Steinbeis

TRANSFER

The Steinbeis Magazine

Keeping an eye on progress

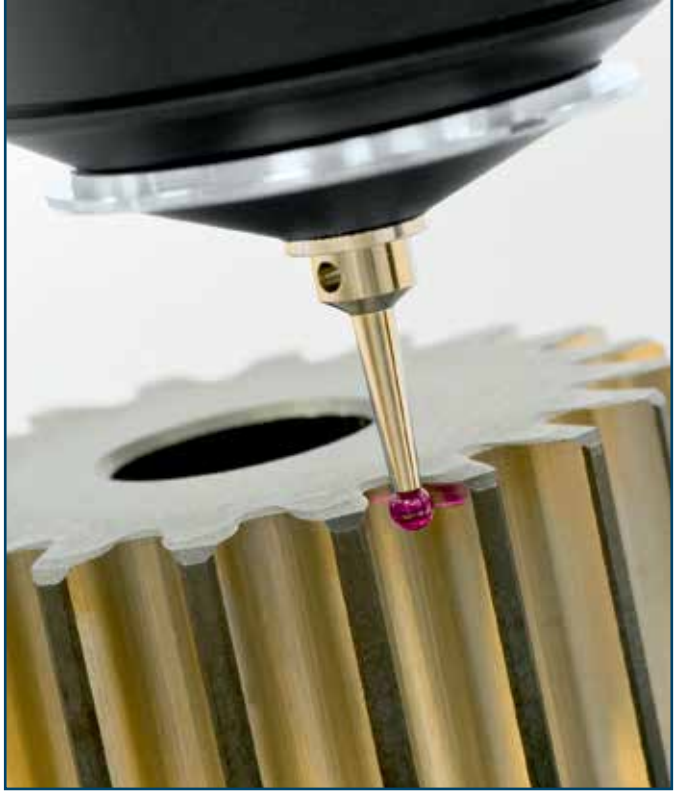
Feature Topic: Sensors And Image Processing
Insights from Steinbeis experts

What is the Value of "the New"
A look back at the 2015 Steinbeis Innovation Arena

How Does Noise Affect Real Estate Values?
Steinbeis experts examine the impact of noise on the value of real estate

Learning How to Learn
Steinbeis team crafts continuing professional development strategies

02 | 2015



News

Find an overview of all Steinbeis Enterprises and their services on www.steinbeis.de → our experts

Dear Readers,

Prof. Dr.-Ing. habil. Gerhard Linß is founder of the Steinbeis Transfer Center for Quality Assurance and Image Processing and founding director of Steinbeis Qualitätssicherung und Bildverarbeitung GmbH. In 2004, Gerhard Linß and his team of Steinbeis experts won the Steinbeis Foundation prize for transfer alongside Carl Zeiss Industrielle Messtechnik GmbH. They received the Löhn Award for a collaborative project called ViSCAN: Light-Based Precision Measurement. In 2008, he won the award with WAFIOS AG with a newly developed image processing system for use in quality control in spring production. Finally, in 2011, the center won an award with NT TOOL Corporation, for a project called Intuitive Software for a New Optical Tool Presetter.

Sensors are often engineered replications of human sensory organs. Digital imaging sensors have been particularly important in this regard. Image processing is a relatively new field which stemmed from (and grew with) technical advancements made in the electronic recording, transmission, and analysis of images.

Their development is marked by a series of milestones, but the decisive breakthrough in wide-scale industrial applications came in 1974 with the development of the imaging semiconductor circuit by Willard Boyle and George E. Smith in the United States. This was then furthered by the development of microprocessors, also in the U.S. By the 1980s, the technology had entered use in business. Ever since, image processing and its use in industry have continually expanded with experienced double-digit growth, hand in hand with the creation of high-quality jobs in the field of research and development and strong value creation.

Image processing is the technical equivalent of the human visual senses, and, in the engineering field, it is as important as the human ability to take in pictures and understand them. More than 90% of the information humans perceive from their environment is sensed through the eyes. It is similar in engineering: of all the sensors available, image sensors provide the largest volumes of information and data streams. As with humans, the system that coordinates the eye, optic nerve, and the brain consists of the image recorder (camera), the connection (interface), and image analysis (computer with software). Central to this is how to replicate the human ability to see and recognize images, taking us as far as the realms of artificial intelligence. The human eye has between 6 and 7 million cones to perceive color and 75-150 million rods to perceive black and white. It is highly adaptable, sensitive to light, has an angle of vision of nearly 180 degrees, and sees razor-sharp images at the center. It is also capable of seeing images in stereo, capturing different colors and already pre-processing information within the eye. The optic nerve contains a million nerve fibers, and the eyes and head can be moved around. In a parallel process, the brain conducts its analysis. It has the ability to recognize objects based on fragments of information, detect edges in fuzzy images, and adjust colors. When it comes to evaluating images, the human brain is vastly superior to modern computer algorithms, but there are now high-tech sensors that are coming close to the performance of human sensors. One area where technical sensors do have the upper hand is when it comes to measuring lengths. They do this objectively whereas humans can only make educated guesses. Technical sensors can also run 24 hours a day, in quick repetition, without tiring.

Digital sensors and image processing sensors are a key technology. They can be applied in a variety of fields of digital image processing, the most essential ones being industrial quality assurance and measurement technology, which now account for roughly 80% of all applications. Only around 20% of all possible applications are currently understood or being exploited (Schwarzkopf 2006).

The important role played by digital image processing in industry is intensifying rapidly, especially in the fields of medicine, transportation, security technology, and defense technology. But this is also the case in society as a whole. Against a backdrop of developments relating to digitalization, miniaturization, smart technology, standardization, globally uniform interfaces, color capabilities, and the need to offer affordable prices, the rate at which sensors and image processing technologies are now being integrated into products, processes, and services is accelerating. Society is being revolutionized by digital sensors and image processing (smart technologies) in connection with modern microprocessors and signal processors. This development will continue at breakneck speed, as testified by autonomous vehicles, driver assistance systems in cars, and smartphones.

In this latest edition of TRANSFER, we focus the spotlight more closely on sensors and image processing, introducing a number of experts and projects in the Steinbeis Network. I hope you find it an interesting read!

Prof. Dr.-Ing. habil. Gerhard Linß

What is the Value of "the New"?

A look back at the 2015 Steinbeis Innovation Arena

In the future, competitiveness and the ability to innovate will depend more than ever on companies' and workers' willingness and ability to bring about "the New." The Steinbeis Network is grappling with this challenge in a variety of ways. The publication "InnovationQuality. The Value of the New" (Steinbeis Edition 2014) set the stage for the Steinbeis Innovation Arena 2015, which took place in the SpardaWelt events center in Stuttgart on April 22, 2015. The event explored the question: What is the Value of "the New"? Eleven discussion partners – representatives of companies, associations, universities and colleges as well as two winners of the online simulation "Young founders" – came together in the arena with some 200 guests. The event was organized by Steinbeis and the industrial association of the German federal state of Baden-Wuerttemberg (LVI). Support with the content and concept came from Beate Wittkopp (Steinbeis Transfer Center TransferWorks BW), while the arena was moderated by Marcel Wagner (BR/Regio TV) and Tina Kraus (SWR).

Baden-Württemberg is a leading powerhouse for innovation within the European Union. But – and this is an important "but" – only 28% of medium-sized industries invest specifically in innovation, and that number is falling.

Has the term "innovation" sometimes been overinflated? Kicking off the arena, a discussion of the term showed its many facets and made it clear that an interest in exploring "the New" is germinated through education – although simply disseminating knowledge does not spark the creative force or reveal the significance of what is taught. It's not until knowledge is actually applied that competency is gained and the spirit of entrepreneurship is awakened. For this reason, incentives such as the online simulation "Young founders" (Jugend Gründet) cannot come early enough to inspire the creativity of young people and provide the necessary stimulus for new ideas, even those that meet resistance or controversy. This is why skills development must be firmly established as a primary focus of education as well as professional life with the aim of creating "the New" within a dynamic of change. After all, the call for radical innovation is louder than ever, while the frequency of upheavals and transitions seems to have only increased.

As their next topic, the participants looked at the fundamental issue of whether the ability to innovate is a question of money. This round of discussion made it clear that first and foremost, innovation starts with an individual. However, according to a 2009 Gallup study, at many companies only 30% of employees' individual strengths are actually used in their regular jobs. Management must provide space for the creative development of employees outside of routine work processes, because innovation rarely occurs predictably at the press of a button – as the audience in the arena also affirmed with their votes.

And what makes a company innovative? The ability to innovate does not depend on the size of a company, but on a corporate culture and visionary spirit that make it willing to take risks and accept new challenges. Only by breaking rules can a path be cleared for good ideas and new business models. This often calls for nothing less than a paradigm shift toward a new workplace culture of "Resourceful Humans." This approach does not revolve around technology, but places its trust in human beings and their intuition. For companies, this also means applying new methods to analyze talent during recruitment. Team diversity can be extremely valuable for the process of innovation. Knowledge and ideas must be communicated quickly across hierarchies and managed agilely until their direct implementation, if necessary as external spin-offs

Arena participants

- Prof. Dr.-Ing. Rolf-Jürgen Ahlers | Board Chairman, Forum Luft- und Raumfahrt Baden-Württemberg e.V.
- Nadine Antic | Managing Director, GlobalFlow GmbH
- Prof. Dr. Werner G. Faix | Managing Director and Associate Member of the School of International Business and Entrepreneurship GmbH (SIBE) at Steinbeis University Berlin
- Sonja Fritze | Head of Development, Display Instruments and Head-up Displays, Robert Bosch GmbH, Car Multimedia
- Dr.-Ing. Toralf Kahlert | CEO, Pumacy Technologies AG
- Miriam Kamal-Specht | Founder and CEO, Yellow Frog, Guest Lecturer at University of Stuttgart
- Bernd Kussmaul | Managing Director, Bernd Kußmaul GmbH
- Prof. Dr. Dr.-Ing. Dr. h.c. Jivka Ovtcharova | Director of the Institute of Information Management in Engineering, Karlsruhe Institute of Technology
- Susanne Peter | Managing Director, Finanz IBM Deutschland GmbH
- Christine Regitz | Vice President, SAP SE
- Albrecht Stäbler | CEO, NovaTec Holding GmbH
- Jochen Wirth | Project Manager of the online simulation "Young Founders" at the Steinbeis Innovation Center for Business Development at Pforzheim University
- Max Jagiello and Leopold Schäffer, winners of "Young Founders"

to the company. Failure should not be a hindrance, but seen as know-how for following projects.

Innovation is a form of competitive advantage, with companies measured by the quality of their products and services. The entire network of value creation must be able to stand up to international competition. A technology-driven revolution is transforming the workplace and society. Information and data are becoming important raw materials, and software engineers are the inventors of the future. As software-driven processes increase in complexity and size, human beings are nevertheless assuming a key role – by thinking laterally, recognizing overarching connections and potential, and creating effective networks between companies, partners and customers. This is also because a "real" innovation is not limited to manufacturing processes. Tangible products are not the only things that count; complexity also matters. Interdisciplinary expertise can thus lead to reinterpretation and innovative projects, as was clearly illustrated in the arena discussion using examples of transfer between the construction of stadium roofs and e-vehicle concepts.

The final discussion round asked whether there is a creative conflict between innovation and quality. And when does an innovation add quality? A minimum amount of creative chaos, vision, curiosity, courage and drive are all necessary for ideas to grow into innovations. But an innovation must make it onto the market at the right time and stand the test of market forces. The selection of an appropriate business model in particular shows the importance of quality management for sustainable business growth, with indicators and targets providing the necessary guidance.

The Steinbeis Innovation Arena provided lively proof of the special expertise and innovative spirit of the discussion partners – and of the topicality of the subject matter. Attendees were impressed not only by the unusual format, but also the intense discussion, and expressed interest in continuing the conversation. With this in mind, the arena is launching an online discussion forum and a creative, interdisciplinary network for innovative processes. Starting immediately, contributions, opinions and critical observations can be sent to inq@steinbeis.de to serve as the basis for a discussion platform.

To watch a full-length video of the Steinbeis Innovation Arena, go to the Steinbeis media library at www.steinbeis-innovationsarena.de.

