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The Steinbeis magazine

Production and component properties

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Editorial

Dear Readers,

Welcome to the latest edition of Transfer Magazine. This time the spotlight is on production and component properties. Why? Because of their significance in arming companies with the knowledge and skills they need to lead from the front. And because of their key role providing small and medium sized enterprise with a technological edge worldwide. Corporations are always on the look-out for ways to improve product portfolios, but they also have to deal with complexity. So to raise efficiency in production they need functional, world-class components.

To steal a march on competitors in technology terms, companies need the right tools to innovate. But they also need a solid grasp of test engineering techniques to keep improving and developing existing materials and technology. Testing techniques have come on in leaps and bounds in the last two decades. The focus used to be on pinpointing parameters, optimizing test samples and often simplified experimental methods of confirming consistency. Today the main aim is to find the right experimental methods to confirm reliability under conditions as similar as possible to real practice – exposed to realistic loads and working conditions. The solutions must be as cost-efficient as possible, and the time taken running tests kept to a minimum.

Over the years, Steinbeis has shadowed these changes in experimental technology. Our Test Engineering degree at the Steinbeis University Berlin promotes staff education in the field of testing. Our Production and Component Properties symposium centered on new insights and developments in manufacturing. And so does this edition of Transfer Magazine. The practical value of any component is closely dictated by the sound expertise of construction and also the base material itself; how it was tested, and how smooth processes are in production. So this Transfer Magazine takes an insightful look into a variety of the latest developments and potential new areas of application. I hope it proves an interesting read – and provides you with some useful insights!

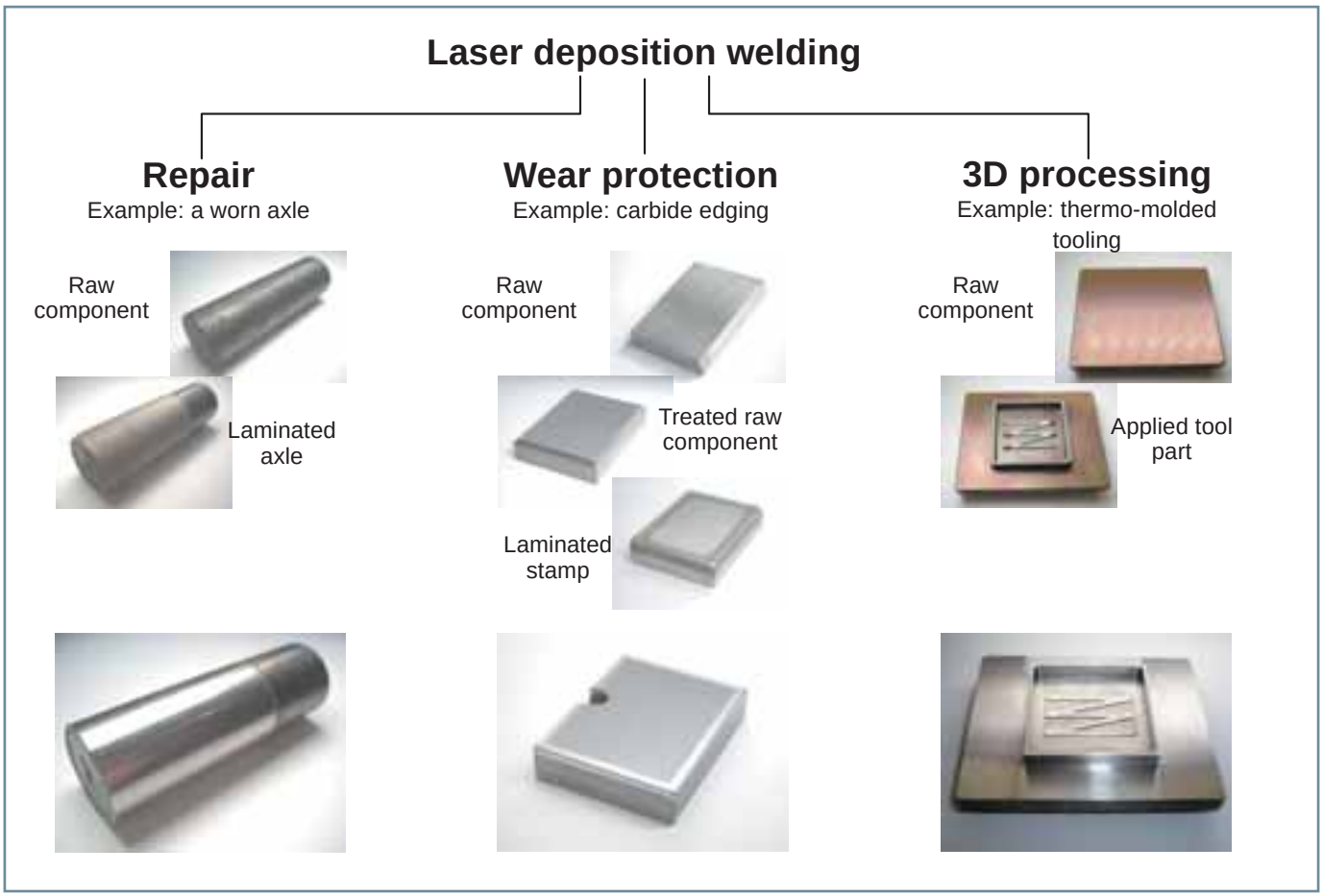
Sincerely,

Prof. Dr. Heinz Trasch

Innovative laser deposition welding in the manufacture and repair of tools

Layer by layer

Punching and cutting tools are subjected to a lot of rough treatment. As a result they are mostly made out of special grades of steel or carbide specifically designed for tools. The problem is, raw material prices continue to rise and at some point business becomes unprofitable. With large tool parts you simply cannot get hold of the sintered carbides needed and larger formats are sometimes not even technically feasible. On top of this, sintered carbides may be strong but once they wear out they can not be repaired so they have to be replaced entirely. Enter laser deposition welding: a relatively new technique used in tool making which allows you to create selective protected zones and even localized repairs on tools which are subjected to more wear and tear.

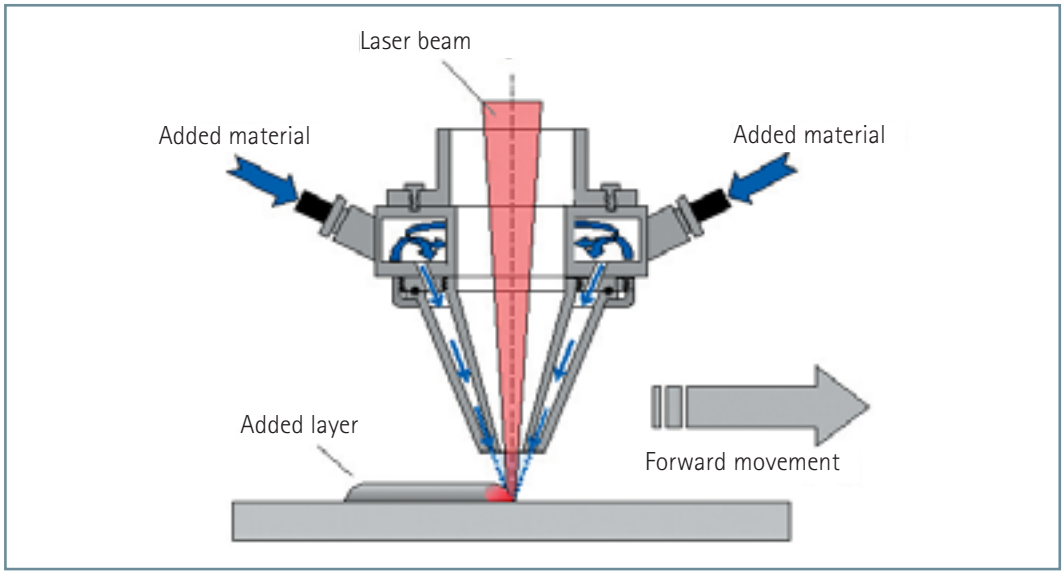


Apart from providing protection against wear, laser application welding can be used to finish material surfaces (eg, rust-proofing).

Laser deposition welding submits the material to a continuous laser beam, coating it with a powdered layer free of cracks and pores. The processing nozzle is moved to create a grooved coating, the measurements of which can be adjusted and set as required. The grooves can be anywhere between 0.1 and 6 mm in width and by coating the material more than once it can be given a profile with heights of up to several centimeters. The process creates a merged zone in which the base material coalesces with the melted powder material forming a hard, welded metallic bonded layer. By repeating the process a number of times you can add layer after layer and create any type of shape desired, consisting of the cladding material or an alloy with the base material.

In theory all sorts of metallic powder materials can be used in laser deposition welding, although you should carry out careful testing first as not all material combinations are suited to welding – as with all coating methods. The process is limited when encountering decomposition, materials with major differences in properties, brittle inclusions, ruptures, or even vaporization of one of the materials.

The process really becomes interesting when you apply coating materials with carbides. The layers on the base material can be extremely hard and provide excellent wearing properties. Carbides are a member of the family of composite materials, with two constituent parts: the matrix – which acts as a bond and dictates the ductility of the carbide – and the carbide itself which works as the major wear resisting component. The Steinbeis Transfer Center for Laser Processing and Innovative Manufacturing Technology in Pforzheim has used this technique to apply layers without cracks with a hardness of up to 1600 HV.



A laser nozzle used in laser application welding

This type of laser deposition welding is particularly useful for repairing tools and protecting them from wear. It has tremendous potential, as wear protection can be applied during the original manufacturing process or during maintenance. The potential savings offered by this laser technique are best demonstrated by looking at stamping tools. Most small stamping tools used in manufacturing are made out of sintered solidcarbide or solid-carbide metal inserts. If you look at the damage inflicted on solid-carbide metal inserts, you will notice that the areas along the cutting edges suffer most, even if they only make up a small part of the overall insert. By using laser deposition welding techniques, it is possible to make completely new types of highly economic tools for the first time.

In this application a main part of the tool is made out of cheaper base materials to provide it with the right solidity. You can then use laser deposition welding to provide the areas subjected to more wear and tear with a carbide layer specially tuned to the type of application. As well as cost-cutting benefits in production, this new laser-based approach to making tools sidesteps the need to replace worn or defective carbide metal inserts (and the associated cost). Instead, you simply repair the right area of the tool.

To do this you first have to separate the worn carbide layer from the base before applying the new layer. This method provides low cost and a short repair and finishing time, thus the tool comes back into service quickly. The technique can now be used also with larger tools, by applying carbides specifically to areas affected by wear.

Recent research (including work at the Steinbeis Transfer Center for Laser Processing and Innovative Manufacturing Technology) has also looked at tool manufacturing techniques using 3D technology in which entire tools would be made layer by layer. Current 3D techniques center mainly on laser sintering on a powder base, a type of rapid prototyping process. But the problem with parts made with laser sintering is that they are not always suitable for immediate use and do not allow for the selective adding of layers to existing tool parts. Based on laser deposition welding, the 3D process used here helps avoid many of the disadvantages of laser sintering (such as pores). And so the final tool is immediately available for use with all the characteristics of a part made in serial production.

Working partly with Pforzheim University and the FhG-IWS in Dresden, researchers are continually uncovering new uses for this technology. Laser deposition welding is also proving highly flexible. The layers it creates are extremely precise and can be adapted to individual requirements. Businesses can use this approach to tool production to radically reduce costs: with layering speeds of up to 9 cm^3/min, the process is extremely cost-efficient. At the moment, there is no such thing as a universally applicable 'standard layer', so for this technique to work in industry the layers will have to be checked out in detail and matched to each specific application.

