, and is considered to have great innovation potential. Although existing laser standards have helped ensure Germany's lead in the field, they do not deal adequately with the new method. There is clearly a need for speedy, forward-thinking standardization in this area.

By evaluating the current state of technology, this INS project is helping German businesses strengthen their position on the market and is promoting the translation of research results into competitive solutions. Suggestions for revising current standards and proposals for new standards have also been made.

One of the project's most significant accomplishments is the standardization of terminology used in connection with this new technology, which is contributing to successful communications in a common language. This is essential not only for standardizers but also for manufacturers, users, and test laboratories. The experts have also agreed on a method of measuring short and ultrashort laser pulses, a fundamental prerequisite for ensuring the reproducibility of measurement results.

**Optics and Precision
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Production technology

• Determining hydrogen content in welds

The economic and technical development of welding technology is being influenced largely by cost considerations, the need for minimal component thicknesses and material selection on the basis of the »fitness for purpose« principle. Accordingly, the use of high strength fine grain steels in large plant construction has gained in favour over the past few years. However, owing to their particular characteristics, these materials are more susceptible than normal steels to hydrogen-induced cracking.

Whether a steel is susceptible to hydrogen-induced cold cracking (HICC) depends on its microstructure, mechanical stressing, and the hydrogen concentration in welds. The latest research shows that the hydrogen concentration cannot be determined with sufficient accuracy using conventional methods, particularly the standard mercury method (the only reference method being that described in DIN EN ISO 3690:2001).

During the revision of DIN EN ISO 3690 the German Federal Institute for Materials Research and Testing (BAM) carried out an interlaboratory comparison with national partners to develop new, alternative test methods to be standardized at international level. The INS project was used to continue the initiative for the standardization of less costly and more environmentally friendly test methods. The project concluded with an international committee draft (ISO/CD) describing a new alternative to the mercury method – the BAM is planning an international interlaboratory comparison of this method.

Welding Standards Committee (NAS)

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•• Dry machining and minimum quantity lubrication (MQL)

(follow-up project)

Machining is still one of the most widely used processes in metalworking. The continual development of new, improved methods is essential for machine tool manufacturers to remain competitive.

»High speed cutting (HSC)« and »high performance cutting (HPC)« are optimized processes which enter new realms of machining performance. But these days new processes have to take greater account of ecological aspects – one answer is the dry machining technique minimum quantity lubrication (MQL).

Used during HSC/HPC processes, the MQL technique considerably reduces environmental risks as well as material consumption and disposal costs and contributes to the efficient use of raw materials. Experience already gained in practice is being used to develop a standardized MQL dry machining process. Standardized system elements and interfaces will help promote the effective, wide-spread use of this technology.

Machine Tools Standards Committee (FWS)

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The knowledge gained in the 2007 INS project activities has made its way into the draft standard DIN 69090-1, while a draft for the third part of this standard series is under development. It is expected that both draft standards will be published sometime during the second half of 2008

Security Security

• Security research

The aim of this project was to develop a strategy with which Germany can become a leader in security technology and services by means of standardization at an early stage of research. The subject of security and civil protection has high priority and encompasses not only the prevention but also the reaction to catastrophes caused by acts of terrorism, natural catastrophes, human-induced catastrophes and criminal acts.

To this end, 30 innovative businesses active in the security sector were invited to a workshop held in November 2007. The contributions by the participating representatives from research, industry and various associations reflected a certain amount of uncertainty as to the need for standardization on this subject, while at the same time great interest in the possible economic and innovative benefits of standards was shown. The workshop culminated in a strategy paper supported by all of the relevant organizations, »Germany's standardization strategy aiming at market leadership in the security sector – Potentials and challenges«.

Firefighting and Fire Protection Standards Committee (FNFW)

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•• Warning system using radio transmitters (follow-up project)

Ever since the extensive siren system in Germany was dismantled in the 1990s there has been no nationwide civil warning system. A new system using existing German DCF77 transmitters for radio-controlled clocks is being developed to fill this gap. The DCF77 signals are available »around the clock«, although the transmitted time information only takes up 46 seconds of every minute – the remaining 14 seconds are free and can be used for warning signals for the civil populace across Germany.

A microchip in end devices such as clocks, smoke alarms or even coffee makers could receive the code sent and in an emergency set off an alarm. When an end device makes an unexpected noise, users will know to switch on their radio and listen for the appropriate announcement.

This INS project involves the development of a basis for certifying end devices for warning systems. Requirements regarding selectivity, sensitivity, input voltage and interference suppression were agreed upon. Separate discussions were held on coding and data security as well as on alarm signals. The results will be published in a Publicly Available Specification (PAS).

Optics and Precision Mechanics Standards Committee (NAFuO)

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Once a PAS is issued on this topic, manufacturers who meet the requirements of the document will be able to incorporate a microchip in their products which will then issue a warning signal in a civil emergency.

Services Services

Municipal Services Standards Committee (NKT)

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• **Defining innovative process standards in public cleansing and waste management** (follow-up project)

Considering the rapid urbanization that is taking place worldwide, the poor coordination and wholly inadequate networking in the development of comprehensive public cleansing and waste management systems is alarming. To master the challenges facing society in the future, process standards need to be developed that integrate existing standardized technologies into a modern information management system by means of networked data technology.

In 2006 this INS project took the first step by defining standard process chains, devising a uniform presentation of procedures and identifying interfaces. This work was continued in 2007 with a substantiated and detailed overview using event-driven process chain (EPC) diagrams. In 2008 EPC diagrams for road services and maintenance will be drawn up, a terminology database completed, and key issues for standardization defined. The results of this three-year investigation will be published in the form of a publicly-accessible database.