Beate Wittkopp
Steinbeis Transfer Center TransferWerk-BW (Schönaich)
beate.wittkopp@stw.de | www.transferwerk-bw.de

“Not everyone has a talent for taking risks!”

A conversation with Bernd Kussmaul, managing director of Bernd Kussmaul GmbH

Mr. Kussmaul, there seems to be general agreement about the importance of technology transfer, but we usually talk about transfer between the worlds of science and business. Hardly anyone mentions technology transfer between companies. Why do you think that is?

I believe that nowadays technology transfer takes place between many companies, but it's not broadly communicated. This is motivated in part by a desire to protect the resulting competitive advantage. This aspect is particularly important to small and medium-sized enterprises (SMEs).

What would you say is necessary for the transfer of technology between companies to succeed?

Open communication, with each side focusing on their own core competences! At the same time, it's important to take a holistic view of the process so you can leverage the potential of each technology partner to add value. And the human factor plays a major role as well. Employees have to be given training – and they need the ability to remain neutral in their dealings with partners. I also see technology and network management as prerequisites.

“Traditional” technology transfer between research institutes and businesses is subsidized by the government. When it comes to technology transfer between companies, do you believe this is useful or even necessary?

It would be nice, but is it necessary? For the sake of their own competitive advantage, I think companies have to be willing to invest in technology transfer. The next step, the resulting gain in expertise, is something that benefits every company.

When I think about subsidies for technology transfer between companies, I believe it would be useful to have support for big projects involving several technology partners, at least in the run-up to the project when a lot of planning activity is necessary. Generally speaking, it remains difficult for SMEs to take a cool idea and run with it – there's too much bureaucracy! And that's not a problem that can be solved with subsidies.

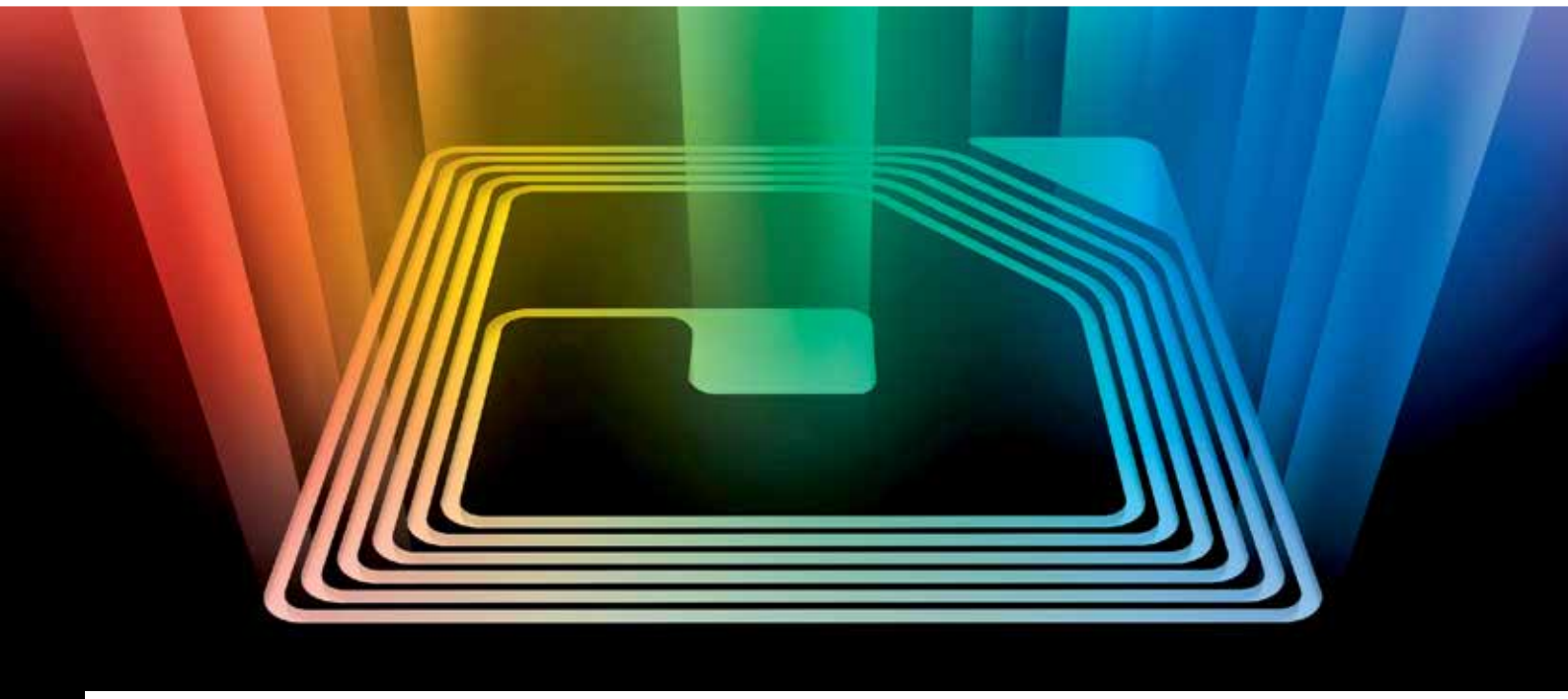
Risking a glance into the future, what do you think technology transfer will look like in five or ten years time?

Best-case scenario? All companies will be cooperating with each other, so there will no longer be a need for incentives or initiatives. But being realistic, I think technological complexity will force companies to cooperate across sectors just in order to implement their new product ideas. International competition will accelerate this process. In addition, new careers and fields of study – like technology broker or network manager – have to be created to make transfer more effective. We have to be able to identify which technologies could be applied where. Not everyone has a talent for taking risks! A database could be developed to support this process, along the lines of the “Wer liefert was?” (“Who supplies what?”) search engine. But it should be called something like “Who can do what?” or “Who has this core competence?” – a directory of competences. And because things constantly change and develop, that would certainly be a difficult challenge! The regional Steinbeis centers could offer their support here.

Image: Bernd Kussmaul GmbH has proven that technology transfer between companies can succeed. The company worked with Harro Höfliger Verpackungsmaschinen GmbH to develop an innovative partition system.

Bernd Kußmaul is managing director of Bernd Kussmaul GmbH. A technology service provider with customers all over the world, the company specializes in complex, made-to-measure technical products and processes. Bernd Kussmaul was a discussion partner at Steinbeis Innovation Arena 2015, advocating the idea that customers are an important building block in the product development process, contributing their core competencies and experience.

Bernd Kußmaul
Bernd Kußmaul GmbH (Weinstadt-Großheppach)
info@bernd-kussmaul-gmbh.de | www.bernd-kussmaul-gmbh.de



Feature Topic: Sensors and Image Processing

Insights from Steinbeis experts

Image processing and sensors are now encountered in almost all areas of science and engineering. This trend has been fuelled by a number of factors, including the shift toward automation in the production of increasingly compact systems, the growth in mass production in increasingly larger volumes, and the desire to improve quality controls. A variety of Steinbeis experts look at current developments and examine the trends that are likely or possible in the future. Professor Dr. Jörg Eberhardt, director of the Steinbeis Transfer Center for Vision Systems, reports on current trends in industrial image processing and even dares to offer his prognosis for the future of the industry. The fact that sensors can also be used in the great outdoors is demonstrated by Professor Dr. Uwe Schmidt, who heads up the Steinbeis Transfer Center for Energy – Environment – Information. Professor Dr.-Ing. habil. Hagen Malberg, director of the Steinbeis Research Center for Applied Medical Technology, describes technological trends and developments in the field of medical sensors. The director of the Steinbeis Transfer Center for Image Processing and Applied Information Technology, Professor Dr. Ulrich Klauck, provides an overview of image processing developments in recent years. Prof. Dr. Bernhard Wolf from the Steinbeis Transfer Center for Cell Chip Technologies and Christian Scholze, the Heinz Nixdorf Chair for Medical Electronics, take a look at the development of intelligent implants. The article featuring Prof. Dr. Dietrich Hofmann, director of the Steinbeis Transfer Center for Quality Assurance and Quality Measuring Systems, and his partners in the SpectroNet business cluster reveals how photonic microsensors and digital image processing can be used with the aid of SmartPads. In addition, Prof. Dr. Thorsten Leize of the Steinbeis Transfer Center called Sensorics and Information Systems – SensIn' teams up with Dr. Marc Schöttler of Phrealog to present another field of application for sensors: the detection of groundwater movements. In an interview with Steffen Lübbecke, managing director of Steinbeis Qualitätssicherung und Bildverarbeitung GmbH, Lübbecke discusses the exciting connection between quality and image processing.

Image: © Fotolia.com/science photo; Fotolia.com/Cake78; Fotolia.com/Alterfalter

"One major trend is the increasing use of 3D technology."

An interview with Professor Dr. Jörg Eberhardt, director of the Steinbeis Transfer Center for Vision Systems

Professor Eberhardt, your Steinbeis Transfer Center for Vision Systems has been part of the Steinbeis Network since 2014. What factors influenced your founding of this enterprise?

There are a number of unsolved problems facing the world of industrial image processing, despite major advances in the development of sensors, improvements in the power of modern IT architectures, and the trend toward simplified user interfaces. But it's the sheer number of different technologies and trends that is overwhelming companies in their quest for a simple, pioneering, and – most importantly – functional automation solution. I'm often approached by classic small and medium-sized enterprises (SMEs) asking for help with their automation problems. The scope of questions I'm asked is extremely wide. The requests range from conventional consulting to the development of prototypes. The Steinbeis Transfer Center for Vision Systems gives me a framework within which to carry out these projects. It allows me to focus on the key issues and removes the burden of administration and routine tasks. I have major hopes for the future in terms of new ideas arising from collaboration within the Steinbeis Network and the possibility to take on more people.

The know-how at your Steinbeis Enterprises revolves around R&D and consulting in fields relating to industrial image processing. What areas of industry do your customers work in and what sort of problems do they approach you with?

The problems they approach me with at the transfer center can be completely different, and they come from really broad areas of industry. The latest client requests range from woodworking to pharmaceuticals. Of course there are also clients that I got to know when I was working in industry, with whom I have a close understanding. Lots of the questions I'm asked are about investment plans in the field of industrial image processing. An increasing number of queries come from SMEs in the region, which value the opportunity to work with a professional partner in the area. For them, too, it's mainly about professional advice related to automation projects, although there are also feasibility studies and prototype developments.

You're also involved in the field of machine vision, where irrelevant information is filtered out and only meaningful data is handed on for analysis. In times of too much information, that sounds extre-

mely appealing. What are the challenges with this technology and what is the current status of developments?

Machine vision has made tremendous progress in recent years. On the one hand, the area is benefitting directly from the development of faster and faster computer architectures, while, at the same time, energy consumption is going down. Algorithms that were undergoing scientific testing years ago have now finally made their way into industrial projects under suitable conditions. Then, on the other hand, there has been major progress in camera technology. All industrial cameras are now digital with megapixel resolutions and quick image refresh rates. Also, advances made in sensor production make it possible to achieve ultimate sensitivity and cover a broad spectrum. Because cameras are getting faster and faster at producing bigger and bigger images, it's now all the more important to be able to process the huge data volumes. This makes it necessary to distribute image data in parallel across several systems. This is where we're reaching the existing borders of possibility. To process camera data simultaneously, it often takes an entire cluster of computers. The pixels have to be consolidated, filtered, segmented, transformed, and the put into categories using neural networks, support vector machines, or similar kinds of algorithms. The costs of such image processing systems are correspondingly high, often a 6-digit number.

In less complex areas, increasing use is being made of "intelligent" cameras made by traditional sensor manufacturers. These cameras already come with an integrated evaluation algorithm and they're much easier to operate. Users don't have to think about all the pixels, they just interact with the system and define what needs checking on the component.

The number of areas industrial image processing has entered into has risen sharply in recent years. Which trends do you think will dictate the future for us?

End customers have rising expectations in terms of quality and it's already the norm in lots of areas to have 100% checking and traceability. Visual checks and quality controls are already key technologies and without them, the majority of the automation tasks that are carried out would be impossible – not just in classic quality assurance but also when it comes to robot vision systems.