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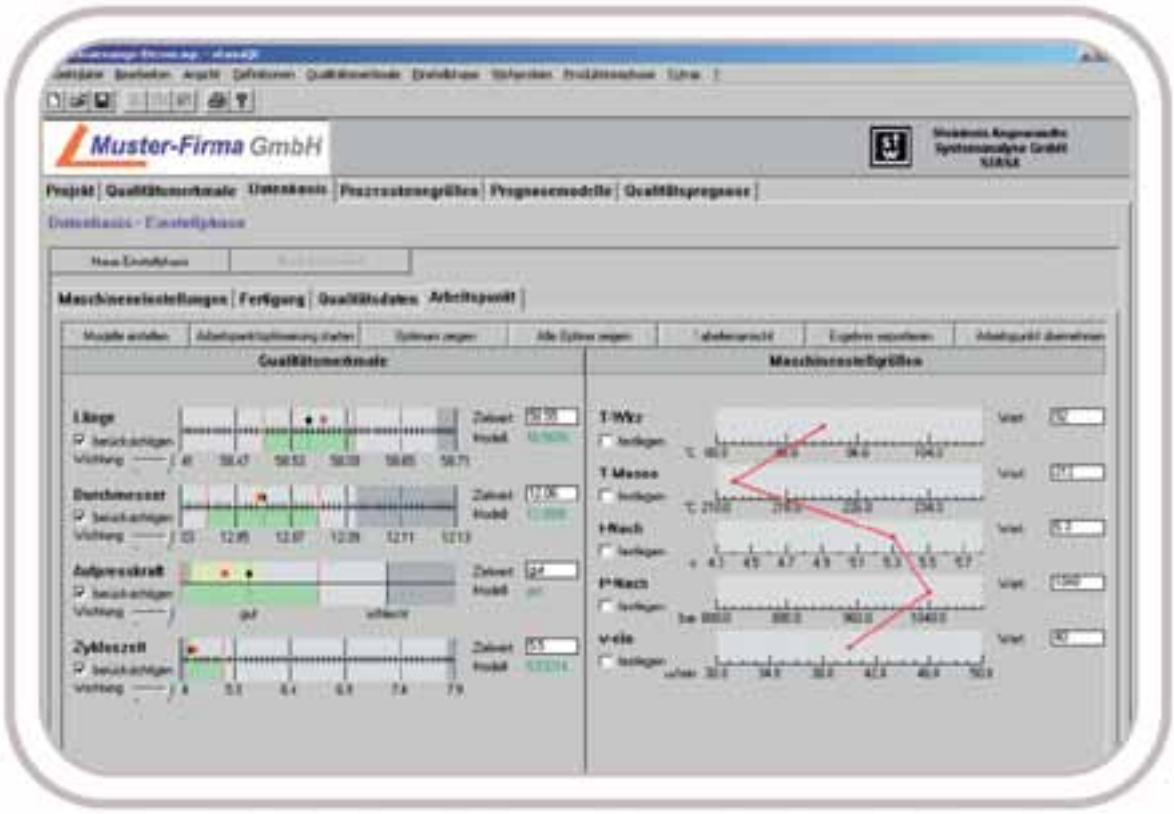
STASA QC – Operation point optimization and online quality forecasting

Specific and spot on

Increasing quality specifications in manufacturing processes require innovative, software-assisted systems for operation point optimization and quality forecasting, especially with respect to time and cost savings combined with a better efficiency in energy consumption and material usage. The application of the software solution STASA QC developed by the Steinbeis-Transfer Centre Applied System Analysis in Stuttgart provides a considerable improvement of manufacturing quality combined with a significant reduction of rejected inaccurate parts. The software is user-friendly and applicable to almost all industrial manufacturing processes.



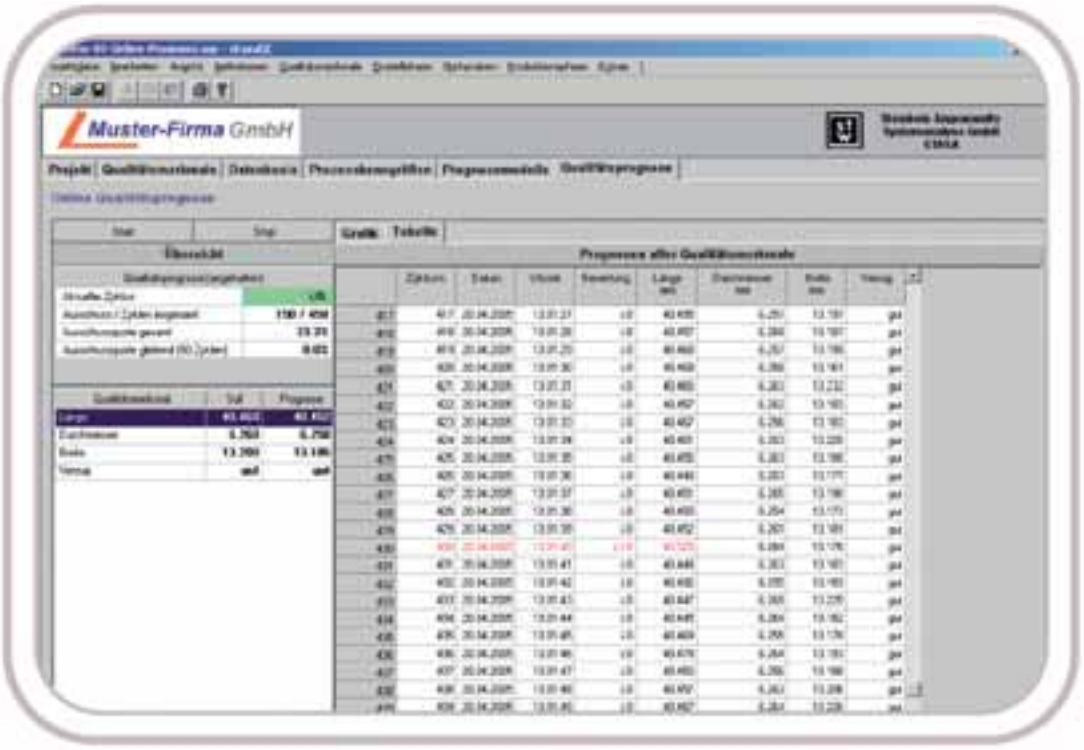
Machine phase optimization

Increasing miniaturization combined with growing levels of product complexity are resulting in a rise in quality specifications. Many SMEs these days have developed into system suppliers in the field of international just-in-time production. So not only must they prove they can provide the precision and functionality to match, to succeed as a business, operating processes have to work like clockwork. Businesses are coming under increasing pressure to cut costs and globalization is causing many manufacturers to look closely at energy and material costs.

In many areas, for example injection molding, there is still plenty of unutilized potential to optimize production processes and cut costs for energy and material use. With high end-product quality specifications there are still substantial amounts of rejected parts. Most faults are the result of small variances of process parameters over time ('process drift'). Even the smallest deviation in product quality results in rejects, leading to higher levels of material usage and extra costs.

In many manufacturing processes it is simply not possible to recycle rejected parts, especially when there are lots of components involved or components are coated. With conventional quality checks based on spot samples, subtle disruptions in the production process – which lead to unacceptable quality deviations versus targets – can sometimes take hours or even days to notice.

As a result, parts produced in the intervening period have to be classified as rejects. On top of this, often the process was not optimally set from the outset with respect to component quality and production times, such that – even with otherwise stabile process management – saving potential still exists.



Documentation

The only way to exploit energy and material cost-cutting potential in production is to look systematically at all the information generated during the setup phase. Until now it has been common, to adapt the operation point of the machine in production by successively changing machine settings by trial and error until quality specifications have been fulfilled and serial production can get underway. As a rule, the trials to adjust the operation point are not documented and important information and insights are thus lost.

As a result, when making settings or carrying out any changes needed in the operation point during production, an unnecessary number of attempts have to be made.

The specialists from STASA in Stuttgart have developed a software solution called STASA QC which already starts identifying the optimum operation point while the machine is being set up. Later, when production is up and running, it is possible to monitor quality permanently by carrying out online quality forecasting using new algorithms for data driven modeling. The modeling technique was originally developed at STASA and has already proven itself in a variety of real-life applications.

The developed optimization procedure works out the best machine setting to hit the target parameters needed to achieve all quality specifications. As well as quality aspects, the cycle time can be considered during optimization to minimize production times and therefore costs. Energy and cost parameters can then be kept to a minimum during operation. This systematic approach based on design of experiment (DoE) ensures that additional costs and energy consumption brought about by unnecessary trials or repeating previous trials can be avoided. Seamless documentation of the optimization process is also guaranteed thanks to the automated reporting tool.

One feature of this optimization procedure is that all operation points can be identified which provide almost the same component quality as the optimum quality. It then provides the operator with a choice of operation points and provides a recommendation of the best one to maximize process stability (in other words, quality fluctuation margins are at a minimum at this recommended operation point). Alternatively, if it makes sense for the current production process, the operator can override the system and switch to another operation point.
With STASA QC the user can interactively change machine setting parameters and see the effect each change has on each quality feature directly on a screen in a simulation – without having to run an additional test on the production machine. Also, it can show separately the effect of separate machine setting parameters on individual quality features. This makes it possible to work out interactive correlations between machine settings and quality features which would otherwise remain unrecognized due to the complexity of the task at hand.

By adding data supplied by sensors during the production process, the STASA QC system can forecast the values of the quality features for any produced part on a variety of continuous and attribute-based quality criteria. This turns the system into an extremely powerful quality assurance tool. The forecasts made are much more accurate than conventional regression modeling. STASA QC determines the relevant process parameters automatically. Process drifts are recognized early by the system. Also, by adjusting the process using a newly defined optimal operation point, reject levels are minimized. As a result, material and energy use can be kept to a minimum – as can the costs.

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Using stress speening to extend the dynamic lifetime of components

Stressful times

Coil or parabolic suspension springs are crucial parts in any modern vehicle. Not only do they have to meet modern demands to reduce the overall weight of vehicles, they should never take up too much room. In fact they now have to fulfill a whole catalogue of requirements, each with a corresponding list of solutions – which are often interwoven.

Image: smeyli/photocase.com

In this area of vehicle components one of the key challenges is to make materials stronger and more stable so they can be put to more effective use. But to do this, technicians have to improve shot peening, otherwise they counteract another original aim which is to reduce weight. So everything the engineers do has to help reduce weight but also extend lifetime and quality.

The dynamic lifetime of a component is closely linked to the success of the shot blasting process – the level of the induced residual compressive stress is key to performance. So to improve results a process has been developed called stress speening. For stress speening you take a spring and – during shot blasting – actually tension the component in the direction it would be loaded during use. Afterwards, once the load has been reduced, it returns to a higher lever of compressive residual stress.

Stress speening is used in three areas of component production. First, heavy goods vehicle suspension systems, ie: parabolic springs (a particular type of leaf spring with a parabolic shaped thickness progression). This keeps strain placed on the leaf constant. Second and third: it is used with vehicle suspension springs and piston rods in engine production.

An example of how to extend components' dynamic lifetime is best described with parabolic springs. The spring is pre-stressed until it reaches the yield point. This generates high levels of tensile residual stress. Peening it now creates a residual compression stress zone in the layers just below the surface. When the spring is released, the compression residual stress rises to the pressure yield limit. Simultaneously the residual compression stress zone expands. The stress-cycle pattern shows a marked improvement in dynamic lifetime. In fact stress speening makes it possible to improve the dynamic lifetime of components significantly as long as they are stressed primarily under cyclic bending stress.

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Steinbeis links up SMEs with innovative research partners across Europe

XPRESS – Intelligent solutions for flexible manufacturing

XPRESS is one of the big collaborative research projects – a so called Integrated Project – for flexible manufacturing funded by the European Commission. Current approaches in flexible production are either concentrated on flexible concepts on the organisational level or have the disadvantage that the implementation of the methods demand a totally new production line. The approach followed by XPRESS, however, integrates the complete process chain from the production planning to the assembly and finally the quality assurance of the produced/ assembled products and the reusability.

The Steinbeis-Europa-Zentrum assisted the medium sized company Harms & Wende GmbH, Hamburg, during the entire project development of XPRESS, from the development of the project idea and the writing of the proposal to the contract negotiations in Brussels. The support was worth, the EU has decided to select the project for funding. Since the 1st of January 2007 SEZ has been partner in the project and responsible for the management of knowledge, of intellectual property, for technological studies as well as the administrative and financial project management.

In order to minimize the costs for production planning and to reduce the ramp-up times drastically, XPRESS aims to develop a software system for an optimal production configuration. The main goal is to integrate different kinds of production components like weld controls, robots, etc., into the simulation. After that, the integration into the real production process will be possible without high effort. Furthermore, the whole system will allow the simulation of different fall-back scenarios, fact that will make possible to react flexibly on production failures.

A new concept for the structure in interaction concerning production components (robots, weld controls, transport carriers, etc.) will be developed. The latter will provide the possibility to produce different variants of a product on one single production line. The changeover time for a variant change will be drastically reduced. The availability of production lines will be notably improved as well.

The processes within a production line will be monitored in a permanent basis. In order to implement the latter, intelligent methods for quality assurance systems will be investigated and developed. At a later stage, the intelligent monitoring systems will be integrated into the corresponding process controls (e.g. weld controls). By integrating these controls in a network, the quality data of each product produced can be monitored, analysed and archived in a databank for further usage.