Packaging Standards Committee (NAVp)

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•• **Innovating the packaging industry by means of standards** (follow-up project)

Sustainable, innovative solutions for the packaging and logistics industries are prerequisites for a smoothly functioning flow of goods. Such solutions target the efficient use of resources, the quality of overall packaging, manageability, automatization ability, and the recycling of used packaging materials. Because so many partners are involved and interact in the transport chain, standardization is a key factor for the success of innovative packaging solutions.

Around 50 potential topics for standardization were reviewed last year in the general areas of functional packaging, an »internet of goods«, safety aspects and global goods transport, and the following subjects given high priority: ease-of-use of packaging, active packaging and RFID (Radio Frequency Identification) on steel vats. Workshops on these subjects were held and working groups formed for the latter two topics; these groups have already begun work on specified projects. This INS project will be continued in 2008.

••• **Skills model for personnel development**

Skills, their coaching and their measurement, have an ever greater impact on business success in times of economic flexibilization, acceleration and globalization. To remain innovative and survive in the market, businesses must make the most efficient and effective use of their human resources, giving them as much support as possible. The current need for personnel development has to be assessed and appropriate training and development measures initiated and measured.

However, the term »skill« is defined in many different ways, especially so in corporate practice in personnel development. Great efforts are thus being made in the personnel development sector to harmonize the concept of skills on the basis of business needs so that an effective, widely applicable instrument for the coaching, measurement and modelling of various skills can be developed.

**Research & Development
Phase Standardization (EBN)**

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The INS project »Skills for personnel development« began in 2007 with an open workshop at DIN in which a group of interested parties presented a draft skills model for discussion. The consensus-building process will continue in 2008, culminating in the publication of a DIN Publicly Available Specification (DIN PAS). This document will then be presented as the German contribution to supranational standardization work on this topic, with the aim of creating relevant standards as quickly as possible and thus gaining acceptance in Europe and worldwide for this skills model.

•••• Standardization of an innovation capability rating system for manufacturing SMEs

Quickly translating new ideas into innovations represents an important leverage for increasing growth and profitability in businesses. The innovation capability of small and medium-sized enterprises (SMEs) can be considerably improved if factors relevant to innovation are continually measured and evaluated in terms of a rating.

This INS project involved the development of a CEN Workshop Agreement (CWA) describing an innovation rating method based on a model encompassing all aspects of the innovation process in which innovation capability is measured and evaluated in four steps.

This standard method developed for Europe will enable companies, especially SMEs, to compare their innovation capability rating results with those of other companies. According to this method the company with the highest rating is the most capable of innovation. In addition, the method will allow a company to monitor its progress, present its achievements in a transparent manner and better communicate its innovation activities.

**Research & Development
Phase Standardization (EBN)**

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••••• Standardized process for developing services in networks

The focus of the PAS developed as part of this INS project, »Standardized process for developing services in networks« is a clear and generally applicable description of the process for developing industrial services in networks. This reference process serves as the basis for carrying out and controlling service development projects in an efficient and targeted manner.

This standardized method involves several practical steps for systematically developing industrial services in-house and within a business' own network. Customer-orientation is explicitly given priority. The PAS also includes detailed definitions of work procedures and results.

The content of the PAS was drawn up in three workshops attended by providers of industrial services, consulting firms, and research organizations. Examples taken from practice were reviewed and the transferability of the reference process in various possible application scenarios was established. The reference process is conceived as a set of guidelines which need to be adapted to the specific requirements of the company or network in question.

**Research & Development
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..... **Standardized requirements for international service providers**

The services sector is an important economic sector, not only in Germany. One major challenge to service companies is internationalization, as more and more businesses offering services find themselves faced with global competition. Many offer services in Germany for international companies and are thus confronted with global-oriented demands. Or a German company offers its services abroad and is judged according to the benchmarks prevailing in other countries.

Global activities result in different demands being placed on service providers depending on the customer and/or location; these demands increase the complexity of the tasks a service business faces and can be costly. As no uniform requirements for internationally active service providers have been developed or published, any comparative assessment of services must lack transparency. To achieve this, businesses have to spend time and use additional resources to develop their own criteria for evaluation.

This project involved the development of a Publicly Available Specification (PAS) containing the following: checklists of requirements for international service providers, guidance on how to carry out an analysis of such requirements, an overview of methods for setting priorities, and an assessment of the quantitative and qualitative benefits of using such a standard.

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..... **Systematic development of international services in the investment goods industry**

Services are key aspects of a competitive strategy for stopping margin erosion, especially when they are used to expand or supplement an existing business portfolio. Since German manufacturers of investment goods are extremely active in the export market, services take on international significance. International activities present businesses with more complex situations as the conditions of not only one market but of several have to be dealt with.

This project's objective was to develop an approach for systematically setting up services for the international investment goods market while at the same time taking specific company needs into consideration. The approach is intended to strengthen the global position of small and medium-sized businesses, which German manufacturers of investment goods typically are.

The project involved an assessment of different functions and instruments for developing services on the basis of existing company practices. This helps businesses quickly identify the most important activities and essential criteria for decision-making on the basis of the situation in which the services for the international market are being developed.

A follow-up project is planned in which a broad sampling of investment goods manufacturers will be surveyed. This will enhance the general validity of project results and give them greater detail.

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