On top of that, image processing is increasingly making its way into tasks related to optimization and manufacturing controls. This technology is profiting from the trend toward more flexibility in production, right down to batch sizes of one. The concepts underlying this general automation trend are often mentioned within the context of Industry 4.0 – something that wouldn't even be possible in many cases since flexible production cells are dependent on the output produced by highly sophisticated sensors.

One major trend is the increasing use of 3D technology which not long ago was considered complicated and expensive. Now people are using a whole variety of 3D technologies, some of which are extremely economical, in areas ranging from stereo image processing to laser scanning.

Just as it's always been, the automotive industry is still the biggest area using this technology, and it has played an instrumental role in industrial image processing becoming an irreplaceable part of automation technology in recent years. But more and more attention is now also being given to non-industrial applications, especially the fields of medicine, transportation, security, sports, and farming. The driverless cars of the future will need a variety of 2D and 3D sensors and cameras to take in the traffic environment. In sports, we need ultra-precise imaging devices to do things like spot the ball crossing the line. But we're also increasingly seeing imaging technology used in farming to drive autonomous harvesters but also to monitor the optimum time to harvest crops.

Image: The identification, counting, and quality control of printed objects in production batches of 1 (labels in the food and beverages industry)

Professor Dr. Jörg Eberhardt is director of the Steinbeis Transfer Center for Vision Systems at the Ravensburg-Weingarten University of Applied Sciences. The services offered at center range from the development of optical camera systems (2D, 3D, color measurement) to consulting in the fields of optical measurement technology, lighting development, 2D and 3D technology, applied research in the field of optical measurement technology, and 3D camera technology, as well as seminars and training.

Professor Dr. Jörg Eberhardt
Steinbeis Transfer Center Vision Systems (Meckenbeuren)
SU1840@stw.de | www.steinbeis.de/su/1840

Total Turnover of Industrial Image Processing in Germany

Traditional Manufacturing Becomes Industry 4.0

Image processing today and tomorrow

Image processing has developed into a core technology in many areas of industry. It is difficult to imagine many production processes without the use of image processing, especially at the required quality and low cost. The key drivers of this trend are now the applications themselves: in the automotive industry, with its high hopes of autonomous driving, in robotics, medical applications, not to mention the entertainment industry – just to name the most important areas. There are also many non-industrial fields of application where components with image processing capability are required.

All of this makes the field extremely important from an economic standpoint. In the German image processing industry alone, sales hit Euro1.8 billion in 2014. This was a year-on-year increase of over 10%. Sales growth is expected to be just under 10% again in 2015, bringing industry turnover inches short of the two billion mark.

A study issued in 2013 by the McKinsey Global Institute (Disruptive technologies: Advances that will transform life, business, and the global economy) examined the areas of technology that will have the greatest economic, technological, and societal impact in the future. In many of the areas examined, the study considers image processing as a key enabling technology.

The traditional view of image processing is that it's used in areas where things have to be precise and quick, or where tiresome tasks have to be carried out over longer timeframes. A defining feature of such applications revolves around the low levels of complexity encountered in such environments. Recent technological advancements in the fields of image sensors, memory technology, image data transfer, computational power, and, crucially, algorithms are making it possible to develop applications in areas marked by highly unstructured and extremely complex environments.

We see good examples of this in areas like autonomous driving and advanced robotics. Driver assistance systems became an established feature of the car industry some time ago. These systems cannot survive

without a variety of sensors, some of which fall into the field of imaging sensors. These make a number of functions possible, such as lane departure warnings, traffic sign recognition, lane change assistants, blind spot monitoring, and emergency braking systems to protect pedestrians. All of these systems are extremely useful in their own right, but when it comes to autonomous driving they are absolutely indispensible. Technology has come a long way in these areas, but, at the moment, the biggest (technological) problem is still the highly complex nature of the environment and the performance of autonomous vehicles in all kinds of weather conditions, in all seasons, at all times of day, and in all kinds of traffic.

Modern robotics moved beyond the realms of pure "Teach-In" technology a long time ago. Robots are now able to monitor their working environment for possible collisions and are much more adaptive in terms of the environment and allocated tasks. In the future, robots and people should be able to work "hand in hand." A decisive role in this will be played by sensors and, in particular, image processing.

Another example is Industry 4.0, commonly alluded to in international business by the term "Internet of Things." This is all about the future world of big networks in which objects (things) will increasingly by equipped with sensors, actuators, and communication links. This will make it possible for objects in the real world to observe their surroundings, store and share their current status, receive instructions, and start or carry out actions. This technology will revolutionize industrial manufacturing and working environments, even in non-industrial settings, although it will also have an impact on our everyday lives. Naturally, not only will image processing play an important part in this area, it will also be considered a key technology.

It's not difficult to identify many more areas where image processing already plays an important role and will keep moving things forward, primarily because of its economic significance. But there is perhaps one area that seems less important to some at first glance, yet it is still significant: the consumer or entertainment market. Almost all young people have instant access to image processing technology on their cell phones and no games console is the same anymore without a camera. The computing power of the components in these devices is now gigantic. They can do things like recognize gestures or offer optical character recognition (OCR), augmented reality, 3D image processing, and a lot more. In essence, it's irrelevant whether the key driver of developments is the consumer market or industrial applications, the trend for the future in both areas is still clear. 3D applications will become more and more common. In many areas they will be standard technology and enter more new fields of application. The miniaturization trend will continue unabated, with more and more applications being made to include embedded image processing systems. Finally, technologies that are currently not common will become more important. One such technology is spectral imaging, which goes beyond just providing image information and delivers spectral information within individual pixels. Examples of applications in astronomy are now commonplace and thanks to miniaturization and significant price drops, this technology will also enter industrial image processing, where it will provide valuable additional information for use in image analysis.

There is a danger with the rapid pace of developments in image processing, the wide availability of technology in everyday life, and the way people become accustomed to new technologies: people no longer understand just how complex this field really is. To do something about this, high standards of training and continuing professional development are required in this area. Given the particularly important role played by image processing in the field of the Internet of Things/Industry 4.0, any degree with a strong foundation in engineering should include training on the fundamentals, or at least offer it to students as an option. Technology sharing at universities and research institutions also has a role to play and it can make valuable contributions to this field, which is developing extremely rapidly. There are many training, research and technology transfer establishments in Germany with outstanding experts in the field of image processing and this gives Germany a leading position in the international market. The industrial and scientific community continue to develop in this way, and it's of supreme importance that things stay that way.

Image: Turnover of imaging processing in Germany, including exports (Source: VDMA Robotics and Automation)

Professor Dr. Ulrich Klauck is director of the Steinbeis Transfer Center for Image Processing and Applied Information Technology, which is based at Aalen University. The Steinbeis experts at the center offer their clients services in the fields of image processing and pattern recognition, color measurement/comparison/recognition, thermography, and high-speed imaging and image processing.

Professor Dr. Ulrich Klauck
Steinbeis Transfer Center Image Processing and Applied Information Technology (Aalen)
SU0530@stw.de | www.steinbeis.de/su/530

“Now it’s all about getting on with transfer again.”

An interview with Professor Dr. Uwe Schmidt, director of the Steinbeis Transfer Center for Energy – Environment – Information

Professor Schmidt, looking back on your education and career to date, it’s instantly apparent that you have two passions in life: technology and the environment. How did this interesting yet probably highly challenging combination come about?

As a qualified university lecturer and engineering scientist, one first gets involved in the development of engineering machinery and processes; one tries to transfer the fundamentals of science to technical systems, especially from physics. But if one looks around at our natural environment, one can’t be but amazed at the creativity and perfection with which evolution has created systems – systems that are functional and efficient in every possible way. Biological systems that didn’t become a sustainable part of nature had no chance of surviving. An engineer can only look at this with awe and observe and learn. This is why I was particularly taken by agricultural science, because for centuries, humanity has been trying to optimize the biological system, using technical aids, our knowledge of the scientific fundamentals, but also a healthy serving of experience – all to arrive at products for our own nutrition, or in the meantime, for our own supply of materials and energy. From my point of view as an engineer, what’s particularly interesting is intensive crop cultivation in greenhouses. It’s here that we can control all the factors that influence plant growing conditions. But before we’re able to optimize things and use technologies to control the microclimate, we first have to work out how the processes of plant physiology – things like photosynthesis – react to these synthetic alterations in conditions. It’s an exciting job on an interdisciplinary level.

At your Steinbeis enterprise, Energy – Environment – Information, the services you offer include consulting, research and development in the field of sensor technology in nature. What sort of problems do your customers ask you about? Where do you see the greatest need to do something?

We’re not just seeing a whole host of different ways to obtain sensory information in nature, in high concentrations in terms of timing and space. What’s now happening is that we have a deluge of data that can hardly be managed. People are crying out for algorithms that filter data, compress it, and keep it in agile databases for analyzing processes. After that, there’ll be a proper gap to fill caused by the fact that, in many processes, there are no intelligent routines to evaluate the data as a basis for decision-making. What’s needed here is close collaboration between process scientists and IT experts, and these are the biggest areas where action is needed. Again, examples from agricultural science show how challenging this kind of work is. If you want an industrial robot to make a weld along a line on a car body, the location and the 3D coordinates can be reproduced precisely and there are also good ways to investigate how the materials react during welding. To get a robot to pick cucumbers or tomatoes, you need image analysis sensors that understand crop architecture, that select fruits of the right size, that analyze their ripeness, and carefully separate them from the plant. In automation engineering terms, this is a herculean task. Getting sensors to recognize the quality of different parts of a plant like flowers and fruit, or spotting plant disease in large crops would help improve the quality of production processes. Again, the information provided by the sensors has to be interpreted and optical signatures have to be evaluated. Cli-

ents in the agriculture industry want these kinds of systems to help them with decision-making. The complex interdependencies have to be represented in a way that is understandable and the time taken working with the measurement technology and analysis system has to be kept to a minimum.

Professor Schmidt, you founded your Steinbeis enterprise nearly 20 years ago. How have client demands and the affect this has on your work changed over the years, and what developments have shaped these the most, not just for technological reasons but also due to changes in society?

After I founded the transfer center, we invested a lot of time and energy developing measurement systems such as so-called phyto-monitors. We soon saw the first customers who bought these systems experiencing the shortcomings I described regarding data interpretation. Because of this, more was invested in software development to process the data, right up to entire automation systems for use with greenhouses.

As expertise grew in these areas, there was more interest from clients in related areas like materials research and power engineering. Society is now more aware of sustainability issues and this also spurred us on at the transfer center. Over the last five years, we've been involved in a major German collaborative project looking at the development of energy-saving greenhouses (the ZINEG project). Our role at the transfer center was to develop the software and sensors for controlling the greenhouses, which will also be able to function as solar thermal energy collectors. The innovative solution and other ideas the consortium came up with earned it the German sustainability prize for research. This was awarded in fall 2014 by the BMBF and it's also a nice honor for the work of my Steinbeis Transfer Center in Berlin. Now it's all about getting on with transfer again, which often involves just knocking on doors. Projects are now extremely complex. We get everything from collaborative projects to the ion-selective control of closed-circuit nutrition solutions and even new types of water disinfection systems in plant cultivation.