Resistance welding processes in the automotive industry, © Harms & Wende GmbH

Responsibility for the overall coordination of the project XPRESS lies with Harms & Wende, a German Limited Company (GmbH) with experience of several EU projects backed by the European Commission. The SEZ also took care of administration with the European Commission freeing up Harms & Wende to focus on technical aspects. As an Integrated Project, XPRESS works on a high plain; the sheer scope of the budget means a consortium of 16 partners have to be brought together, from end users to suppliers, ICT developers, SMEs and research organisations. Not only do the partners come from very different backgrounds, they are also from eight different countries, adding intercultural complexities to the project.

The SEZ, with consulting offices in Stuttgart and Karlsruhe aims to provide small and medium sized enterprises with information on European support programs, advice on submitting proposals, and support in searching for partners in Europe or negotiating contracts with the EU. It acts as the Operational Unit under the Commissioner of Europe for Baden-Württemberg's Minister of Economic Affairs, doubling up as a National Contact Point for SME under the auspices of the Federal Ministry of Economics and Technology.

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A conversation with Prof. Dr. Berthold Leibinger, Chairman of the Supervisory Board, TRUMPF GmbH + Co. KG

"Endeavours for Germany as a business location must be sustained"

Undeniably, Berthold Leibinger is the embodiment of entrepreneurship. Add an apprenticeship as a mechanic, a degree in mechanical engineering, classic virtues such as industriousness and a sense of responsibility, and he has everything it takes to turn a minor SME into an international group like Trumpf. Since handing over his role as Board President to his daughter in 2005, Leibinger has been Chairman of the Supervisory Board. TRANSFER spoke to the entrepreneur par excellence about training, changing working conditions and globalization.

TRANSFER: TRUMPF is a member of the Knowledge Factory, i.e. the "Wissensfabrik – Unternehmen für Deutschland" campaign. Its aim is to prepare Germany for the future. What steps are you taking to achieve this and what were your personal motivations for joining the campaign?

Berthold Leibinger: The aim of the Knowledge Factory is to promote and pass on know-how among two groups: children gain access to business and technology through the company network; young educated adults looking to start up their own business are supported as well.

The Knowledge Factory pursues these goals through initiatives and projects. These impart knowledge, focusing on children in nursery and primary schools. For example there is the KieWis project, which loosely translates as Children Discovering Business. Here, 9 and 10 year-olds at primary school can get to know our company and hear about correlations in business. Depending on their age, some children also make simple products. They're thrilled by it. We have contacts in a variety of schools and have fixed partnerships. We also organize "Speech makes you strong" events to support the development of German language skills in kindergartens. Then there is the "NaWi – how?" project

looking at links within natural science to encourage experimentation and make it more tangible by providing primary schools with experiment kits. We do the same in the technical area with technology kits.

The other main emphasis is the promotion of entrepreneurship. This primarily entails coaching for people setting up businesses, provided by experienced people from our company.

Overall we find it important to encourage other companies to join the initiative. We can achieve more by spreading our wings. People in Germany need to recognize that technology and the natural sciences are not just fascinating and interesting in a business sense, we're making a practical contribution to society and doing important work for people.

You are quite critical about the standard of education in German schools, saying it's removed from reality and unfriendly towards business. In what way?

The text books that introduce our children to business – if they actually get any business exposure from books – are mainly written by people who have never worked in business. The information is either based on the society shaped by farming in the 19th century – wood cutting and harvesting crops with threshers – or, as is often the case, there's a tendency to view business critically.

'Universities for the Elite' are a hotly debated issue among German academics at the moment. What for you is a 'University for the Elite', or more's the issue: what are the key prerequisites for elite education?

Universities of the Elite must provide high quality education but also demand a lot from their students. They should have the right qualifications to enter and be genuinely interested in attending. But the universities also need the right funding and legal standing.

For a company to succeed financially it also needs to be innovative. But critics in German business keep telling us that we've been coming out with innovations for years – but nobody's putting them into practice. How innovative are German companies in your opinion and in which areas do you see room for improvement?

Lots of German companies (though not all) are innovative. If that wasn't the case we'd have been forced off the market ages ago by international competitors, because of our high costs. We can still count on our excellent dual system, a solid education for engineers and a solid infrastructure in Germany. The best policy for us would be to keep bolstering these strengths.

Every time a major corporation announces record profits, hand-in-hand with job losses, you hear loud cries for business to be ethical and uphold morals. What are the responsibilities of modern-day management, and is it possible to reconcile social responsibility and profit-orientation?

First and foremost the task of senior management is to run a company successfully, in other words to make profit. If not, all the other aims fall by the wayside. But this still leaves enough room for ethical and social issues. I think it should be part and parcel of German business strategy to make us think carefully about the effects shifting production and research activities abroad have on German business. I'm not saying nobody should shift activities abroad. On the contrary, it's necessary to thrive and survive. But our endeavours for Germany as a business location – often the very lifeblood of the company – must be sustained.

The divide between unions and employers' associations on the issue of longer working hours is widening. One party argues that extending the working week will cost jobs. The

Professor Dr.-Ing. E. h. Berthold Leibinger

Berthold Leibinger was born in 1930 in Stuttgart. After finishing school he embarked on an apprenticeship as a mechanic at TRUMPF & Co in the Weilimdorf suburb of Stuttgart. He went on to study machine engineering at the Stuttgart University of Technology, graduating with a Diploma in Engineering.

In 1958 Leibinger began working as a development engineer at Cincinnati Milling in Cincinnati before returning to Germany in 1961 to head up the construction department at TRUMPF GmbH + Co. KG. He was subsequently appointed Technical Director. TRUMPF is now based in Ditzingen, West of Stuttgart. During this time Leibinger developed solutions such as the first punching and nibbling machine with numerical control. A string of other new developments led to a complete overhaul of the production range eventually laying the foundations for TRUMPF as it is known today.

After succeeding his godfather, Christian Trumpf, who was the owner of the company and had no children of his own, Berthold Leibinger became President of TRUMPF in 1978. Shortly before his 75th birthday in 2005, Leibinger handed the chair to his daughter, Dr. Nicola Leibinger-Kammüller. He assumes his role as Chairman of the TRUMPF Group Supervisory Board.

Leibinger also serves in a honorary capacity on the committees of various associations in the world of business and culture. In 1992 he founded the foundation Berthold Leibinger Stiftung which supports the arts, science, the church and charitable causes. Leibinger is also University Council Chairman at the University of Stuttgart and member of the Asian-Pacific Commission at the Federation of Germany Industry.

TRUMPF group turnover in 2006 was 1.65bn euros. The group employs 6500 people, 4000 of these in Germany.

other counters this argument with the need to remain competitive. Where do you stand on this issue?

I currently believe that we in Germany should be striving to maintain the income status we have achieved. I'm also convinced that we must remain open to working longer hours to do this. Longer hours reduce costs per hour, make better use of capital and raise our competitiveness. Anything else is nonsense.

There's little doubt that globalization creates opportunities and risk. Product piracy and unintentional technology transfer – often referred to as technology theft – are increasingly considered a key threat, perhaps exaggeratedly. What do you feel about this issue and how does an international group like TRUMPF protect itself?

Protecting intellectual property is an important issue to us. We can never protect ourselves totally from copycats. But we must use our full international weight – which is strongest in the business world – to keep this issue in the headlines.

We need to find partners who accept our fundamental ethical values. Successful business is always a matter of give and take and you have to respect the interests of both parties. But this also means that you sometimes have to avoid seemingly simple, quick solutions. I'm also convinced that people who copy others today will be the target of product piracy themselves one day and will then recognize the value of intellectual property. It's something we're gradually witnessing in China.

You're an avowed enthusiast of the "Old Economy". What important is production engineering for you in this respect and what part do science and politics inevitably play?

The way I see the world, production and sales of goods are still fundamental to economic activity. Services are growing rapidly but they can only be provided to people who need them and can pay. Smaller countries, which work like a financial hub – like Luxembourg – are probably pursuing another strategy. But in Germany production remains necessary for our survival.

Material-based laser treatment is gradually creeping into the general vernacular. It's a specialized area but where do you think trends will go next and what is your company doing to prepare for them against the background of a globalized planet?

My company's main focus is indeed lasers and laser applications. In terms of laser-based production technology we are the number one producer worldwide. We spend more money on development in this area than any other company in the field. We have yet to explore all avenues opened up by lasers in their ability to bundle energy and put it in one place. The future lasers will not only be used for cutting 30 mm plates, they will also be used for welding and other joining applications. Laser marking or engraving is growing in importance and lasers will play an increasingly important role in micro and nanotechnology.

You company has been known as a technology pioneer for decades. What will you be doing to safeguard continuity and success in this respect?

To stay at the forefront of technology we use a German mnemonic with 4 Gs. Geist, Geduld, Geld and Glück – or spirit, patience, money and fortune. If we want to stay ahead we need all four components. And even fortune can be looked for.

Optical processing: a precise science

Real-life robots

Modern automotive production is unthinkable without robots to weld, spray-paint or maneuver parts. And they have to be extremely precise, often down to the last millimeter. Things are somewhat different with optical processing. Robotic workers are the exception rather than the rule. Breaking down the barriers is Prof. Dr. Rainer Börret from the Steinbeis Transfer Center for Technology Consultancy at the University of Applied Sciences in Aalen.

Börret's key objective is to remove subsurface damage of glass caused by grindings or figure correction of the shape. His interest also extends to other areas such as ceramics and metals. To control the robot, the center developed software as part of a research project which is able to compute a dwell time profile that, with a given tool, will correct the figure of the part. A generated CNC file allows to simulate the removal rate on the workpiece. The process takes in some important parameters such as the desired and actual shape of the part, the make-up of the polishing tool and the kinematics of the machine. The result: production tolerances down to the last micrometer – precision previously hard to find in robots of this type.

Based on the results of the research, two items are important for the industry, both of which are being looked by the Steinbeis specialists in Aalen. On the one hand there is a need to manufacture parts with different shapes and optical precision down to the last micrometer. This relates particularly to processing that is not feasible on existing commercial equipment, not just because of the shapes involved but also because of the levels of accuracy required. On the other, there is a need to simulate processing techniques, taking into account machines' individuality and taking a particularly close look at the influence of machine behavior on results. The focus here is on examining machine error – such as insufficient machine guidance or vibrations – and its effect on the material surface being processed.

With so many ways to use robots, they turn out to be a highly versatile instrument – and much more precise than standard solutions. Software is also more intelligent, so robots can now be applied to precision processing of glass, special metals and ceramics. The motion involved in optical processing could also be interesting for other areas where uniform processing is needed – such as welding and soldering.

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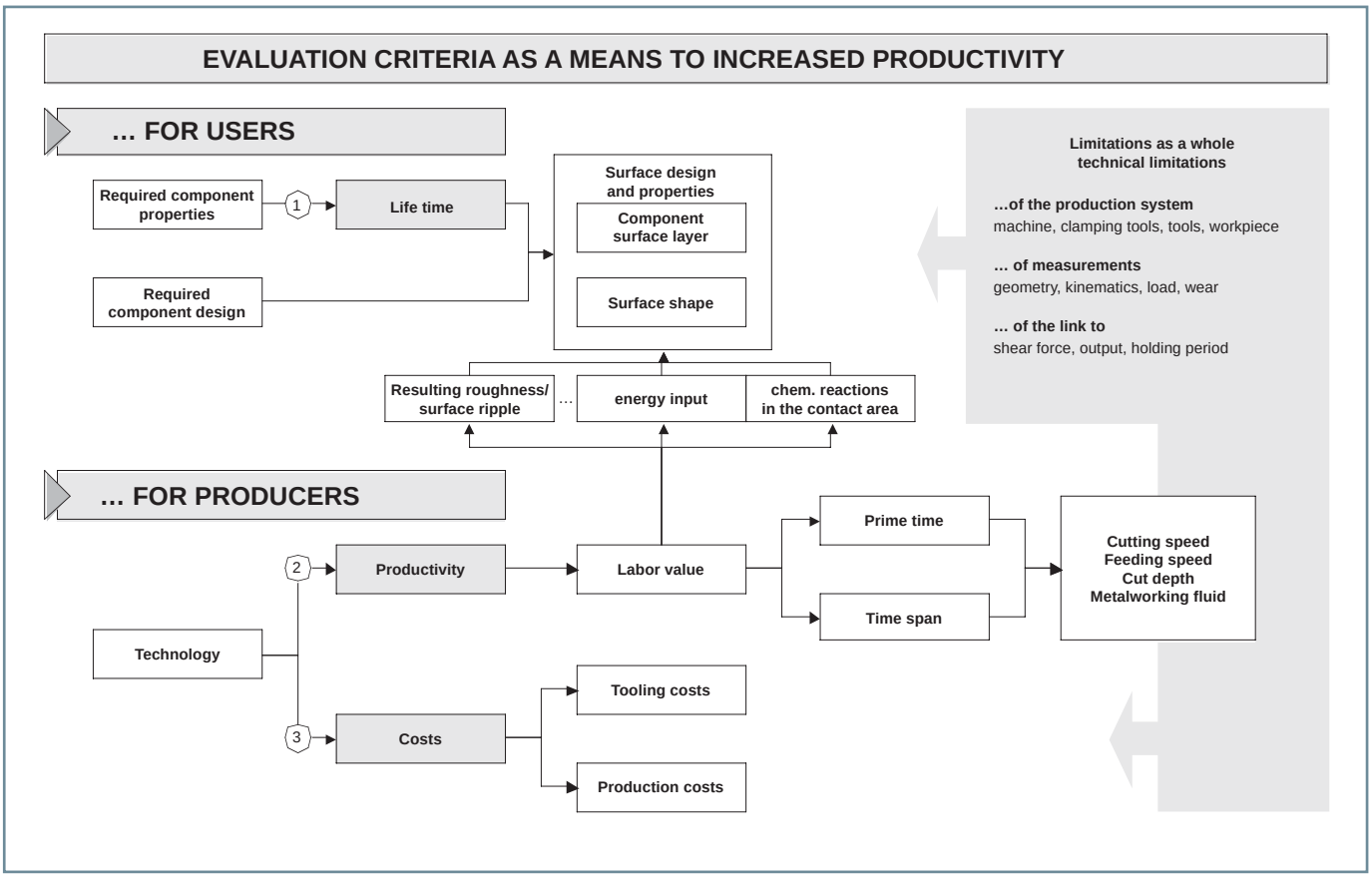
The influence of metal-cutting production on component properties