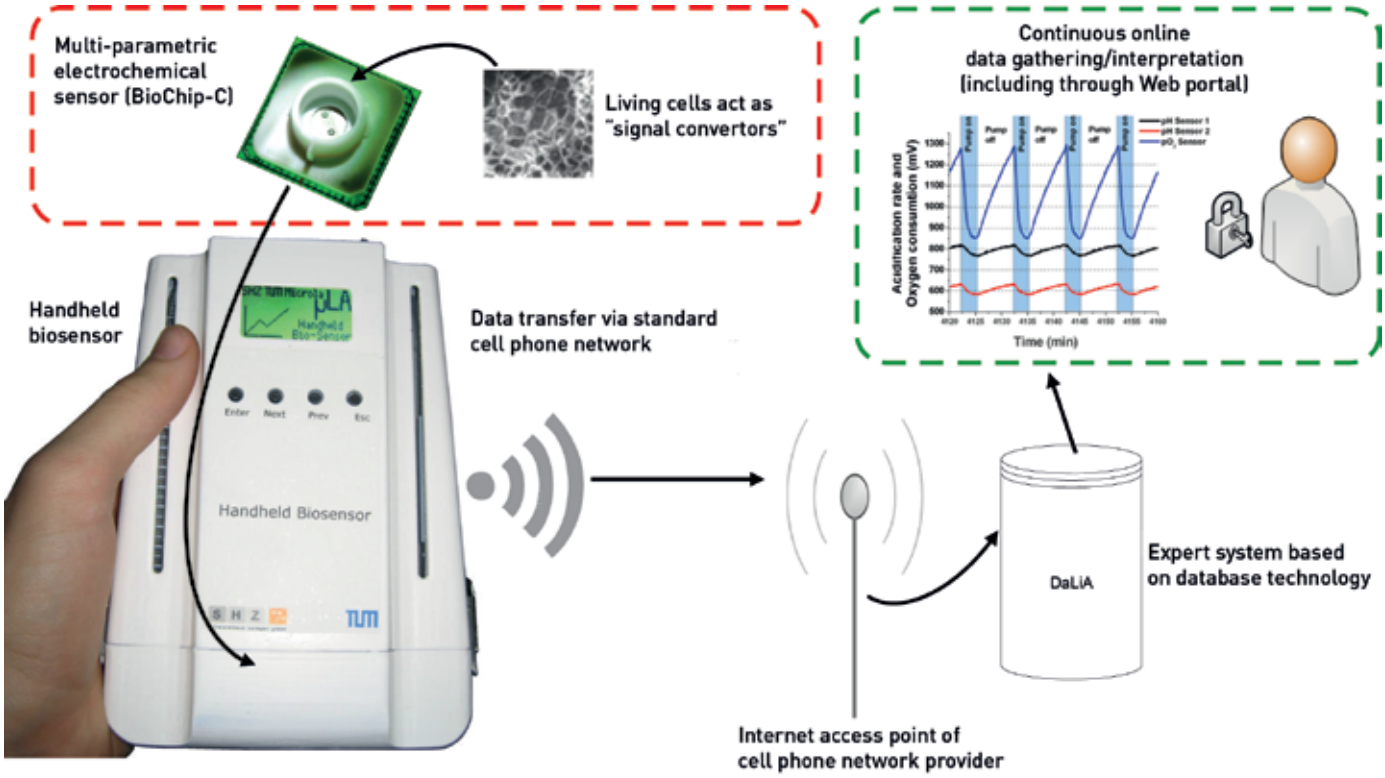
Environmental protection will remain an important topic in the future. Which role will intelligent measurement and sensor technology play in all this?

Measurement and sensor technology will have to become an integral part of the overall concept of information gathering. Not everything that can be measured has be captured by sensors in the production process. In keeping with the rapid development of computer systems, lots of things are possible if you use modeling. But the models that are used have to be trusted to provide the right information. For example, when we were developing phyto-monitoring, we integrated parts of the models used in artificial intelligence. We did this to test the plausibility of sensory information, so that we could keep working with model data if the sensors failed. These kinds of secure information systems play an important role in environmental protection. Environmental damage is often the result of substances escaping into the environment because automatic systems fail or because people start to think things are safe and there are material level "overdoses" in production. An example of this is fertilizers in crop production. In the past, people were worried about not putting enough fertilizers on cultivated plants, so they put on a little bit more than was actually needed, just in case. By the way, the same applies to watering and thermal energy supplies. An intelligent information system can tell you what's absolutely essential. For producers to stop adding a little extra, just in case, and give crops what they really need, without leaching, energy loss, or CO2 emissions, they have to be able to trust the information. On a conceptual level, this is where the underlying philosophy of biosystem engineering – the specialist area I work in at Humboldt-Universität in Berlin – overlaps with the interests of my Transfer Center for Energy – Environment – Information. It's about research, development, and technology transfer at the interface between engineering science and biological production processes – coming up with engineering solutions for use in the sustainable production of farming products, as well as technologies for a safe and clean environment.

Image 1: A gas exchange cuvette: phyto-monitors developed at the Steinbeis Transfer Center for Energy – Environment – Information. These can be used to detect crop signals relating to the physiology of the plants.
Image 2: The solar energy collector greenhouse on the Science Campus in Dahlem (Berlin).

Prof. Dr. Uwe Schmidt is director of the Berlin-based Steinbeis Transfer Center for Energy – Environment – Information and professor for biosystem engineering at the faculty of life sciences at Humboldt-Universität in Berlin. His work at the Steinbeis enterprise deals closely with issues related to automation, sensor technology, measurement devices and software.

Prof. Dr. Uwe Schmidt
Steinbeis Transfer Center Energy – Environment– Information (Berlin)
SU0308@stw.de | www.steinbeis.de/su/308



Biosensors get cells talking

Steinbeis experts develop analytical instruments for medicine and biology

How will a tumor react to different medicines? What impact do contaminants have on water plants? There are many situations when it's essential for medical experts and biologists to know precisely how cells and tissues will react. Only then can they decide what to do next. Scientists at the Heinz Nixdorf Chair for Medical Electronics at the TUM in Munich have spent years designing microsensor chips and entire sensor systems that can help them do exactly that: evaluate and monitor the behavior of cells and tissues. Drawing on this technology, researchers at the Steinbeis Transfer Center for Cell Chip Technologies have been working with business partners to develop analytical devices for a broad variety of applications, and these have already made their way into products supplied by small and medium-sized enterprises (SMEs).

Cells have so much to tell us but they can't talk. Living cells react constantly to influences in the environment, and, when they do, they communicate with their surroundings. For example, they react to chemical and physical stimuli by adapting their metabolic activity. This can be seen when oxygen is released or used, or when the pH value of their direct surroundings goes up or down. But they could also react by producing proteins, increasing the rate of cell division, or even by dying off. Under the directorship of Prof. Dr. Bernhard Wolf, the experts at the Heinz Nixdorf Chair for Medical Electronics in Munich have developed multi-parametric microsensor chips capable of capturing lots of these reactions. These bio-hybrid sensors cultivate cells directly on the surface of the sensor. "The cells practically grow with the sensor, so it can then precisely measure exactly what the cells are actually doing and if they're alive," explains Bernhard Wolf, who also manages the Steinbeis Transfer Center for Cell Chip Technologies.

But that was just the first step. Next, the scientists developed the bio-hybrid sensors into lab-on-chip systems. With these, reagents are placed in a reaction chamber located on the biosensor. This makes it possible to precisely examine things like how cells react to certain substances. Lots of animal testing might be avoided by this method because the chip practically replaces live laboratory animals. For example, oncologists can test the influence of cytostatic agents on tumor cells.

To make their systems available for mobile applications outside clean room environments, the Munich-based researchers worked with a company called Cellasys to develop an "intelligent mobile laboratory for in-vitro diagnostics," or IMOLA-IVD. At the heart of their systems lies a bio-hybrid chip with sensors for detecting pH values, oxygen, impedance, and temperatures. There is a reaction chamber on top of this. The systems include tubes and a pump to add substances and nutrient solutions for the cells. This is fully automatic. It is possible to link up several of these individual, enclosed systems and run them in parallel. This increases the throughput rate of experiments (e.g., 6-fold IMOLA-IVD). There is a software module to control the sequence of experiments, gathering, processing and interpreting the different measurements. In the future, it will be possible to use the IMOLA system for individual courses of chemotherapy, the development of active ingredients, in regenerative medicine, and as an alternative to animal testing.

Bio-hybrid chips also have uses in food and drinks monitoring as well as in environmental applications. The scientists have now miniaturized their system and come up with a portable, wireless handheld device called the µLa (=micro-lab). "You can take measurements with bio-hybrid construction elements, completely independently of laboratory equipment and electricity," explains Bernhard Wolf. "So you can even do it outdoors or collect samples in warehouses or grocery stores." For example, thanks to yeast cells growing on the integrated biochip, the handy device can be used to measure fungicide on fruit. It can be seen if they're alive by adding a sample of the food (and, if present, also the contaminant). The µLa displays the results on a screen although it can also send them to a database through the cell phone network. These can then be collated and interpreted. Testing carried out until now has shown that living cells are indeed a sensitive "signal convertor" for food testing. "With the micro-lab, tests can be carried out really quickly and accurately on xenogenic residues," says Wolf.

Of course there are also times when it's not about being mobile and more about high volumes. When looking for active substances or carrying out tumor therapy the priority is to provide large batteries of measurements within a short timescale. One results of the collaborative project at the Steinbeis Transfer Center for Cell Chip Technologies is a fully automatic analysis system called the Intelligent Microplate Reader (IMR). To make this, the scientists position their biosensors on the surface of a microtiter plate, placing a multiparametric sensor in each of the 24 wells on the plate. It's on this plate that the cells grow (for example tumor tissues from a patient). Thanks to an ingenious flow system, the systems can be provided with plenty of fresh nutrient solution. The IMR also has a fully automated pipette robot which can inject different substances in the 24 wells in a single sweep, or even 24 different concentrations of the same substance. This allows the machine to quickly pinpoint which chemotherapeutic agent a specific patient's tumor cells react best to, and in what dosage – or which mixture of active substances works best. This makes it possible to define treatment that matches perfectly with the specific patient – more effectively and yet still more gently/carefully than conventional cancer treatment.

This method requires a biopsy to remove tumor tissue from the patient and place this on the sensors. Alternatively, there is the option of implanting sensors in the patient. Such intelligent implants can monitor tumors and, in the future, they may even help cure them. They are no bigger than a sugar cube in size and on the inside they contain a button cell battery and a radio unit. Such active implants can be implanted in the body near tumors in situations where it would be difficult to operate. The sensors are positioned on the outside of the implants to measure oxygenation in the tissue and send data to a receiver outside the body. This makes it possible to work out the growth rate of the tumor. If the tumor grows, the doctor can react accordingly.

"Our goal is to develop a closed-loop system," explains Wolf, referring to the latest research projects. If the implant spots tumor growth, it could inject a chemotherapeutic agent directly into the tumor from an integrated substance reservoir. This would be an effective and comparably gentle procedure for the patient. As the professor underscores, "that would make it possible to avoid the heavy strain placed on the liver and kidneys by aggressive medication when it's injected intravenously." In the future, similar implants could even be used to monitor bone healing or be used in orthopedic implants. They could also help care for wounds or be used with transplants. This is because, in such cases, it is also important to assess tissue oxygenation to understand the condition of certain parts of the body.

The Munich-based researchers have also come up with a particularly clever way to print sensors onto plastic foils using an inkjet printer. They call these nanoparticle sensors and they are inexpensive and effective. Because the foils are so delicate, they can be rolled up into small capsules that can be swallowed. Inside the capsules, there are microelectronic chips, a battery and a radio unit – all in a miniature format. The sensors on the outside of the foil could then identify a bleeding stomach ulcer and attach themselves to it. The "intelligent nano-pill" could then monitor the ulcer, transmit data to the outside and maybe even administer medication – precisely in the right place next to the ulcer, without causing the patient unnecessary discomfort. The sensor pill is already under development and it could soon be ready for first trials.

Image: The process used by the handheld µLa system to carry out mobile cell biology assays (standardized reaction processes to prove the existence of a substances).

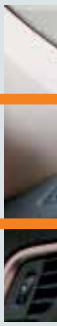
Christian Scholze

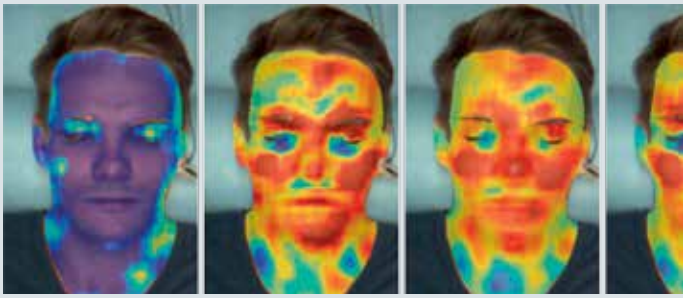
Bernhard Wolf

Christian Scholze works at the Heinz Nixdorf Chair for Medical Electronics at the TUM in Munich. Prof. Dr. Bernhard Wolf is director of the Steinbeis Transfer Center for Cell Chip Technologies which was founded at the TUM in 2000. The center is closely involved in the field of biomedical sensors, actuators used in diagnostics, and medical treatment, bio-electronics test systems used in environmental analysis, micro-sensor array technology, the biophysical characterization of cellular systems, and analytical electron microscopy.

Prof. Dr. Bernhard Wolf
Steinbeis Transfer Center Cell Chip Technologies (Munich)
su0564@stw.de | www.steinbeis.de/su/564

Christian Scholze
Heinz Nixdorf Chair for Medical Electronics at TUM Munich





"The direct interface between people and sensors will increasingly move into the foreground."

An interview with Dr.-Ing. habil. Hagen Malberg, director of the Steinbeis Research Center for Applied Medical Technology

Professor Malberg, one of the focal topics at your Steinbeis Enterprise for Applied Medical Technology is medical sensors. What services do you offer your clients in this area?

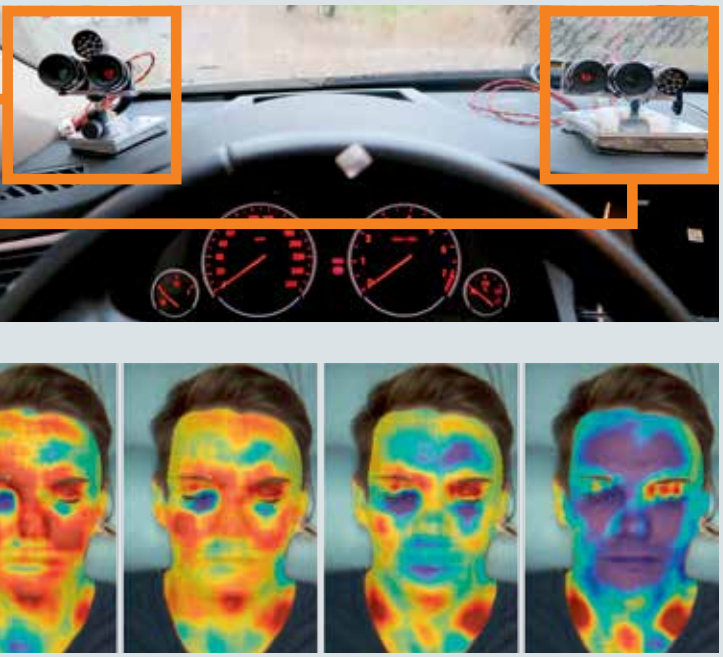
We have three application areas in medical sensors and bio-signal processing. There are classic clinical applications such as pacemakers or monitoring in intensive care and sleep medicine. Then there are non-clinical applications like ambient assisted living (AAL) and occupational medicine. Finally, there are other non-clinical areas such as driver assistance systems and lifestyle applications. All areas are closely related to one another and gain a great deal of benefit from our expertise, which has a strong leaning toward medical fields such as the measurement and characterization of the autonomous nervous system. The human nervous system is a highly complex information system which is incredibly sensitive to physical and mental stress. It also reacts to the malfunctioning of individual organs and it can signal personal health risks. There are new kinds of sensors that even allow us to transfer the latest clinical know-how to non-clinical areas – it's one of things that makes this area so fascinating for me.

You set up your Steinbeis Enterprise five years ago. What sort of influence have technological developments had on your work during this time?

Five years ago I'd never have imagined that you'd be able to measure the human heart beat with a webcam – and even do it quite accurately. We're now able to measure the heart beat, perfusion, and respiration with optical instruments, at a comparatively low cost. Contactless cardiovascular measurement technology is opening up completely new application areas for us, especially outside of hospitals. What we are increasingly witnessing is the growing power of smartphones as a measurement device or as an analysis and communication unit of external devices, hand in hand with increasingly rapid computation and transfer rates in centralized and decentralized networks. And this trend is no where near its end. About once a year a new sensor gets integrated into smartphones. At the moment, it's not yet enough to meet clinical requirements but it's only a question of time. The same applies to other kinds of sensors and cameras.

The area of application for medical sensors is vast. They're not just used in clinical areas but also for out-patients. They're used in online monitoring, in in-vitro and in-vivo diagnostics, etc. What sorts of questions do your customers ask and which services are in particularly strong demand?

We are mainly asked about two things. The first one is: How can new algorithms be used to acquire information that is more relevant to medicine from routinely measured bio-signals? This is the classic area of medical technology where it's all about optimizing existing measurement techniques using new algorithms with a particular focus on the cardiovascular system. The second question is: How can new medical sensors be integrated into comparatively unconventional measurement environments?
The projects we work on are a major challenge because sometimes there's very little previous knowledge to go on worldwide. It's certainly quite easy



to measure the heart optically in young patients with a healthy heart under laboratory conditions, but the question is how to do this with older patients or cardiology patients, and how well does this work in a sleep lab or in a moving car? This involves addressing a lot of highly challenging interdisciplinary details; although at the end of the day, it's not about the measurement technology solving the problem, it's actually about how to interpret the measured values. And this is where we primarily see our role, with processes for reducing artifacts or innovative ways to process bio-signals to help with decision-making. There are some big challenges in this area and they can only be mastered through long-lasting collaboration. Questions like "How can you predict the process of falling asleep by the minute?" or "Is sudden cardiac death actually the sort of occurrence that can be predicted?" are not trivial and they can't be solved quickly.

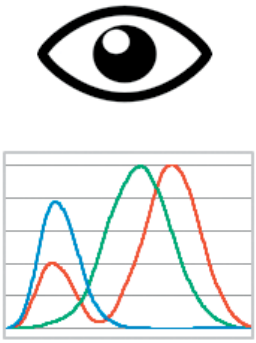
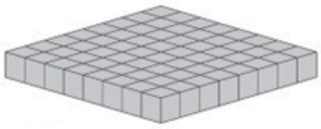
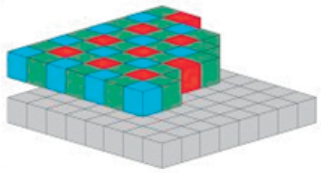
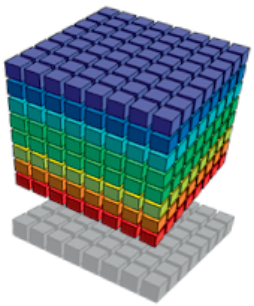
Innovative, intelligent materials and RFID sensor developments – just two of the most recent technology trends we're seeing in medical sensors. Where do you believe most research will take place in the future and what will the key areas of application be?

Intelligent materials and RFID sensors are indeed highly interesting areas with every potential to gather better medical information in completely new application environments. But what I find more fascinating is contactless medical measurement technology. What's the best way to gather high-quality medical information without coming into contact with the body? In western societies we have at major strategic disadvantage in this area. Medical technology, like the instruments you find in hospitals, generally has negative associations among the population – it reminds you of growing old, being ill, and awful medical procedures, so who wants that sort of stuff at home? A good example of this is measuring blood pressure. Taking measurements yourself at home has become quite established now. The equipment doesn't cost much, but people still don't like it because of the pressure of the sleeve on your arm and it's a bit difficult to take measurements. I believe the challenge is to develop a completely new generation of medical instruments that aren't actually seen as medical instruments and are well accepted, and to motivate people to look after themselves. eHealth and mHealth are only going to gain widespread acceptance if the systems make the people the key point of reference and motivate them and they even enjoy using them. Unfortunately, our thinking regarding conventional medical technology still has a lot of catching up to do. More and more emphasis will be placed on the direct point of contact between the patient and the sensor. I consider the big challenge for the future to be the developing and establishing of solutions for this, even in the market for "non-standard" patients.

Image 1: A contactless intensive care medical station. Center top: universal camera/illumination unit. Right top: a non-clinical application integrated into vehicles. Bottom: perfusions during a cardiac cycle (red shows the areas of high blood circulation).
Image 2: Personal use of a smartphone to measure stress levels via a cordless pulse oximeter (finger clip). ©Toni Klemm

Professor Dr.-Ing. habil. Hagen Malberg is director of the Steinbeis Research Center for Medical Technology. The center is closely involved in issues relating to biomedical technology, the development of medical instruments and sensors, and bio-signal processing.

Professor Dr.-Ing. habil. Hagen Malberg
Steinbeis Research Center Applied Medical Technology (Dresden)
SU1475@stw.de | www.steinbeis.de/su/1475

Sensors 1.0	Sensors 2.0	Sensors 3.0	Sensors 4.0
Human Eye	BW CMOS Sensor	RGB CMOS Sensor	HSI CMOS Sensor
			
Subjective / Biological • Shape • Color	Objective / Technical • Shape	Objective / Technical • Shape • Color	Objective / Technical • Shape • Color • Spectrum

Convenient, reliable, affordable

Mobile photonic microsensors and digital image processing using smartpads

Growing expectations regarding the quality of technical and natural products used in industry, biology, medicine, farming, and the environment – hand-in-hand with security and administration issues – mean it's necessary to find objectively measurable quality parameters for use in production, products, and services. Help is now at hand thanks to photonic microsensors and smart computers. These make it possible to measure shape, color, spectrum and hyperspectral parameters, even in mobile situations outside the laboratory. A Bavarian initiative called Strategische Partnerschaft Sensorik e.V. (Strategic Partnership for Sensor Systems) has joined forces with an international business excellence cluster founded in Thuringia called SpectroNet. Together, they have decided to accelerate the pace of the cross-industry development, production, and introduction of photonic "Sensors 4.0" through cross-cluster alliances. The alliances will receive support from the Jena Technology and Innovation Park and the Steinbeis Transfer Center for Quality Assurance and Quality Measuring Systems.

Recent developments in photonic microsensors now make it possible to gather simultaneous information on shapes, colors, and spectrum using special micro-cameras – so-called hyperspectral cameras. This technique means that in addition to detecting shapes and colors, it is also possible to identify things like contaminants or foreign particles in foods, to check the sugar or water content of fruit and vegetables, or to assess the concentration of substances in tablets. To measure, manage, and control the quality of solids, liquids and gasses, the new photonic microsensors can be used with smart computer devices such as smartphones, smartpads and smartwatches, which can process the digital images.

The BMWi (the Federal Ministry of Economics and Technology) runs a program called go-cluster with the aim of sponsoring cross-industry alliances throughout business clusters working in the fields of science, engineering, commerce, applications, and continuing professional development. Under its auspices, the Strategische Partnerschaft Sensorik e.V. program, which is based in the Biopark in the Bavarian city of Regensburg, and SpectroNet, the international excellence initiative set up in Thuringia, which is based in the Jena Technology and Innovation Park, are now intensifying and accelerating their cluster management.

The emphasis of the project is to link up cluster partners digitally in order to accelerate the exchange, introduction, and on-going development of open innovations in research and development, production, products, services, marketing, sales, training, and continuing professional development – all with a bearing on photonic microsensors and digital image processing using smart computers.

The aim of the cross-cluster service is to use established hierarchies and official channels to generate digital records of the services offered by cluster partners. This makes organization and operation more effective, with the prospect of allowing cluster partners to market new products and application services interactively, and access broader digital markets with improved business models.

During the initial phase, a website at www.spectronet.de will function as a digital commercialized business cluster platform with its own open, digital and mobile hierarchy for information, communication, and collaboration. The digital commercialization service will improve the margins of the cluster partners, making it easier to create new products and services in a reliable and affordable manner. Furthermore, by allowing for responsive smartphone and smartpad design, the workplace can be made mobile and kept modern for operational reasons.

The service offering has been organized such that current resources can always be shared among the parties involved in the cluster, at all stages of the value chain of photonic microsensors and digital image processing, addressing the needs of measurement technology and quality assurance in terms of R&D, production, products, services, marketing, sales, training, and continuing professional development. The database offers a selection of suitable experts and companies, and it makes it possible to offer new products and application services online, as well as to promote these through a digital marketplace. Training and continuing professional development are also supported with open specialist presentations and videos.

The innovative nature of the new digital commercialization service stems from the completely new underlying concept, despite the individualized delivery of the service. The structure, contents, and management of the cluster platform have been tailored specifically to mobile photonic microsensors and digital image processing. This kind of digital presentation and service delivery is unique in the photonics industry, adding value in financial terms by providing new operational and selling channels, especially by offering immediate global availability.