Complex analysed

With production components, fatigue strength is dictated by a complex combination of factors. From the condition of the outer case to material quality and production standards. In fact fatigue itself is pivotal to the practical value of any part. Modern engineers are keen to make processing and forming component surfaces as simple as possible and use state-of-the-art production techniques to raise effectiveness and productivity. But you need precise information about the effect of surfaces on fatigue characteristics, and as a function of this: component reliability. Everything has to be looked at as a whole – taking into account the reciprocal relationships between the material, production and the component.



The aim of manufacturing is to maximize productivity while keeping costs as low as possible and maintaining process and component standards. The challenge lies in balancing the equation, but doing so raises energy loads throughout the system, between the machine tool, tools, work pieces and clamping tools.

An engineering concept developed at the Steinbeis Transfer Institute for Production and Engineering and IMA Material Research and Application Technology Ltd now makes it possible to analyze an entire 'chain of influence' (from production to component geometry to component properties). This takes in parameters such as

- manufacturing processes and procedures (machines, production parameters, dry/wet processing, etc)
- component surface layer properties (deviations in dimensions, position and shape, residual stress, hardness, micro-hardness, etc)
- component fatigue properties (S-N curve/ service strength curve)

These are then analyzed and evaluated before setting targets with respect to productivity, costs, availability, quality and environmental factors.

Results and experimental data flow into a technical graph showing the workload (eg, cutting speed vc as a function of feed f) within the constrains of the 'chain of influence' (machine tool/tools/work pieces/ clamping). This makes it possible to pinpoint productivity and/or cost potential and create a ranking according to the 'labor value' (true value related to the labor needed to produce

something). Results from fatigue testing on the component are then worked into the system.

Quantifying relationships along the 'chain of influence' makes it possible to work out life-time limitations with respect to working materials, processes and individual components – and as a function of the technological 'labor value'. The benefit is seen when this 'labor value' is combined with technological improvements.

Overall, this approach makes it possible to put numbers to the entire evaluation – from production to component geometry to component properties – separating out factors such as tool costs, prime-time costs and production costs. You have a precise cost breakdown of time and 'labor value', hand-in-hand with potential productivity reserves as a function of component quality (or lifetime). The potential identified through calculations or experimentation is then verified using reference projects.

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Test Engineering at the Steinbeis University Berlin

Industry and research institutes now expect universities to furnish them with students armed with previously unheard of experience in testing. To make things worse, in some fields there are already too few applicants to read certain disciplines. Due to demographic shifts, things will only get worse. If you ask an interview candidate or participants on a company seminar some of the questions they should be able to answer to enter into test engineering, there is often a gaping hole between requirements and specialist knowledge. To address this problem, Steinbeis University Berlin offers a degree program specifically targeted at test engineering.

Over the past decade the options available to engineers to carry out virtual testing on material lifetimes have improved significantly. Problems previously solved through experimentation – such as improving the strength, weight or costs of serial production parts – are now almost always being solved virtually. This generally cuts development time and costs. But there are no guarantees that testing alone can be used for interpretation, especially given the current status of computational techniques and simulation and the complexity of the types of processes outlined above. For component development to succeed, one essential ingredient is close cooperation between construction, calculation and trials. The tangible influence of each component and the correlations should also be a fundamental factor of modern teaching.

The Test Engineering degree program takes a close look at specialist areas such as static strength, stability in the creep range, material and component fatigue, fracture mechanics, tribology, wear and corrosion – in other words processes that restrict the lifetime of components, structures and entire systems and, if not properly interpreted, capable of causing breakdowns during the useful lifetime of a component. Experiments play a pivotal role in understanding issues reliably and dependably, especially if they are part and parcel of business management processes.

The Test Engineering program is offered as a Bachelor of Engineering or as an advanced option culminating in a Masters of Business and Engineering (MBE)®. It is targeted at people working in test engineering and experimentation, maintenance, general engineering, machine commissioning and technical services, construction, cost account, product organization/implementation and purchasing. Instruction is provided by experts at the university, at research institutes and from industry. It includes seminars, workshops and conferences staged by the DVM (the German Association for Material Research and Testing) and taps into the test engineering infrastructure provided by IMA Material Research and Application Technology Ltd IMA in Dresden. To meet the specific demands of the discipline, advice on the content of teaching is provided on a continual basis by an advisory board recruited from science and industry.

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Material-based laser treatment at the Fraunhofer IWS

From base materials to complete components

For many applications, identifying material properties – 'material characterization' – is a key factor in successfully transferring new technology into industrial use, from structural to microanalytical and mechanical characterization. You have to know state-of-the-art laser technology inside-out, entailing not only detailed knowledge of working materials and structural changes in manufacturing processes, but also resulting component properties.

With many components the area most subject to outside influence is the surface layer. For this reason, engineers often use mechanical, thermal and thermo-chemical surface treatment technology – along with surface coating processes – to improve the surface's ability to deal with mechanical loads, protect it better from corrosion and wear, or to simply allow it to perform specific functions. Laser techniques are particularly useful when you only need to treat specific areas or when you are dealing with more extreme thermal gradients.

The behavior of surface layers is closely linked to the microstructural composition, so to improve properties and optimize the production process it is essential to characterize – in detail – not only the surface layer itself, but also surrounding areas. This would not be possible without the right techniques to capture the topography of the surface layer, assess the quality of the structure just below the surface and identify changes in chemical composition. Until now engineers had to use high resolution processes to identify the correlation between materials, the technology used and resulting component properties.

The Fraunhofer Institute for Material and Beam Technology IWS uses a variety of mechanical testing methods to carry out detailed characterization of surface layer and coating properties, as well several mutually complementary methods involving metallography, scanning transmission electron microscope/transmission electron microscopy (STEM/TEM) and energy dispersive x-ray analysis (EDX). This makes use of a variety of mapping techniques offered by electron microscopy including material and crystal orientation contrast with STEM, but also bright and dark field mapping and defraction analysis with TEM and high-resolution. Using special low-damage techniques to prepare transverse microsections, even heterogeneous materials and complex layered systems can be examined. The processes are already available to produce precisely the right type of electron-transparent microsection prepa-

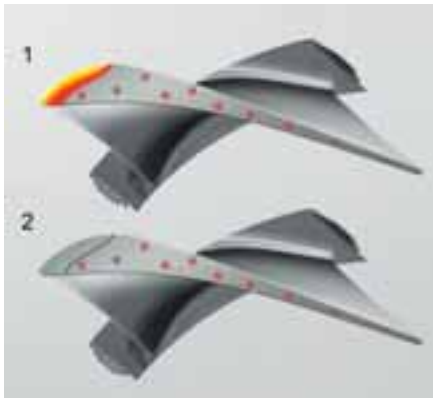
rations for a range of materials, and new ones are constantly being introduced.

A recent example of the successful application of high resolution structural research in transferring technology into industrial practice was the development of a process for improving the wear-resistance of rotor blades used on steam turbines. Low pressure blades on large steam turbines are prone to extremely high levels of stress and strain in operation, caused by tiny water droplets in combination with high cyclic and centrifugal loads. To counter high cyclic loads, large steam turbines that are subject to such loads increasingly use CrNi steel. Compared to conventional martensitic turbine blade steel, this can be subject to higher mechanical loads but it is less resistant to water droplet impact, cyclic load and stress corrosion cracking.

As a result, the team joined forces with Siemens Power Generation in Mülheim to develop a new thermal treatment technology for precipitation hardenable CrNi steel. The area in need of protection is first subjected to depth-hardness solution annealing using an oscillating laser beam in specified temperature/time cycles. The area then undergoes another round of precipitation hardening over the entire turbine blade at unusually low temperatures. This makes it possible to apply a wear-resistant and fatigue inhibiting surface layer on component areas most subject to wear and tear. The result: a geometrically optimum hardened area, fine-tuned to the specific load placed around the leading edge of the turbine blade. The coating has hardness levels of up to 150HV. In cavitation tests, wear was found to have been reduced by as little as one third. In fatigue tests, samples that have undergone this type of surface layer treatment show no sign of lowering cyclic fatigue strength.

A decisive microstructural mechanism for achieving the right component properties was confirmed under high resolution examination of the material structure: clusters formed out of copper atoms and copper precipitation. These are carefully controlled during the process.

Thanks to this new technique, the service life of blades used in steam turbines can now be significantly prolonged. In fact turbine blades treated in this manner are already establishing their advantages in a number of major steam turbines found in power stations in Germany, Europe and the Middle and Far East.



Separation of Cu precipitations (1) and Precipitation of fine Cu clusters (2) on leading edges exposed to greater wear and tear

Depth hardness solution annealing with a laser

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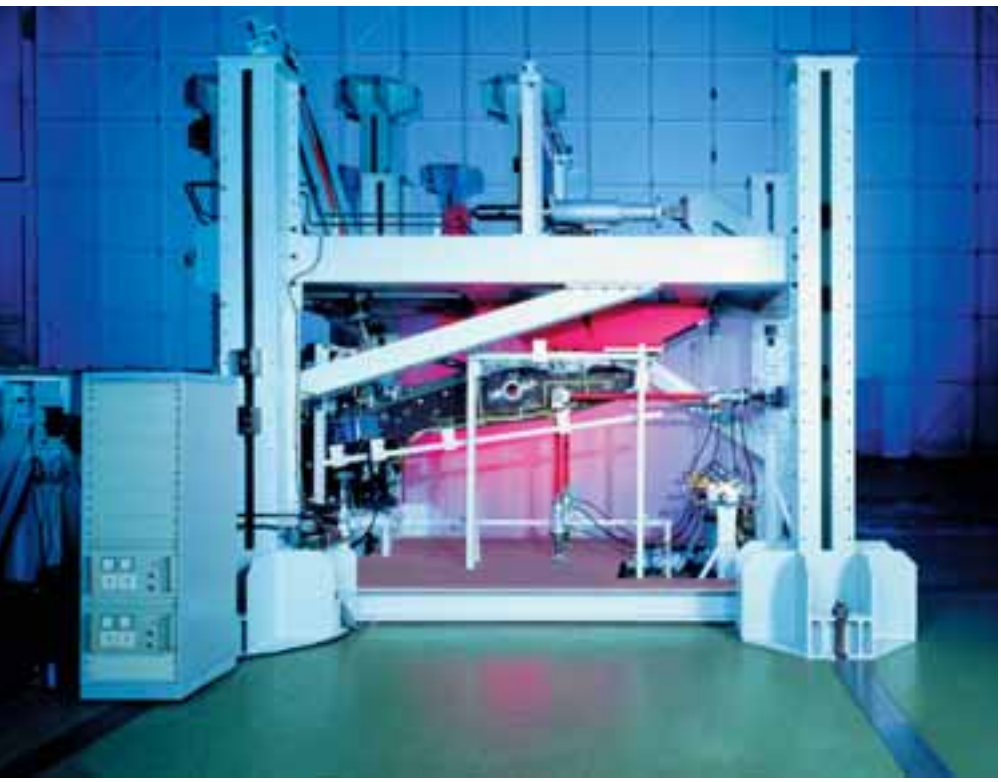
Materials research at IMA GmbH Dresden

Future scenarios

Cyclic strength, fatigue life, structural safety and system reliability are important issues in IMA's engineering tasks. So they stay high on the agenda as science and technology develops. And every time a new material, structure or technology is discovered (or developed), or new behavioral properties and stress scenarios are uncovered, the demands placed on testing intensify.