The solution is of particular benefit to cluster partners, not just in terms of specialist and social aspects, but also from a commercial standpoint. The digital commercialization service is especially effective at raising awareness among customers, both of the business clusters themselves and its partners. It significantly cuts the coordination costs of the different parties involved, also significantly shortening the development cycles of products and services. The SMEs, research establishments, and universities involved in the cross-collaboration cluster can raise their productivity by reducing requirements relating to materials, energy, information, cost and specialist support. By improving the competitiveness of cluster partners, satisfaction with the work carried out by the cluster improves. Being able to exchange tangible and intangible products and services directly with others also strengthens trust. Rising sales and lower costs make cluster membership more attractive. The growth that comes hand in hand with this is to the benefit of clusters in the form of higher revenues.

Image: Classification of photonic microsensors compared to the human eye ©www.spectronet.de

Dietrich Hofmann

Randolf Margull

Paul-Gerald Dittrich

Nina Galushko

Hubert Steigerwald

Prof. Dr. Dietrich Hofmann is the cluster manager of the business excellence cluster SpectroNet and director of the Steinbeis Transfer Center for Quality Assurance and Quality Measuring Systems, which offers services including quality evaluations, quality management, quality measuring technology, and statistical process control.

Randolf Margull is managing director of Technologie- und Innovationspark Jena GmbH, which works to promote the interests of technology-based startups. The technology and innovation park in Jena is a cluster management organization belonging to the SpectroNet business excellence cluster.

Paul-Gerald Dittrich is a content manager and Dr. Nina Galushko is a project manager of a cross-clustering project called Sensorik 4.0 (sensor systems 4.0). Both are closely involved in the topic of mobile photonic microsensors and digital image processing via smartpads in industry, biology, and medicine.

Dr. Hubert Steigerwald is director of a strategic partnership in Regensburg called Sensorik e.V. This has been officially responsible for cluster management issues relating to sensors in Bavaria since 2006.

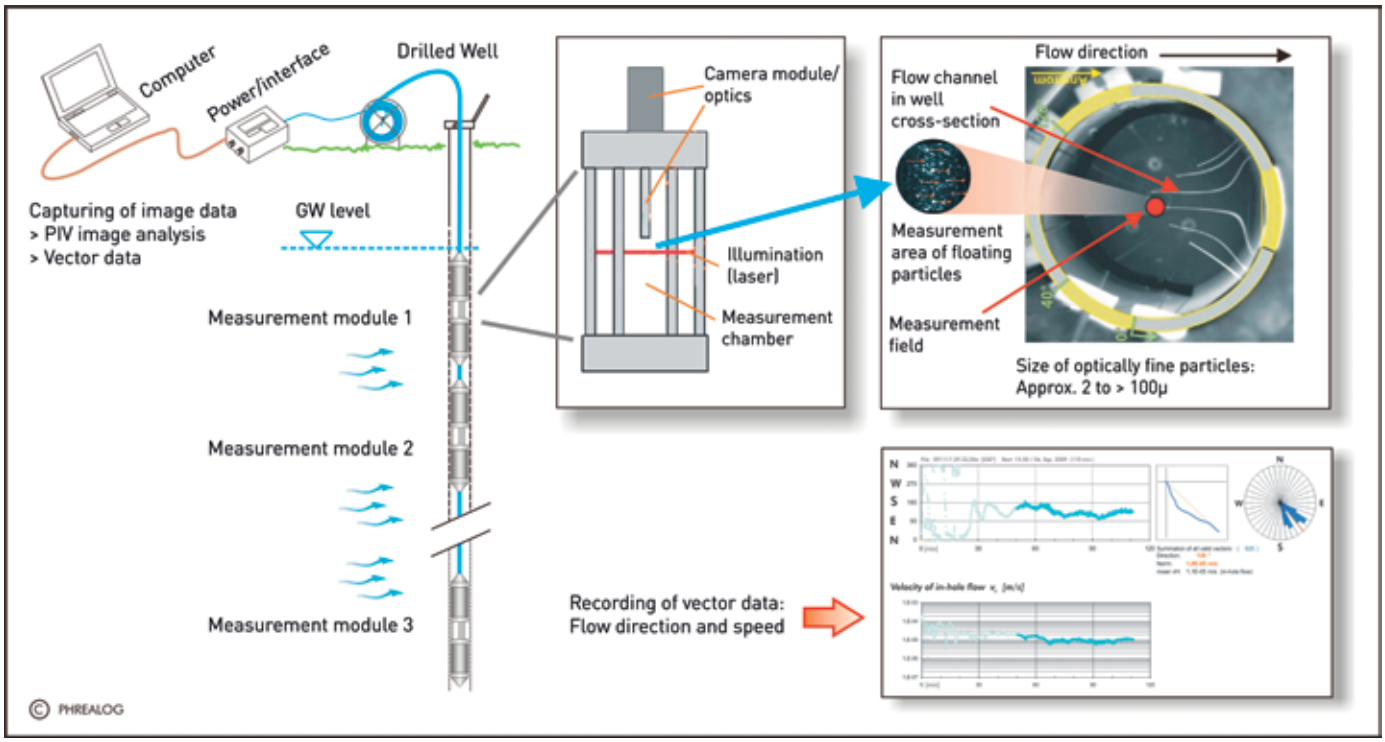
Prof. Dr. Dietrich Hofmann
Steinbeis Transfer Center Quality Assurance and Quality Measuring Systems (Jena); SpectroNet Collaboration Cluster (Jena)
dietrich.hofmann@stw.de | www.stz-jena.de

Randolf Margull
Technologie- und Innovationspark Jena GmbH (Jena)

Paul-Gerald Dittrich
SpectroNet Collaboration Cluster (Jena); Cross-clustering "Sensorik 4.0" (Jena)

Dr. Hubert Steigerwald
The "Sensorik e.V." strategic partnership (Regensburg)

Dr. Nina Galushko
Sensorik e.V. strategic partnership; Cross-clustering "Sensorik 4.0" (Regensburg)



PHREALOGx: Precise, Productive and Lasting

Steinbeis experts develop operating system for a state-of-the-art sensor system used to measure groundwater movements

The Steinbeis Transfer Center for Sensorics and Information Systems – SensIn' has been working in collaboration with the Mainz-based company Phrealog as part of a project called FLIMSYS. Sponsored by the German Federal Ministry for Education and Research (BMBF), the aim is to develop an image-based measurement technique that makes it possible to work out the speed and direction of local groundwater flows in specific locations or around drilled wells.

The technique involves using a measurement probe with a free-flowing chamber to make minute floating particles visible in the groundwater. It does this by directing a laser beam into a drilled well and capturing visible patterns of particles on camera. These are then analyzed for pattern changes over time (particle imaging velocimetry, or PIV). The resulting vector data is then used to record the water flow in the well. This is a direct reflection of flows in the groundwater in the immediate vicinity. The process is used for hydrogeological inspections in the water utilities industry, in environmental protection, in civil engineering, and for geothermal energy purposes. The aim of the ongoing development project is to design a modular measurement system that can be used to take simultaneous measurements at various depths within the groundwater at a given location. Further down the line, it is hoped not just to capture water flows but also the different physical and chemical properties of the groundwater, depending on the given requirements. The benefit of the system that is currently being developed is that it can capture flowing movements extremely accurately, improving productivity and thus paving the way for sustained use in monitoring scenarios.

At the heart of the new system lies a camera system that was specially developed for the project. This delivers video sequences up to XSGA resolution via I2C and SPI interfaces. The laser can be controlled and directed and there is also a compass sensor complete with I/O ports. The interfaces make it easier to integrate further sensor systems. The modular version of the system has an individual camera system within each module. These can be linked up with data cables to allow each individual module to be controlled and monitored individually. Each module is contained within a high-pressure housing and equipped with the required optical components to be connected to other modules via sections of cable and form a "measurement chain." This delivers simultaneous data from different depths. Image data and the data supplied by the integrated sensors is forwarded via GigE to a computer for processing. The new measurement architecture made it necessary to come up with a new kind of camera system to work with the control and image processing software. As a result, as part of the collaboration between Phrealog the Steinbeis Transfer Center for Sensorics and Information Systeme – SensIn', a new measurement operating system was developed. This is called PHREASOFT and it has been specially adapted to the camera equipment and the nature of the task. As a measurement operating system, PHREASOFT includes system controls and the ability to read onboard sensors, capture measurement images, evaluate these, and transmit and store this measurement data. Since the overall aim was to develop software that is platform-independent, the project partner wrote the

Literature

Schöttler, M. (1997) – "The Measurability of Groundwater Movements by Visualizing the Flows in Drilled Wells". Dissertation at the University of Cologne; 119 pages; Shaker Publishing, Aachen.

Schöttler, M. (2007) - "A new Process – Groundwater Flow Visualization (GFV)" – published in the magazine energie | wasser-praxis 12/2007 – DVGW annual review – Publ.: DVGW e.V.; p. 32-37; 6 diagrams; wvgw Wirtschafts- und Verlagsges. Gas und Wasser mbH; Bonn

Joachim Driessen, J., Schöttler, M., Enzmann, F., Lakdawala, Z., Steiner, K., Popov, P ., Oleg, I., Drews, M., Wieber, G., Kersten, M. (forthcoming 2015): PHREASIM – "An Expert System for the Simulation of Flow Properties in Groundwater Measurement Locations and their Immediate Groundwater Environment" – Grundwasser magazine, Springer Publishing, Berlin.

software in Java to allow for various types of platforms. One particular challenge with the development of PHREASOFT is the bidirectional communication between the proprietary driver and the Java components. This meant that data formats had to be adapted and peripheral components had to be synchronized. The configuration data, measurement values and results are stored in corresponding XML files for other uses later down the line. To manage the complexities of the task, the PHREASOFT software involves intensive use of multitasking.

In parallel to the technological development work, the University of Mainz, the Fraunhofer ITWM and Phrealog are also working in collaboration to develop an expert system called PHREASIM. This will make it possible to simulate and map water flow scenarios in wells. First field trials are scheduled to take place in the summer of 2015.

The PHREALOGx measurement system is an important step forward in capturing groundwater flows in-situ. Hand in hand with the PHREASIM expert system, it is now possible to assess and interpret acquired flow data in a more realistic setting than was previously possible. An important aim with the newly developed system is to be able to use it as a stationary monitoring instrument in groundwater measurement networks. One of the major advantages of this system is that, depending on the measure requirements, the existing system interfaces can be expanded to integrate other sensors into the system, without having to change the existing technical equipment and communication infrastructure.

Image: The basic function of PHREALOGx is to measure flows by capturing images to observe the drift of natural particles floating in moving groundwater. ©Phrealog

Farjana Huq

Silvana Mehmetaj

Marc Schöttler

Thorsten Leize

Farjana Huq completed her master's thesis on the above topic as part of a project for her degree in Sensor Systems Technology at Karlsruhe University of Applied Sciences.

Silvana Mehmetaj works as an assistant to Prof. Dr. Thorsten Leize who founded the Steinbeis Transfer Center for Sensorics and Information systems – SensIn' at Karlsruhe University. Work at the center focuses among other things on software development, model-based drafting and implementation, bus system security, security issues in automation technology, cryptology, and sensors.

Dr. Marc Schöttler is the founder of Phrealog, a company specialized in groundwater flow measurement and drilled wells.

Silvana Mehmetaj, Prof. Dr. Thorsten Leize
Steinbeis Transfer Center Sensorics and Information Systems - SensIn' (Karlsruhe)
su1467@stw.de | www.steinbeis.de/su/1467

Dr. Marc Schöttler
Phrealog (Mainz)

"One of the particular challenges is miniaturization"

An interview with Steffen Lübbecke, managing director of Steinbeis Qualitätssicherung und Bildverarbeitung GmbH

Mr. Lübbecke, you've been director of the Steinbeis Transfer Center for Quality Assurance and Image Processing since 2009, and managing director of the company Steinbeis Qualitätssicherung und Bildverarbeitung GmbH since it was founded in 2011. But you originally came from a completely different area of engineering. What made you decide to move into image processing?

That's right, I originally studied Civil Engineering in Weimar. My first project right out of college brought me into contact with image processing and work with the Steinbeis Transfer Center for Quality Assurance and Image Processing. We were inspecting the angle of tilt on a leaning church tower in Bad Frankenhausen using an optical inclination sensor. Even then I was amazed by the variety of areas that overlap with image processing. The technology has made leaps and bounds ever since and it's now impossible to imagine manufacturing – and increasingly even consumer markets – without it. It was this potential, my interest in image processing, my experiences and my contacts at Steinbeis that resulted in my moving into this field.

You invest a lot of time and energy in sensor systems and image processing. Looking at it today, which developments have had the most lasting influence on this sector of industry?

I'd say that the most influential development on positive developments in image processing and sensors has been computer technology, although the miniaturization of cameras and sensors has also opened up lots of new areas. The performance of cameras has also improved markedly in terms of image rates and resolution. Industrial image processing is an excellent match with in-line quality assurance in production and assembly processes, and, if it's used systematically, it can almost result in zero-defect production.

Steinbeis Qualitätssicherung und Bildverarbeitung GmbH offers its customers applied research and the customer-specific development of components, equipment and machines used in industrial image processing, as well as the production of industrial applications. Which services are in particularly high demand from SMEs?

A growing number of our companies ask us about services related to the integration of image processing systems – the tasks they're working on are becoming even more complex and they often can't be carried out using standard solutions. Image processing is having a large impact on automation and quality assurance in production processing. But our consulting services are also popular, especially in quality management related to DIN standard EN ISO 9001, environmental management related to DIN standard EN ISO 14001, or energy consulting related to DIN standard EN ISO 50001.

As in the past, quality is still tremendously important in manufacturing. What role does image processing have to play in this area?

An increasingly central role. Lots of our customers are experiencing upturns in production volumes so they're shifting away from manual quality checks to semi- or fully automated image processing systems, because they're more reliable and effective.

3D image processing, CMOS image sensors, miniaturization – just some of the more recent trends in image processing. What challenges do these present and what sort of impact are they having on your work?

One particular challenge is miniaturization, often simply because it's difficult to cram all the required components into the smallest possible area. Then there's the cost squeeze because image processing is making more and more inroads into the consumer market and the automotive sector. 3D applications for recording our environment and creating graphical representations are coming up strong at the moment.

Steffen Lübbecke is the managing director of Steinbeis Qualitätssicherung und Bildverarbeitung GmbH. Work at the company revolves around applied research and the customer-specific development of components, devices and systems for industrial image processing, as well as consulting in the fields of quality assurance/quality management.

Steffen Lübbecke
Steinbeis Qualitätssicherung und Bildverarbeitung GmbH (Ilmenau)
SU1544@stw.de | www.quick-image.de

Standstill 4.0

Has our manufacturing been stuck on "needs improvement" for years?

2011 was the first year we were given a 4 out of 10 for our performance in manufacturing. Ever since, despite unprecedented numbers of strategic alliances, things haven't changed much. Politicians on a national and regional level still seem to be investing "every ounce of energy" in the next industrial revolution.

What got underway in Germany four years ago soon caught on in China ("Made in China 2025") and even in the United States ("Industrial Internet"). And over here? Somehow we got stuck on 4.0. Or maybe it's a much more fundamental problem. And anyway, where's this all supposed to be taking us in manufacturing? We have software evolutionists and technology-driven project sponsors battling vehemently to raise the bar to 5.0. At the other end of the scale, economists sit there calling out for sustainable and holistic development at a speed matched to the implementation rates of small and medium-sized business, based on real business cases, along the lines of an Economic Miracle 2.0.

Talking of economic booms: the German economic miracle – version 1.0 – started 60 years ago, fundamentally fuelled by a passion to make something new happen, coupled with the courage of creative, vision-oriented workers and entrepreneurs. It resulted not only in products and services that were a global success, but also in methods and technology excellence, processes that made it possible to manufacture competitive industrial solutions.

Maybe it would do us good to think about these two aspects more closely again in all the discussion that is going on at the moment because, successful as they may already be in international markets, there's no guarantee that products will safeguard jobs and affluence in Germany if they don't add value. Focusing the debate on the "how" of industrial manufacturing will only get us so far, because to work out "how", one has to start with "what": What it will actually be possible to sell in the international markets of the future. This also opens people's eyes to the fact that what should interest customers most is not the manufacturing process itself, but the benefit provided by a particular product, even if a manufacturing process may only have been "adequate." Otherwise German businesses run the risk of becoming substitutable suppliers.

So will we soon start talking about Products 2.0? There are plenty of technical reasons to use this term, especially given the accelerated networking of (everyday) objects and the opportunities this creates to provide new services. Even here, people are talking about "revolutions" fuelled by disruptive technologies that could have a radical impact on our manufacturing, the world we work in, indeed even the entire world we live in. This could be extended to a string of terms like Work Environment 2.0, Living Environment 2.0, etc. By this point, there is sufficient evidence to say that there are enough layers to the topics covered by the term Industry 4.0 and that to move things forward, one has to consider the bigger picture.

At the Ferdinand Steinbeis Institute, where these topics are looked at closely and activities are coordinated within this context, the term Industry 4.0 is used to mean a "company-specific overall approach to enhancing value creation using interdisciplinary business capabilities and employee skills." This interpretation hinges on business capabilities and employee skills, based on the interplay between the different disciplines of engineering, IT, and management. Developments on the technological and conceptual level – as "revolutionary" as they may be – are "enablers" in implementing corporate strategies and business models as required. So Industry 4.0 is not the goal, it's the means or journey to a competitive future. Identifying, assessing and establishing a foundation of business capability and employee skills are a step in the right direction in achieving this, and thus an absolute must for every industrial enterprise.

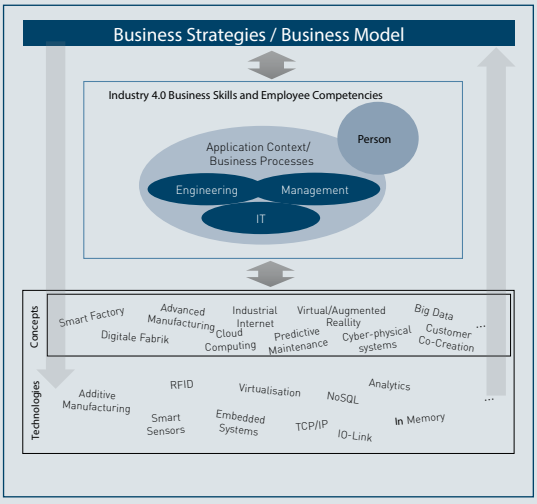


Image: "Industry 4.0 is a company-specific overall approach toward enhancing value creation using interdisciplinary business capabilities and employee skills" (Kemper/Lasi 2015)

The Steinbeis Network spans over 1,000 Steinbeis enterprises specialized in a variety of disciplines. Its international contacts are practically predestined to provide the German Mittelstand (small and medium-sized enterprises) with interdisciplinary support. Steinbeis has the unique potential to implement and deliver more individual projects, adding to the many examples of new technologies and demonstrating its power with business models that are also sustainable from an economic standpoint. This would be an important step in overcoming the widely perceived standstill.

Steinbeis Swipe! is a new section in Transfer Magazine. The aim is to examine specific topics at regular intervals. Occasionally, the author might take a swipe, left or right, up or down, along the lines of a critical commentary.

Dr. Heiner Lasi
Ferdinand Steinbeis Institute (Stuttgart)
Heiner.lasi@stw.de | www.fsti.info

Additive manufacturing and Industry 4.0

The 2015 Steinbeis Engineering Day

The 2015 Hanover Trade Show was not the first time it has been demonstrated that digital models can be used to produce complex 3D products layer by layer, completely automatically – and that is becoming part of everyday manufacturing reality. Thanks to additive manufacturing (AM), it is now possible to make small batches to high standards, without divulging technical know-how to the outside world. Using AM in industrial manufacturing (hand in hand with Industry 4.0) is allowing companies to explore commercial opportunities far beyond the simple production of products. These opportunities, the challenges they bring, and how to integrate AM into existing production processes were the key topics looked at by around 160 visitors to the 3rd Steinbeis Engineering Day, which was held in the Stuttgart House of Commerce (Haus der Wirtschaft) back in April.

The event turned the spotlight on the impact of the introduction of AM to business processes, alongside IT and business models. During the morning session, a variety of experts talked about their experiences with AM, followed by an afternoon of workshops in which groups looked at topics related to specific projects that are already taking place. These are to be followed up at a later point.

Prof. Dr. Günther Würtz (Steinbeis Transfer Center for Management – Innovation – Technology) moderated the event and gave a thought-provoking talk on the use of AM. He also explored how there will be a trend toward more modular businesses in terms of products (and their functions) and processes, hand in hand with new business models, and that individual modules could merge back into an integrated solution for complete value-adding processes with a combined offering of products and services.

Dominik Morar (University of Stuttgart) then presented the first results of the Steinbeis Engineering Study, which will be published in the coming weeks. The study was started in October 2014 under the scientific coordination of the University of Stuttgart (chair for general business studies and business information systems 1, Prof. Hans-Georg Kemper) in collaboration with Aachen University of Applied Sciences (Prof. Thomas Ritz) and the Steinbeis Transfer Center for Management – Innovation – Technology (Prof. Dr. Günther Würtz). The study confirmed that companies see AM as an enabler for tapping into production and value-adding networks in order to leverage the success factors of time-to-market and customer-centric production. By fulfilling this role, AM has already had an impact on companies' core business processes and even their overall business models.

Dr.-Ing. Andreas Wolf (robomotion GmbH) gave a speech on a business case and showed how innovations made by robomotion in laser sintering components can be transferred to the everyday use of robotic machinery,

now making it possible to economically design and make not only grippers but also up to 200 other parts. Wolf also touched on the substitution of existing materials like aluminum or carbon-fiber composites and used business examples to show how AM methods can help significantly cut development cycles and thus outlays.

The project presentation made by Prof. Dr.-Ing. Thomas Ritz (Aachen University of Applied Sciences, m2c Lab, Steinbeis Transfer Center for Usability and Innovative Interactive Systems for Information Logistics) took a closer look at 3D printing as a tool for delivering individual client solutions in retailing, raising important questions about the impact of 3D printers one day being available to end-consumers in the shops.

This was followed by a business case presentation by Tobias King (voxeljet AG), who showed clearly how using large 3D printing systems and a variety of different materials can open up new application areas for many sectors of industry. King also drew on a variety of actual business examples to show how 3D printing technology makes it possible to produce models quickly, accurately, and economically – as prototypes, individual parts, or small batches.

In a talk on "3D Printing of Flight Control Components – Emerging Design Principles Facilitate Ultimate Weight Savings," Frank Schubert (Chemnitz University of Technology), working in collaboration with Prof. Dr.-Ing. Wolfgang Nendel (Steinbeis Transfer Center for Product Development), showed how 3D printing with metals has now reached such a high technical standard that even highly stressed parts can be produced. A recently developed solution was introduced, which is also unique in that it has a reduced mass of over 50% and can be produced at the same cost of conventionally milled comparable components.

The afternoon of the Steinbeis Engineering Day was given over to "Products – Processes – Value-Adding Networks: Optimization through Additive Manufacturing." The event was so popular that registration to a creative workshop on additive manufacturing and Industry 4.0 had to be closed early. The workshop was moderated by Dr. Jonathan Loeffler (Steinbeis-Europa-Zentrum), who first introduced participants to current funding programs offered within the EU and Germany for projects with an AM focus. This was followed by three group discussions on possible funding projects, personal experiences, challenges, and existing possibilities to carry out collaborative projects. PD Dr. Heiner Lasi (Steinbeis Headquarters/University of Stuttgart), Dominik Morar (University of Stuttgart) and Dr. Anthony Salingre (Steinbeis-Europa-Zentrum, Karlsruhe) joined Loeffler to moderate the individual groups. Because of the variety of findings that came out of the group discussions, as well as the extremely interesting current issues they raised and the strong interest showed at the workshops, the concept workshop acted as a catalyst for new activities in the Steinbeis Network, with an emphasis on Industry 4.0 and AM.