The 'flap track' part of an aeroplane wing undergoing stress testing

Another center undergoing good growth is the Dresden-based IMA Materialforschung und Anwendungstechnik GmbH (IMA GmbH Dresden). IMA works in aerospace, railway and vehicle engineering, and provides a variety of scientific and technical services in the fields of plastics, metals and wind energy. The center is also involved in a new program with Steinbeis University Berlin, with a special degree in Test Engineering based on-site at IMA in Dresden through the Study and Research Center of Steinbeis University Berlin. IMA provides professional research, development and monitoring services for working materials, components and products. Since its foundation at Dresden Airport in 1993, IMA's main challenge lies in developing customized testing techniques that closely reflect reality with results that customers can put into practice.

A wide variety of parts coming from any field of industry go on the test bed. As a result the testing area will soon expand from 10,000 sqm to approximately 15,000 sqm. IMA tests anything from dummies, construction parts and systems, to couplings, components, entire vehicles, railway compartments and even house wall sections.

One of IMA's biggest challenges is testing the strength of aeroplane structures. Few products contain so many individual parts and everything has to work in unison. Rarely is the mechanical and thermal stress so intense and complex. And aviation still leads the way in lightweight construction.

IMA draws on the very latest insights from engineering based on decades of firsthand experience. It takes tremendous skill and experience to simulate the life of an aeroplane in slow motion and make it as realistic as possible. IMA often receives highly complex testing requests – from simulations with individual components to fatigue testing of entire systems. Scrutinizing other people's quality takes a lot of self discipline. IMA is certified under DIN EN 9100 and adheres to all requirements laid down by DIN EN ISO 9001. Its laboratories have received accreditation and are recognized as a test station by institutes in a variety of industry sectors. The company currently employs 140 trained experts, most of whom – as can be expected for a science and technology services provider – are engineers. In fact at IMA engineers currently make up 60 per cent of employees; and a quarter of them are graduates. Since 2001 the number of engineers has risen to 83, an increase of more than 50 per cent.

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A Steinbeis Transfer Center produces casting prototypes

Casting science

Schneider is a window producer from north east Baden-Württemberg, one of the largest façade makers worldwide. One of its projects involved building the high-tech façade of the German chancellor's office in Berlin. For a major project in London, Schneider was needed to provide aluminum castings to be used as brackets to hold façade modules. The company turned to experts at the transfer center in Aalen: Foundry Technology AalenGTA.

The specialists from Steinbeis produced 25 prototypes at short notice within 10 days including model generation, simulation, production in sand-casting technology and material testing. The alloy was a corrosion-resistant aluminum silicon alloy. To provide best possible gating and risering technique the casting was simulated and optimised using 3D simulation software. To tune the material properties to the required specification all castings were "T6" heat treated at elevated temperature. To prove the quality of the parts all castings were X-rayed at GTA. Out of some parts probes were produced and tested to achieve tensile strength, yield strength and elongation data. Some parts have been tested under load to achieve the maximal force at fracture.

Gebr. Schneider Fensterfabrik GmbH
Based in Stimpfach in Baden-Württemberg, Gebr. Schneider develops, makes and assembles window and façade components used in a variety of major construction projects throughout Germany and neighbouring European countries.

Production of its façade and windows in Stimpfach covers an area of 30,000 sq m and offers a variety of state-of-the-art manufacturing systems such as a computer-aided processing center for light alloy and steel sections, a computerized assembly line for wooden and wooden/aluminium windows, and a partially automated system for the airless treatment of wooden and aluminum window surfaces.

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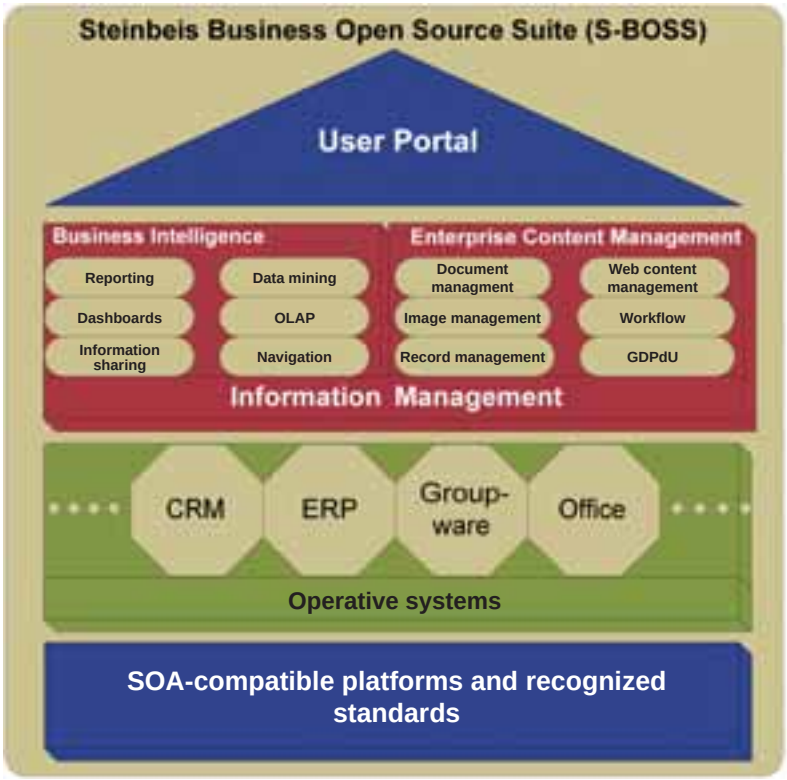
A S-BOSF initiative to bundle business systems

Business open source turns professional

Businesses have plenty of cheap and highly powerful, up-to-the-minute open source solutions to choose from, spanning business intelligence, enterprise content management, cooperative work, customer relationship management and enterprise resource planning. And many managers enjoy toying with the idea of open source. But they are still reluctant to take the plunge, worried it may not be stable enough as a business application, or future-proof. The Steinbeis Business Open Source Factory (S-BOSF) now brings together the work of several Steinbeis Transfer Centers enabling them to weigh up open source software in business applications, bundle them together into an interdepartmental suite and develop a practical step-by-step plan for replacing proprietary software – and ultimately launching their solutions with the aim of optimizing business processes.



As far as companies are concerned, an open source business solution must dovetail neatly with its overall business suite. To introduce open source software professionally and successfully, you have to evaluate the options and benchmark them against minimum performance indicators. To do this, the SBOSF initiative has laid down key criteria and a three step filter system:

Filter 1: focus on business applications with the same type of application infrastructure. Business applications must have high availability, be scalable, safe and perform well.

Filter 2: focus on suite-compatible business applications. Likely candidates are applications that complement each other, have a minimum number of overlaps, work together well in portals, and can be 'orchestrated' into flexible business process mapping.

Filter 3: focus on business applications that have reached a stage of advanced maturity. Individual applications must also meet the following criteria: high software and documentation maturity, dependable development basis, high provider/support network maturity.

One starting point for replacing proprietary software – without the worry of existing interfaces – could be the need expressed by lots of companies for an integrated software-based information management system. There are already a number of professional open source solutions available which would pass through these filters and can be used for figure- and content-based information management. A distinction is made between switching over figure-based information management (ie, business intelligence in the broader sense) and switching over content-based information management (enterprise content management).

Steinbeis Business Open Source Suite symposium on 13 September 2007, Haus der Wirtschaft, Stuttgart.

Partners in the Steinbeis Business Open Source Factory (S-BOSF)

- Information Mining Technology Steinbeis Transfer Center (Prof. Dr. Michael Berthold)
- Logistics and Work Organization Steinbeis Transfer Center (Prof. Dipl.-Ing. Rüdiger Hellig)
- Building IT Management Steinbeis Transfer Center (Dipl.-Ing. (FH) Peter Schupp)
- Steinbeis Transfer Center for Company Management, Organization Management, and East-West-Cooperation (Prof. Dipl-Oec. Hartmut Leschke)
- Management CockpIT Steinbeis Transfer Center (Dipl. Wirtsch.Ing. (FH) Günter Drews / Prof. Dr. Jürgen Treffert)

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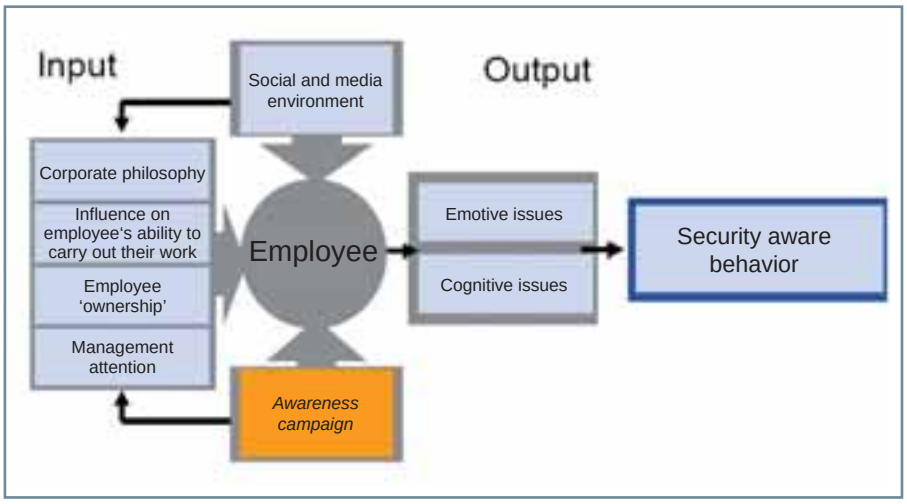
Gauging security awareness among staff

Safe and sound

Very few companies can afford to ignore the significance of IT security. Small, medium size and large businesses capture the issue somewhere in their corporate guidelines and employees are expected to be security aware at all times. But what exactly is security awareness and can it be measured and controlled?



The awareness model

There are two sides to security awareness. Starting with employees: they should understand the relevance of the issue, take it seriously and welcome any guidelines issued by the company to respect security – so you have to take attitude into account. Then, once this underlying positive attitude is reflected in the reaction of employees to prevailing security guidelines, you have the other side to security awareness: behavioral aspects.

These provide two fundamental starting points for gauging security awareness. First: security aware behavior can be observed. This is in contrast to the second: attitudes, which people have to be asked about. So to measure positive attitudes, you need employee surveys to probe the level of security awareness.

Methods used in the social sciences to gauge attitudes have to be based on models capable of systematically capturing key influencers. These methods help you understand the process of becoming security aware, which in turn provides you with the tools to raise awareness. They also provide you with pointers for drafting a comprehensive catalog of questions for the survey. For each key influencer a corresponding question is designed. The answers provided by employees shed light on their attitudes towards issues of a security nature. The Steinbeis 'Marketing – Intelligence – Consulting' advice centre in Pfinztal conducted a survey for T-Systems to measure security awareness in the company.

The project involved modeling key influencers of security awareness, ranging from the social and media environment to particularly important issues of management attention (the corporate philosophy), effects on carrying out one's work, and personal responsibility. These were then captured in questions and scales designed specially for the survey.

Other questions looked in particular at respondents' sensitivity to potential security risks and their implications for the business, checking the awareness of pertinent security guidelines and behavior. The model then underwent 'confirmation checking' which involved analyzing key aspects and reliability to ensure it would be sound in statistical terms. Results could then be compared to internal benchmark criteria aimed at measuring the level of security awareness within individual business units or divisions.

Overall it was then possible to pinpoint problem areas within the organization and introduce targeted measures to raise security awareness. Measures aimed at improving security awareness now start by addressing the following: the influence of data security on corporate success must be communicated credibly; 'management attention' to the issue by direct managers must be raised, particularly in the area of IT; personal responsibility held by individuals has to be augmented.

The measurement tool used at T-Systems works across the board. So apart from using observational techniques, the employee survey was also put online to access individuals' attitude towards IT security. Before embarking on an in-house security awareness campaign everything is in place to gauge the status of the security awareness among company employees.

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Market research helps shape leisure craft surface coatings

Market leadership, full speed ahead

German small and medium-sized business is renowned for its innovation – this being just one way to express technical expertise. But some companies never realize the true potential of product innovation when they progress to launch due to a lack of understanding of marketing and market research techniques. The Steinbeis Transfer Center for Advisory Services for Small and Medium-Sized Businesses helped ski-wax producer Holmenkol conduct market research into the launch of a new surface coating.

You need market research to gain an early and objective understanding of customer needs. You also need it to segment markets. But market research is also about sizing up the competition and analyzing their strategy, marketing tactics and product portfolios. Without it, you cannot understand the overall competitive situation – a prerequisite for effective marketing planning.

Ski wax manufacturer Holmenkol is based in the Baden-Württemberg town of Heimerdingen. Several years ago it set its sights on gradual diversification of its product portfolio and the development and subsequent launch of a product range for coating the surfaces of a variety of sports equipment. The company's Wintersport range, originally launched in 1922, is now complemented by coating products for professional cyclists, runners and jockeys.

To prepare itself for the launch of a corresponding coating product for leisure craft, the company called on the services of the Winnenden-based Steinbeis Transfer Center for Advisory Services for Small and Medium-Sized Businesses. The brief: a survey of 100 boat owners throughout Europe. The main issue in market research was the current problem of protecting boat surfaces and the waxing or coating needs of potential customers. Respondents took part in a telephone survey which used a specially prepared questionnaire.

The findings of the Steinbeis research fed straight into the product development process at Holmenkol as well as the market launch strategy. They also enabled the medium-sized company to pull together its 'Aquatic' range of products. These are high performance coatings for all types of leisure craft, from yachts to surfboards, water skis, motor boats and even competition shells (rowing boats). The new type of surface coating optimizes the hydrodynamic surface properties making the vessel faster through water. Depending on the speed it also reduces surface friction by between 5 and 43 per cent compared to a Gelcoat, or 38 to 77 per cent compared to competitive products, or 10 to 20 per cent in contrast with lacquers.

Holmenkol Sport Technologies
One of the oldest manufacturers of ski wax in the world, Holmenkol Sport Technologies has specialized in the development and global marketing of ground-breaking, eco-friendly sports coatings based on state-of-the-art technology since 2002. Along with ski wax, this has grown to include 15 patented impregnations, cleaning agents, coatings and polishes for all kinds of outdoor and water sports.

Based in Heimerdingen, Baden-Württemberg, in 2004 the medium-sized company was voted one of Germany's 100 most innovative small and medium-sized enterprises. In 2003 its Nanowax range of products was proclaimed the Number 1 Nanotechnology Product worldwide by business magazine Forbes.

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Transfer in education

Getting a head start

Despite pushes for reform, German education receives poor marks in international rankings. Reforms do not go far enough and fail to make a lasting impact. Authorities, schools and instructors struggle with the lack of resource and are renowned for fire-fighting. However, a number of excellent studies, models and best practice examples are at their fingertips.

Business professionals have long known that staying in business means addressing issues, solving problems, and optimizing the value chain quickly. Education – at least the public sector school system – follows a different set of rules. Transfer in the educational system involves more than new products and procedures; here, transfer helps put curricula in place on two levels. The first: the children track from primary to tertiary education or the job market (kindergarten to university); the second: the teacher education track, spanning the first semester of study to a seasoned teacher. With this in mind, the Steinbeis Transfer Center Learning & Education (Offenburg and Schwäbisch Gmünd) focuses on transfer to people and institutions.

These days, authorities in many cities have to help their organizations prepare for future challenges by offering the public and companies educational programs tailored to their needs. Institutions need to weave in the latest research on early education and on how children switch between different types of schools. Teachers also need to familiarize themselves with new concepts and put everything in place in the classroom to apply these concepts effectively. Schoolbooks have to be updated regularly. Schools need to allow for greater mobility in light of globalization and parents taking jobs in different cities. The growing number of private schools also raises the necessary – and justified – question of 'social justice'. So clearly everyone in education has plenty to think about.

How cumbersome can innovation in education be? A call for change in teaching practices in line with the Baden-Württemberg Education Plan (2004) answered this very question. Even today, success has been sporadic at best in bringing forward-thinking, pupil-oriented learning and teaching into the classroom. The nuts and bolts have consisted mainly of reform-oriented postulates (such as those already formulated by Maria Montessori (1870-1952) and other like-minded educators) and have been backed up by modern brain research and school performance studies. From the start, children are naturally curious, although learning develops differently from child to child and is, in general, a delicate process. Now more than ever, three aspects are important: more individual early education, the need to intertwine kindergarten and primary schools and the promotion of inter-year teaching.

Although transfer in the education system is indispensable to schools handling change properly, it needs to include everyone in education, not just institutions and education authorities. This applies to students undergoing teacher training, too; the need for transfer already arises within universities. With student regulations changing frequently, often too much time passes before new concepts and curricula are included in teacher training and university instructors can actually teach them. Professional development programs for teachers in the field are seldom effective because there is no chance to try out discoveries in the classroom.

Get a head start – a credo which resonates throughout every part of the education system. If schools can wake up to toddlers' curiosity and sustain it into puberty, university, and beyond, children will be eager to explore in their careers and make new discoveries. Students in teaching training who understand 'discovery learning' – and how fundamental holistic education is – will be flexible in the long run, turning into teachers who enjoy experimenting and stay focused on the pupil. Trade and industry also needs to show a vested interest in a well-functioning value chain in the educational system. After all: the pupil and student of today is the executive and business leader of tomorrow.

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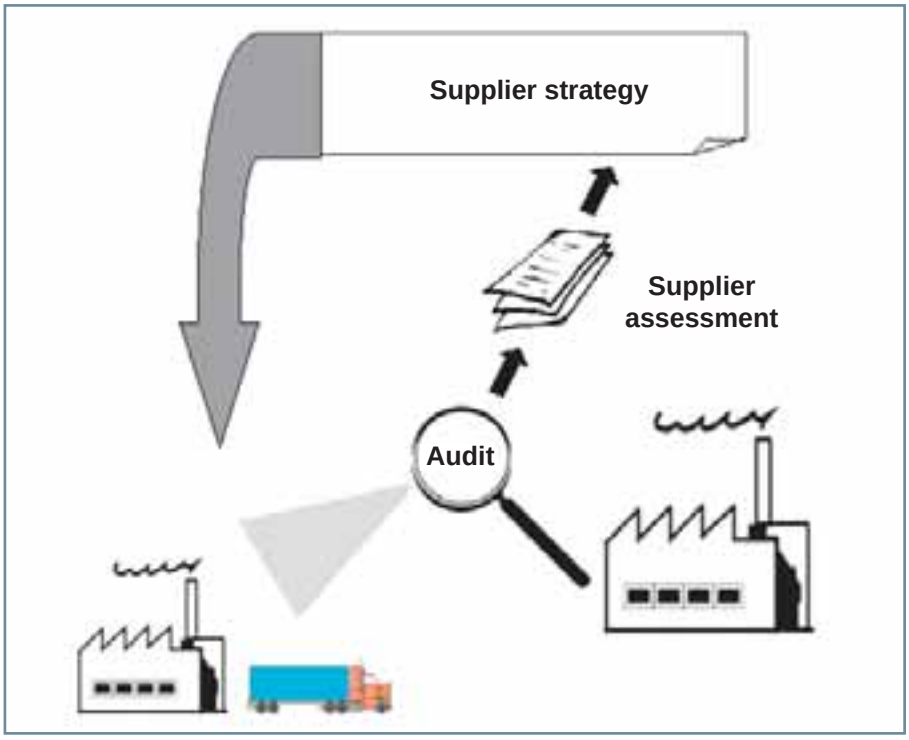
Improve supplier evaluation with audits

Suppliers you can swear by

As industrial companies continue to concentrate on their core competencies, they're also continuing to scale back their production depth. In return, the impact of suppliers' and preliminary suppliers' performance on the company's own achievements is growing in significance. What's more, optimizing company-wide value chains – known as Supply Chain Management – has garnered more and more attention. As a result, targeted supplier management has emerged as a strategic factor for success. Striking while the iron's hot, the Steinbeis Transfer Center Logistics and Work Organization in Heilbronn (now with a branch in Regensdorf, Switzerland) engineers supplier assessment systems and brokers a systematic approach to planning, running and analyzing supplier audits.



Supplier management

Part of supplier management, the supplier audit process is an on-site, systematic assessment. Rather than focus on offering the service of the actual audit itself, the Center assists companies in establishing a systematic approach, putting the company in a position to run their own supplier audits further down the road.

Using system engineering 'building blocks', the Steinbeis experts mapped out a customized supplier audit based on a checklist tailored to their client's industry. They modified standard audit criteria to fit this specific scenario, noting how well suppliers met those criteria on a tried-and-tested point scale. Methodically evaluating the audit like this lays the foundation to continue to align strategic partnerships with suppliers. As a complement to this approach, the Center also gives auditors access to 'code of conduct' guidelines.

Along with quality and supplier management, the Center offers research and consulting support in Radio Frequency Identification (RFID) as part of its logistics and supply chain management services. RFID is exerting more and more influence on business and logistics processes and is already being hailed in Germany and beyond as one of the key technologies for the next decade.

RFID technology is based on identifying objects via radio – even when they are not visible. In other words, radio signals pass through the materials and record the objects in groups (also called 'bulk ID'). RFID helps optimize a number of business processes while establishing stricter security requirements. Take production logistics: this area promises a variety of applications in incoming and outgoing goods, storage place monitoring, inventory, picking and packing, material flow steering, securing goods and monitoring transport chains.

Employees at the Steinbeis Transfer Center Logistics and Work Organization localize custom-made RFID applications and design RFID systems for selecting transponders to evaluate data in their system environments and everything in between. Team members can also calculate profitability, evaluate benefits and provide the compiled results in a report.

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Organizing and structuring work processes

An Intranet application for resource planning

Medium-sized and large companies often deploy complex systems when planning resource to get a clearer picture of business processes. Smaller enterprises and engineering agencies often lack the budget for such immense systems. The Steinbeis Transfer Center Information Technology and Network Technology in Bielefeld teamed up with a company to write the web-based Office Software System, specifically designing it not to replace an ERP system. Relying on databases, this software equips staff with the necessary tools to manage internal work processes.

Some of the system's many capabilities: manage partnerships within projects, track costs for different services, capture and analyze how many hours are invested in a project and how employees divide their time.

Part of the tool is tailored to the needs of the company in question; however, users can easily adapt it to any industry. Looking at individual details, the software keeps track of partner companies and their employees, customers, projects and documents as well the company's own employees. It also displays non-linear relationships such as

- a customer or company along with their employees and associated projects,
- the companies and documents associated with a particular project,
- an overview of the total hours invested in this project, or
- the projects of a particular employee, either prior or current.

Since the application's contents are all displayed uniformly, users quickly and easily recognize items and sub-menus within each menu. The time it takes to get users up to speed with the application is minimal. The developers at the Steinbeis Transfer Center knew that it was essential for users to be able to use the software intuitively.

Users are assigned different profiles. Once their identities have been verified, they only receive access to the areas they require to do their jobs. Each page features an online assistance section, and users can generate a PDF report from each page and print it out or save it for later reference.

When selecting a menu item from the navigation bar, users are first given a list to choose from. They can then use the search function to reach the files they need. Every file in the list is set up as a hyperlink, so a click is all it takes to obtain more detailed information. Depending on their profiles, users have several options on how to work with the file when still in the detailed view.

As web-based software, the application integrates into a Unix/Linux or Windows system. It's also object-oriented and taps into template technology. The software relies on one of two programming languages (PHP or Javascript) and uses any relational SQL database. The Office Software System was transferred to productive operations at the Steinbeis project partner's site. Having been very well received, it is now under further development for the partner.

One of the key issues in this next stage of development will be the ability to calculate costs. Fees, sums, costs and expenses tied to a project will be presented in table form. Users will also be able to perform profit and loss analyses, examine final costs and manage an order book. The backend for administrator profiles will also be greatly expanded.

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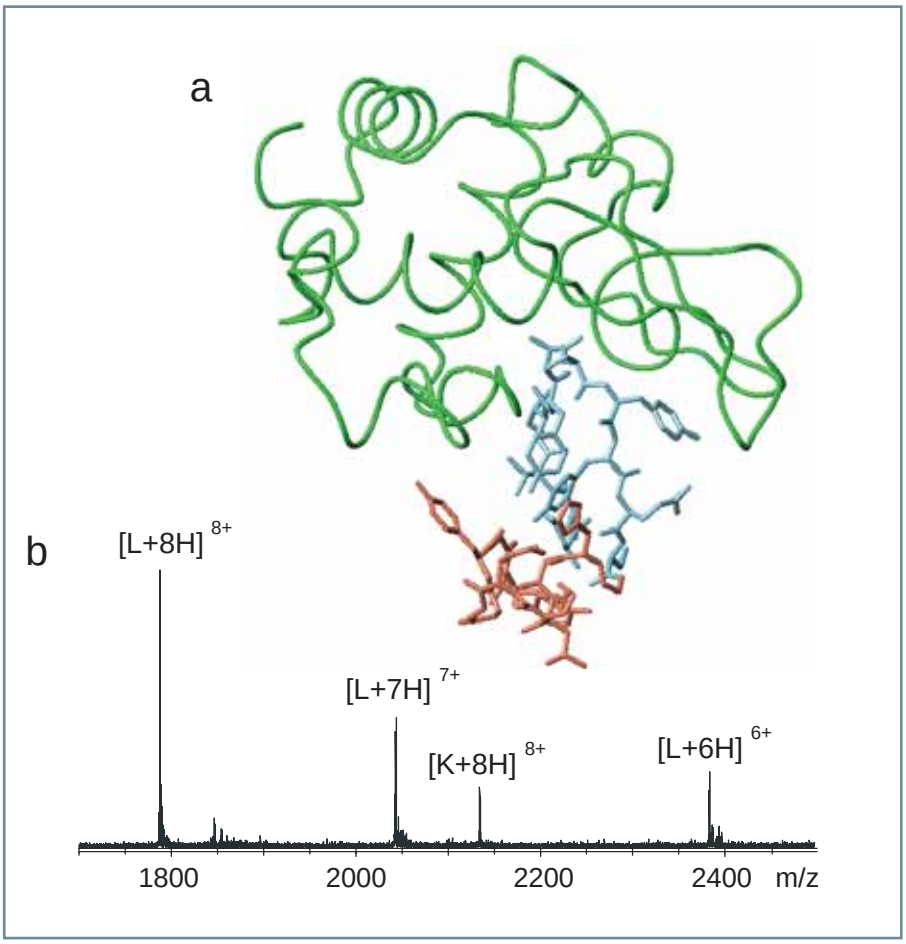
New methods in diagnosing and treating neuro-degenerative diseases

High-resolution proteome analytics

Early diagnosis is fundamental to treating any disease successfully. However, age-related illnesses such as Alzheimer's often make early diagnosis extremely difficult or impossible because the target proteins ('biomarkers') which cause the disease and their molecular recognition structures are unknown. Today's research uses countless methods to identify biomarkers; one worthy of note is proteome analytics.



Molecular structure of a lysozyme complex (green) and a paratope of an anti-lysozyme antibody ('peptide antibody', blue, identified using an affinity proteomics analysis).
2b: ESI-FTICR mass spectrum of the complex. Lysozyme ion signals are labeled with L, the complex's molecular ion with K.

With the human genome decoded – along with the genomes of other higher organisms – proteome analytics has evolved over the last few years into one of the most important methods used in biochemistry, biotechnology and molecular cell biology. Proteome analytics aims to separate and identify the complete primary structural determination of expressed proteins in an organism, a tissue or a cell. As a result, comparative proteome analytics helps researchers take healthy and diseased tissue and spot the proteins specific to an illness.

Proteome analytics requires high-performing methods of conducting structural analyses. These methods also need to allow researchers to obtain as complete a presentation and separation of cellular proteins as possible – and identify them without fail.

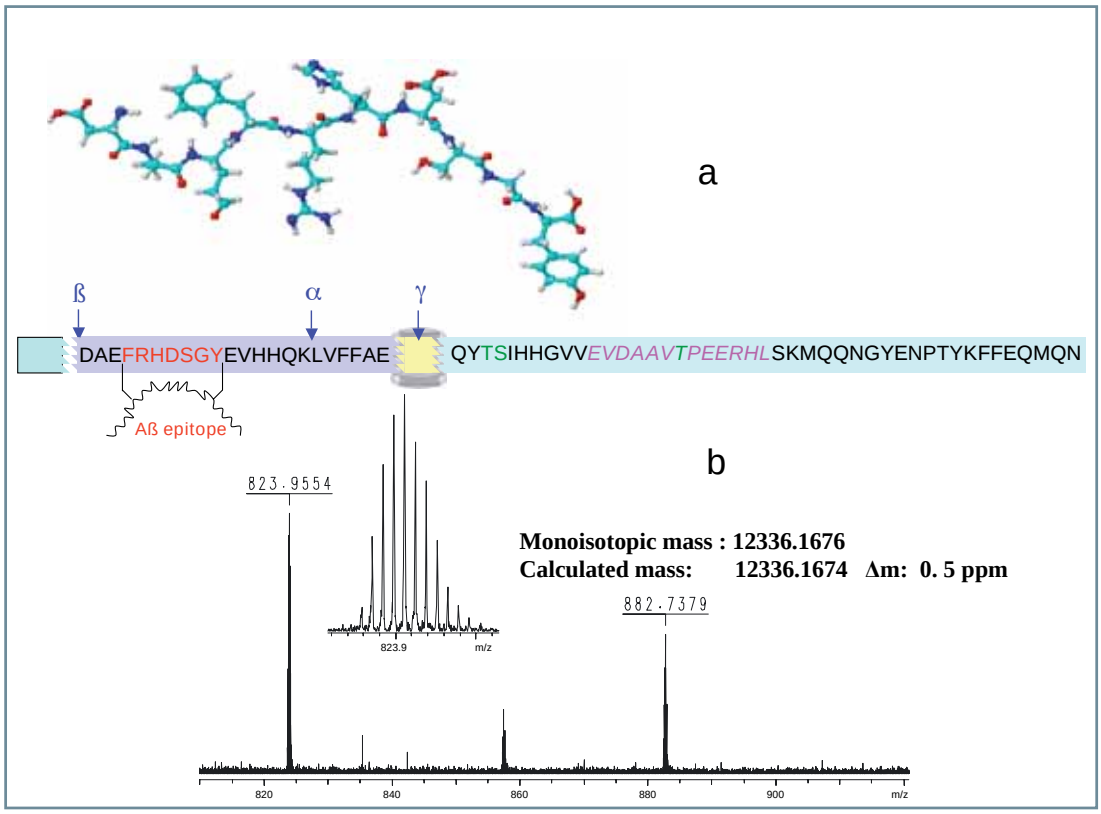
The key technology to have emerged in proteome analytics in the last few years is biopolymer mass spectrometry (MS). The two most important developments in this arena – the electrospray (ESI-MS) and the matrix-assisted laser desorption (MALDI-MS) 'soft ionization' methods – were awarded the Nobel Prize in Chemistry in 2002.

Though ESI-MS still exists, proteome analytics chiefly uses MALDI-MS in conjunction with N2-UV lasers (337nm) and, even more recently, IR lasers (Er:YAG, 2.94µm). Joining the longer wavelengths of the IR-MALDI-MS with just the right matrix system calls for a lower-energy laser pulse (also known as 'softer' ionization). The outcome: less fragmentation. To this end, the team at the Steinbeis Transfer Center for Biopolymer Analytics, Proteomics and Protein Chemistry in Constance modified a MALDI ion source to allow them to run an IR-MALDI-MS parallel to a UV-MS.

When identifying proteins, two factors are critical: unparalleled precision in determining the masses of peptide fragments and a high resolution on the mass spectrometer. These criteria must be met if researchers are to dissect and identify highly complex biological compounds such as 'isobar' peptides of similar size.

Thanks to its incredibly crisp resolution and precise mass measurements, the FTICR-MS's latest development will play a major role in bioanalytical applications. Together with MALDI-MS, ESI-MS will see continued use in proteome analytics as highly efficient 'soft'

ionization technology. Analyzing extremely low amounts of substance (<fmol) and detecting with high sensitivity requires modifications to the conventional ESI-MS – specifically, a miniaturized nano-ESI with flow rates measuring nL/min. As well as long spray times, another one of the nano-ESI-MS's outstanding features is its high sensitivity. On top of that, these methods allow for an extremely soft ionization, making them very well suited for FTICR-MS in proteome analytics.



Sequence of the C-terminal domain C99 of the APP protein and a structural model of the identified Aß-Plaque-specific epitope (red). The lower section of the image shows the high-resolution ESI-FTICR mass spectrum of APP-C99.

Besides biomarkers, another important aspect to understanding molecular recognition is familiarity with recognized structures such as antigen-epitopes and antibody-paratopes (recognized using antigens and antibodies). Armed with this knowledge, researchers are in a position to analyze structure-effect relationships in biological systems. The Steinbeis Transfer Center in Constance has spent the last few years developing new methods which will help scientists use mass spectrometry to identify peptides binding to antibodies once their affinity has been isolated.

Scientists determine antigen-epitope structures by combining an enzymatic proteolysis of the antigen-antibody complex and a mass spectrometry analysis of the resulting peptide fragments (known as 'epitope excision'). This procedure takes full advantage of the antibodies' overall proteolytic stability. In the counterpart procedure – known as 'epitope extraction' – researchers introduce an antibody to a pre-made, proteolytic decomposed mixture of the antigen. Particular bindings of peptides containing epitopes help them stand out in the mixture, allowing scientists to identify them using mass spectrometry. This procedure also helps Alzheimer's researchers isolate and characterize an ß-amyloid-(Aß)-epitope sequence recognized by a specific anti-Aß-antibody.

A recent development in this method works in the opposite way. For the first time ever, scientists are using direct mass spectrometry to identify the recognition structure of an antibody-paratope (known as 'paratope excision' or PAREXPROT) which binds a particular antigen. Since native antibody structures are virtually resistant to proteolysis, the antibody needs to be conveyed – prior to proteolytic excision or extraction – in a form that can both split and bind. A reduction with dithiothreitol or enzymatic splitting with papain could accomplish this.

Thanks to the work of the Steinbeis Transfer Center Biopolymer Analytics, Proteomics and Protein Chemistry, scientists can use the identified molecular recognized structures of an antibody as pharmaceutical leads in diagnosing and developing therapies for various diseases. Taking into account how much ground immune and antibody therapy has gained in medicine, it's easy to predict the potential that the PAREXPROT method holds for future applications.

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Steinbeis student takes growth potential analysis off the beaten path

More than one way to grow

In today's corporate environment, you can hardly turn around without coming face to face with the word 'growth'. Growth is, without question, a worthy goal and a prerequisite to a company's success – yet growth at all costs often has just the opposite effect. Actually, growth is more the logical 'next phase' as the result of multiple, strategic building blocks. This is the view put forth by Fredmund Malik, management researcher: "Growth isn't what you put into corporate strategy – it's what you get out of it." Manuela Schnepper investigated indirect growth potential during her studies at Steinbeis University.

Image: photocase.com, © Peter Ehmann

A company's strength doesn't lie first and foremost in its size. Two other factors come into play: market position and productivity. If the latter are where they should be, a company's bottom line grows healthily. The specifics of how productivity impacts growth was the subject of Manuela Schnepper's degree project. A student at the Steinbeis Career Center working towards a Master of Business Engineering, she set out to analyze how growth can be promoted from the inside out, in terms of making the most of a company's internal talents. Schnepper completed her project under the auspices of the hofer Group, a medium-sized company providing development services to the automotive industry.

The hofer Group consists of eight engineering firms focused on automotive power trains. Its offer spans developments in motors, couplings, gears, differentials, actuating elements, control devices and software. One activity common to every area is the integration of drive train components and their dynamics while ensuring a comfortable drive free of vibrations.

Schnepper's work identified growth potential off the beaten track of revenue growth and cost-cutting. She also uncovered potential in a company's inner structure which could indirectly lead to growth. After presenting her plans to senior management, Schnepper targeted her work to address growth through internal communications, idea management and development projects.

While exploring these channels, Schnepper came across enormous potential waiting to be capitalized. Some of the measures involved the psychological aspects of corporate management and communications. Particularly when stressful situations arise, 'softer' issues and approaches take a backseat and specialists tend to retreat into their niche. As a result, activities on which the three above-mentioned growth potentials are based fall by the wayside.

Schnepper performed a SWOT analysis for snapshotting purposes within the hofer Group. She also conducted a number of written and telephone interviews across all levels of the hierarchy to obtain data. The result: analyzed potential points to synergy effects which act on one another and so are difficult to keep clearly separate. The positive give-and-take of these areas of potential also yields an immense advantage. By taking just a few steps, the company can effect noticeable change and act on latent potential.

Schnepper's work launched a process within the hofer Group that not only establishes and communicates goals, new methods and codes of conduct, but also covers how to consistently put these new tools into practice. With resources now deployed more effectively, productivity takes off and prompts an increase in revenue. This knock-on effect also keeps costs down indirectly – in other words, it does not actively influence costs.

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Master seeks professor

To keep pace with increasing pressure to compete, skilled crafts and manufacturing companies alike are forced to innovate more and more quickly where products, procedures and organizational structures are concerned. One bastion of support in meeting this challenge: technology transfer. The Baden-Württemberg Crafts Congress and the German Confederation of Skilled Crafts are teaming up with the business publication handwerk magazin, the Signal Iduna Group (Insurance & Finance), the Association for Technology Transfer in Crafts and Steinbeis to award the Prof. Adalbert Seifriz Prize for Technology Transfer in Crafts.

This nationwide competition aims to bring science, academia and crafts together which will ultimately assist skilled crafts companies to benefit as quickly as possible from advances in research. The Prof. Adalbert Seifriz Prize recognizes achievements in technology transfer in crafts and showcases those companies as examples for others to follow.

TECHNOLOGIE TRANSFER HANDWERK
PROF.-ADALBERT-SEIFRIZ-PREIS

The prize for successful transfer models is awarded to a joint project between at least one skilled craftsperson and one scholar. Projects may focus on developing new products and procedures or rolling out new corporate organizational structures. The organizers encourage all skilled crafts companies, scholars or technology transfer institutes in Germany which have successfully completed one project to submit an entry which meets these criteria. The deadline for entries is 30 June, 2007.

Awards are endowed up to 25,000. An independent jury chaired by Prof. Dr. Dr. h.c. mult. Johann Löhn, Honorary Trustee of the Steinbeis Foundation, makes final award decisions.

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International Conference: "Knowledge Economy – A Multilayer Challenge for European Regions"

The Steinbeis Transfer Center ESB Research is organizing an academic conference dedicated to the knowledge economy on 27-28 September 2007 in Reutlingen, Germany. This conference will be of interest to scientists and decision-makers in business as well as politicians.

The interdisciplinary conference will cover:

- macro- and microeconomic aspects of regions' ability to compete
- business and society's ability to innovate
- how long-term socio-economic structures influence the shape of the knowledge economy

Structured around themed workshops and plenary sessions featuring keynote addresses, participants are guaranteed to learn and share an incredible amount of information. Those interested can register for the conference or submit abstracts effective immediately. A conference board will screen the abstracts for quality and relevance; a published version of the articles will be available after the conference ends.

KNOWLEDGE ECONOMY

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New publications from Steinbeis Edition

Steinbeis Edition publishes an array of works mirroring the scope of expertise found in the Steinbeis Network. We enjoy sharing knowledge! And enabling you to tap into a broad spectrum of outstanding stand-alone titles and series on management and technology.

Modeling and Reporting with SAP© BW
Peter Lehmann, Klaus Freyburger, Andreas Seufert, Wolfgang Zirn, Sven Grasse, Christian Suhl
1st ed. 2007; English
ISBN 978-3-938062-44-9

The SAP Business Information Warehouse gaining ground as the infrastructure for corporate analysis and management. This book aims to provide a general understanding for the terms in data warehousing. It goes on to instruct readers on the functionality and applications of SAP© BW together with its analysis and reporting aspects.

In this respect, the book focuses on the Administrator Workbench as a tool for a variety of purposes: modeling multidimensional information structures, analyzing data from the end-user's perspective and identifying some of the key functions to create web-based companywide reports. With a case study for the analysis of key sales figures, the functions of SAP© BW are introduced step by step and explained in detail. This book is useful for anybody who wants to brush up quickly and comprehensively on SAP© BW – with real-life examples – so decision makers, consultants and project collaborators will find a lot of support here. It's also ideal for lecturers and university students.

3rd Symposium on Business Intelligence Status Quo – Opportunities & Challenges
Proceedings, 12 December 2006
Institute for Business Intelligence
1st ed. 2007; German
ISBN 978-3-938062-52-4

Business Intelligence (BI) is rapidly evolving into a cornerstone of success for forward looking corporate management. The Institute for Business Intelligence (IBI) meets once a year to take stock of the situation. Among other topics, the most recent conference addressed trends in emerging intelligent companies, state of the art corporate performance management and analytics as well as prospects for intelligent companies.

Compendium of Working Papers from the ScanBalt Intellectual Property Knowledge Network (IPKN): Intellectual Property and Bioscience
1st ed. 2007; English
ISBN 978-3-938062-50-0

Bioscience is an industry built on creating and applying knowledge, so it is important to understand the basic concepts and strategies required to manage this knowledge as intellectual assets and properties (IP) and ultimately derive value. This publication is a collection of the key messages and ideas emerging from the first two years of the ScanBalt IP Knowledge Network Project. The messages presented are working papers covering diverse ideas of intellectual property, innovation and bioscience. This aims to provide the reader with sufficient input to facilitate discussions on how intellectual property and intellectual property management are instrumental in leveraging bioscience to create wealth and welfare.

Corporate Security – Location Security
Dieter K. Sack
Publisher: Steinbeis Transfer Institute Management and Business
Steinbeis BBA Transfer Documentation Report
1st ed. 2007; German
ISBN 978-3-938262-54-8

Elaborate in nature and linked to other divisions within the company as well as customers and risk prevention agencies, corporate security has been taken up by management. Approached properly, corporate security helps safeguard a business's success. In fact, security numbers among the many business enablers. To see security issues through from beginning to end, grasping the subject matter is just for starters – executives will need to know how to see the problem from the right angle and take appropriate action. The cornerstone of modern security doesn't lie in how restrictive the provisions are, but how uniformly they are put into practice and followed consistently for the company's benefit.

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Women still at a disadvantage

Women in executive positions in Germany still report that it's lonely at the top. Just a handful of women reach the highest rungs in business, administration and research. Such were the findings of the Steinbeis Transfer Center Enterprises & Executives titled "Career Roadblocks for Women in Management Positions". Three hundred women in senior and mid-level management took part in this nationwide empirical study.

Part of a joint effort with Furtwangen University, the questionnaire's purpose was twofold: ask women about any specific career roadblocks they had encountered and devise actions to bypass them when they arose in their current work environment. Interestingly, the Steinbeis study showed that many of the women surveyed felt that the efforts and initiatives launched by politicians to support women as they move up the career ladder are insufficient.

A majority of the women interviewed believed that males are more often preferred for management roles and see this as one of the main reasons for the low number of women in senior management. Other causes included: primarily masculine power structures, a stereotypical image of women, the failure to accept women's CVs which may not be perfectly linear, a contempt for parental leave or part-time work as well as women's networks being too low-key. Respondents repeatedly stated a lack of courage in taking risks and how often women poorly represent themselves.

In light of the current public debate, the women surveyed thought that federal and corporate moves to create more childcare options with longer, more flexible opening hours were one of the most essential factors in assisting women in executive positions. Awakening an early interest in technology and the natural sciences among girls – ideally in kindergarten – was also listed as important. According to those running the study, the critical starting point has been established: German companies are becoming more and more family-friendly.

For a digital or printed copy of this study, please contact
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Award of Excellence in Innovation and Quality Baden-Württemberg

The "Award of Excellence in Innovation and Quality Baden-Württemberg" recognizes entrepreneurs and companies from Baden-Württemberg who have done an outstanding job in putting innovation and quality management into practice and helped their company benefit from tangible, long-term success.

What has shaped the way Baden-Württemberg businesses develop their expertise in global competition? A particular talent for innovation and a discriminating sense of quality. The "Award of Excellence in Baden-Württemberg" aims to highlight this work and create momentum in nurturing the potential for even greater innovations and levels of quality.

A joint initiative of P.E. Schall (a trade show company) and the Steinbeis Transfer Center TQU under the auspices of the Steinbeis Foundation, the prize will be awarded for the very first time to mark the Messe Control 2008 trade show. Effective immediately, organizations located in the State of Baden-Württemberg may sumit their entries.

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Integrated Management Systems in SMEs

"Integrated Management Systems in Small and Medium-Sized Enterprises" – this conference was jointly hosted in Stuttgart by Südwestmetall, the Steinbeis Transfer Center ManagementQuality and the Ministry of Economic Affairs Baden-Württemberg. The purpose: highlight how SMEs benefit from integrated management systems and demonstrate how effectively launching the systems impacts day-to-day business.

Small and medium-sized enterprises already tackling the strategic alignment of their management systems for the future (quality, occupational safety, health and the environment) will secure and exploit competitive advantages down the road, too. Integrated management systems aim to bring transparency to a company's structures and processes, improving them, and ultimately leveraging them to slash costs.

They lend a decisive edge in more ways than one:

- Increase revenue and earning power
- Bolster competitiveness and market opportunities
- Cut costs thanks to reduced and prevented errors
- Create transparency and defined responsibilities
- Optimize products and procedures
- Minimize risk through targeted preventive measures
- Constantly improve internal and external processes
- Strengthen legal standing in terms of occupational safety and environmental protection.

An example taken from the automotive industry clearly demonstrates how by ISO 9001 standard quality management has evolved into an integrated management system. Experts were present at the company's site to initiate a series of actions for occupational health and safety which passed OHSAS 18001 muster and integrate them into current processes. The actual process of evaluating working conditions proved valuable in assessing risk. Next, the team used a system audit to determine how to launch a company environmental policy in line with ISO 14001 and integrated this approach into existing processes. They also designed industry-specific solutions complete with action plans to meet the automotive industry's strict requirements with regard to ISO/TS 16949. This example perfectly illustrates how SMEs can truly benefit from an integrated management system when it fits the company like a glove.

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New Steinbeis Enterprises

Abbreviations:
SCC: Steinbeis Consulting Center
SRC: Steinbeis Research Center
SIC: Steinbeis Innovation Center
STI: Steinbeis Transfer Institute
STC: Steinbeis Transfer Center

The following Steinbeis Enterprises have been founded as of March 2007:

SCC Ostwürttemberg, Heidenheim
Director: Markus Brühl

STC Innovation and Mobility, Linz
Director: Mag. Andreas Hubinger

SCC Business Process Management, Reutlingen
Directors: Dipl.-Inf. Marcus Schiesser, MBA,
Prof. Dr. Martin Schmollinger,
Prof. Dr. Guido Siestrup

SRC Optimization, Steering and Adjustment Control, Grasberg
Director: Prof. Dr. Christof Büskens

SCC Competence in Organization, Stuttgart
Director: Dipl.-Inf. (FH) Peter Kiess, MBA

STC Pharmaceuticals – Cosmetics – Medical Products, Tübingen
Directors: Prof. Dr. Ingrid Müller,
Dipl.-Ing. (FH) Elke Weber, MSc.

STI Technology Management, Stuttgart
Directors: Prof. Dr. Werner G. Faix,
Dipl.-Ing. (FH) Rainer Gehrung

STI International Management, Stuttgart
Directors: Prof. Dr. Werner G. Faix,
Dipl.-Ing. (FH) Rainer Gehrung

SRC Application-oriented Material-, Production- and Process-Technology, Crimmitschau
Director: Prof. Dr.-Ing. Lars Frormann

STI Business Management and Engineering, Stuttgart
Directors: Dipl.-Ing. (BA) Walter Beck, MBA,
Dipl.-Ing. (FH) Peter Schupp

SCC Concepts and Solutions for Medium-Sized Businesses, Horgau
Directors: Dipl.-Betriebswirt (FH) Michael Chytry,
Dipl.-Betriebswirt (FH) Oliver Mohr

STC Media and Advertising Research, Heidenheim
Directors: Prof. Dr. Volker Walter,
Prof. Dr. Michael Froböse

STI Management Education, Stuttgart
Director: Prof. Dr.-Ing. habil. Joachim Warschat

STC Learning & Education, Offenburg
Director: Prof. Dr. Eva Schumacher

STI Family Enterprise, Berlin
Directors: Prof. Dr. Jens Kleine,
Prof. Dr. Markus Venzin,
Dipl.-Kfm. Oliver Dörschel

SCC Business Coaching and Competence Management, Stuttgart
Director: Dipl.-Betriebswirt
Christoph Sandmann, MBA

STI Institute Corporate Integrity Management, Berlin
Directors: Dr. Henning Herzog,
Dipl.-Kffr. Birgit Galley, CFE

SCC Education Management, Heidesee
Director: PD Dr. habil. Olaf Kos

SCC Manufactering Systems and Processes, Ulm
Director: Prof. Dr.-Ing. Manfred Wehrheim

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