Speakers at the 2015 Steinbeis Engineering Day 2015

Guest Lecturer, Dr. Heiner Lasi (University Stuttgart/Steinbeis Transfer Center Ferdinand Steinbeis Institute)

Dominik Morar (University of Stuttgart)

Michelle Moisa (University of Stuttgart)

Dr. Jonathan Loeffler (Steinbeis-Europa-Zentrum)

Prof. Dr.-Ing. Thomas Ritz (Aachen University of Applied Sciences/ Steinbeis Transfer Center for Usability and Innovative Interactive Systems for Information Logistics)

Dr.-Ing. Andreas Wolf (robomotion GmbH)

Prof. Dr.-Ing. Günther Würtz (Steinbeis Transfer Center for Management – Innovation – Technology (MIT)/Steinbeis Engineering Group)

Tobias King (voxeljet AG)

Prof. Dr.-Ing. Wolfgang Nendel (Steinbeis Transfer Center for Product Development)

Dr. Anthony Salingre (Steinbeis-Europa-Zentrum, Karlsruhe)

Frank Schubert (Chemnitz University of Technology)

Extracts of the speeches can be viewed by going to the Steinbeis media library at www.steinbeis-engineering-tag.de.

Sandra Haltmayer
Steinbeis Headquarters (Stuttgart)
sandra.haltmayer@stw.de | www.steinbeis.de

Research and Innovation Cooperation Across Borders

Steinbeis supports the Science Offensive of the Trinational Metropolitan Region of the Upper Rhine

Providing funding for seven cross-border flagship projects in the Upper Rhine region from 2011 to 2015, the Science Offensive has made an important contribution to strengthening the competitiveness of the Trinational Metropolitan Region of the Upper Rhine. The iniative was launched by the German states of Baden-Württemberg and Rhineland-Palatinate in collaboration with the French region of Alsace. The aim was to foster cross-border cooperation in the areas of research and innovation. Unique in Europe, this initiative made it possible for the first time to provide outstanding cross-border research projects with co-funding, not just from the three regions but also through the European INTERREG IV Upper Rhine program. Steinbeis-Europa-Zentrum served as an advisory body for the initiative.

Thirty-six applications were submitted in the fall of 2011. Seven research projects in the fields of medicine, renewable energy and the humanities received funding under the Science Offensive totaling some Euro 10 million. The projects were noteworthy for their focus on innovation and the high level of scientific added value.

Steinbeis-Europa-Zentrum (SEZ) supported the campaign in a variety of ways. For example, events were organized to communicate the goals of the program to the scientific community and initiate new project ideas. There were two information days in Karlsruhe and Strasbourg to present the funding and eligibility criteria for proposals to the general public with the aim of reaching out to potential applicants. One-on-one consultations were also offered at the information days. At a ceremony held in Landau in July 2012, high-ranking political representatives of the three partner regions presented the grants to the project leaders of the seven selected projects.

SEZ provided applicants with active support developing their concepts and submitting eligible project proposals. This involved consulting project leaders during concept development, identifying partners, assisting with applications and drawing up funding requirements for the project, in coordination with the regional co-financing bodies and the Joint Technical Secretariat of the INTERREG IV Upper Rhine program. SEZ also helped with project coordination and administration of the funded research and innovation projects.

The consortia of funded flagship projects were also assisted in the long-term application of the research results produced by the projects. Exploitation workshops were organized to allow the consortia to identify project results, evaluate how advanced they were, set exploitation goals and define additional areas of implementation. Furthermore, project leaders were offered assistance creating and disseminating technology profiles.

The Science Offensive was also the focus of numerous lectures inside and outside the Upper Rhine region. There were presentations during an OECD international innovation workshop held in Paris in September 2013, at the European Week of Regions and Cities (OPEN DAYS) in Brussels in October 2013, and at euregia, the leading trade fair for municipal and regional development in Europe, held in Leipzig in October 2014. The large number of publications and press reports on the Science Offensive underscores the tremendous response to the program. In particular, this was made evident by the mention of the campaign in "Regions and Innovation: Collaborating across Borders", an OECD study published in 2013 [1].

The Science Offensive of the Upper Rhine in Numbers

Timing:	July 1, 2012 – June 30, 2015
Total budget:	Euro 9,752,380
Co-funding:	Euro 4,748,690 (EU-INTERREG)
	Euro 1,598,957 (partner regions)
	Euro 3,404,733 (project partners)

For more information on the Science Offensive go to www.steinbeis-europa.de/tmo_wo.html

Sources

[1] OECD (2013), Regions and Innovation: Collaborating across Borders, OECD Reviews of Regional Innovation, OECD Publishing

An online survey was conducted between November 2013 and January 2014 to evaluate the overall impact of the Science Offensive, the call for proposals and the project application process. The general feedback of the survey was positive. Results are available on the website of the Trinational Metropolitan Region of the Upper Rhine (in German and French). At the close of the initiative, SEZ worked with regional partners to produce a brochure in German and French documenting the funded projects.

The seven funded projects of the Science Offensive

The **Rhinfilm** project (project leader: University of Strasbourg) explored different types of documentary films produced or shown in the Upper Rhine region between 1900 and 1970 with the aim of documenting the development of society on both sides of the Rhine.

The **ChiraNET** project (project leader: Karlsruhe Institute of Technology) on the synthesis of chiral porous crystals for racemic resolution examined innovative approaches for developing new types of anesthetics.

The **Oro-Dental Rare Diseases** project (project leader: University of Strasbourg) aimed to develop the knowledge, diagnosis and treatment of oral and dental pathologies in patients with rare diseases in the Upper Rhine region.

The project **"Cardiogene – Genetic mechanisms of cardiovascular disease"** (project leader: GIE Centre Européen de Recherche en Biologie et en Médecine - CERBM) studied the role of genetics in cardiovascular disease.

The **Neuro-Rhine** project (project leader: University of Strasbourg) on neurogenesis and neuroprotection for the prevention of neurological disease or the restoration of neurophysiological function delivered new findings and innovative therapies for Alzheimer's disease and other diseases of the nervous system.

The project **"OUI Biomasse – Innovations for the sustainable use of biomass in the Upper Rhine region"** (project leader: Karlsruhe Institute of Technology) focused on increasing the use of biomass as a renewable energy and raw material source.

The project **"PLAN-EE – A GIS-based planning tool for renewables"** (project leader: University of Koblenz-Landau) developed a new planning instrument to better identify and use potential sources of energy in the Upper Rhine region.

Image 1: High-ranking officials from the three partner regions present grants to the project leaders at a ceremony held in Landau in 2012
Image 2: © Stadler/Région Alsace

Prof. Dr.-Ing. Dr. h.c. Norbert Höptner, Robert Gohla, Dr. Sabine Müller
Steinbeis-Europa-Zentrum Karlsruhe
robert.gohla@stw.de, sabine.mueller@stw.de | www.steinbeis-europa.de

How Does Noise Affect Real Estate Values?

Steinbeis experts examine the impact of noise on the value of real estate

Without a doubt, few people really want a major highway or an airport in their own backyard. It is quite clear that noise makes people avoid properties in certain areas. When real estate is being evaluated, it's important to understand different kinds of noise, noise levels, and how these factors devalue property. Experts working in psychology and medicine (and the overlaps between the two) often conduct studies to understand the negative impact of noise on people, and this topic is also important when it comes to the value of real estate. When people have an issue with noise, they are expected to want a lower price or even reject the whole idea of buying real estate. The Center for Real Estate Studies (CRES), which is a Steinbeis Transfer Institute at Steinbeis University Berlin, has been examining the effect of noise on the value of residential real estate under the scientific supervision of Prof. Dr. Marco Wölfle.

The study focused on two different ways to ascertain possible devaluation: Opinion regarding noise in common rating publications and modeling the impact of noise using hedonic regression calculations.

People often find noise – the sum of all negative sounds – a major disturbance. It is multidimensional in nature and non-linear; people perceive noise unknowingly, consciously or subconsciously. Some consider it detrimental to their quality of life. When there are lots of people trying to sell real estate or cancel tenancy agreements in a regional residential market, offer rises and this can push down the price of the properties that are available to buy. It's often more difficult to find buyers or tenants, usually because of the noise. When this has a long-term impact on yield, the returns on real estate can be low and this can result in a lower market value.

Four physical characteristics must be established to investigate which kinds of noise have to be assessed. First there is "acoustic pressure level." This is perceived as volume and can be measured in physical terms simply by looking at sound pressure. Secondly, one can look at the pitch of a sound. People typically dislike high pitch sounds (high notes) more than low pitch sounds. Thirdly, the number of individual pitches (notes) perceivable within a noise can be described as the tonality. Sounds with more tonality are considered more of a nuisance than those with less. Finally, individual notes with strong variations in the height of notes (pitch variation) are typically considered more of a nuisance than sounds that stay level or maintain the same volume. Measuring this factor is about "sound impulsiveness." All of these four physical noise characteristics are particularly important from a legal perspective when it comes to assessing compensation for noise emissions. This involves "rating levels" – an objective figure is calculated, based on the strength of the different physical measurements, and this figure dictates the higher or lower monetary values.

To show an example of significant value fluctuations experienced in real estate plagued by noise, the experts at the Steinbeis Transfer Institute invented a fictitious apartment, a duplex, and a multi-family house. As a starting point, they looked at typical houses in the real estate market of Freiburg from the perspective of investors (people not wishing to use the properties themselves). Assuming that the property being evaluated is on a busy main road, it could be expected that a tenant would want to pay less rent. As a result, the research based their calculations on a formula used by Stege to assess reductions in gross yield (cf. Stege, J., [1990]).

Compared to other methods for calculating devaluation, as well as looking at reductions in the value of land, one can determine expected reductions

in rent. This makes it possible to ascertain the market value of real estate affected by noise. To do this, the Steinbeis experts made several adjustments to three influencing factors – the remaining duration of use, property interest rates, and the value of land – and this showed the relationship between earning power and individual factors. The only relevant changing factor within the formula was the distance between the front wall of the building and the road. The nearer a building stands to a road, the greater the negative impact on gross yield thus devaluing the earning power.

If one looks at the duration of remaining use for a building and extends this bit by bit, then there is an increase in the degree of devaluation although the level of this curve for individual properties does flatten. For a multi-family house, devaluation flattens out at 12.03%, for apartments it stops at 13.07%. The devaluation curve also rises if there are changes in property interest rates and this variable rises, although the impact of this is not as extreme as the remaining use of a building. For example, the curve for a multi-family house peaks at 11.20% at property interest rates of 1%, rising to 12.06% at 7.5% interest. This is thus much less than the curve for the remaining property duration (9.95% over 20 years, 12.03% over 80 years). As land values go up, the curve dips, although the negative incline is scarcely perceivable.

The modeling and calculations used in the Steinbeis study showed that the devaluation resulting from changes in property interest rates and land value works the same way. Changes in both factors have little influence on the level of devaluation. There are major effects in terms of devaluation when it comes to the remaining duration of use. Compared to property interest rates (1.56%) and land value (1.15%), the level of fluctuation relating to remaining use is more than double. The level of devaluation linked to the remaining duration of use is up to 3.94%. What is noticeable with these calculations is that the devaluation curves are between 10-13% for almost all factors. Of course, such calculations are sometimes disproportionate when it comes to real life scenarios. If other factors had to be included in the calculation of earning power, the results would become less and less accurate as the equations become more complex, and there could be overlaps between difference price factors.

This was not the case with the hedonic modeling used to assess the impact of noise. Most scientific discussion revolves around noise emissions resulting from road traffic and aviation noise. Above and beyond common evaluation methods, a number of literature sources work with hedonic regression models. These do no work out the impact of property characteristics on the value by looking at external criteria such as legal or medical issues. Instead, they use market data and look at numbers based on statistical estimation methods. The result is a more market-oriented and more up-to-date quantification of real estate factors influencing the value. When hedonic modeling is used to ascertain the value of real estate affected by noise, the devaluation effect is almost linear. Devaluation fuelled by road, rail, or aviation noise (exceeding 25 decibels) has a small impact on value of between 2.71% and 5.59%, being near a major highway (with at least two lanes in each direction of travel) has a significant impact on property value (just under 71%).

Other evaluations are being carried out by the Steinbeis experts to examine the impact of the remaining physical properties of noise. Not only does this involve investigating acoustic pressure levels, but also the pitch of sounds, the tonality, and sound impulsiveness. The aim is to show the different values that can come up in the calculations in order to make statements about the value of real estate.

Steinbeis Transfer Institute Center for Real Estate Studies (CRES)

The demands placed on professionals in the real estate industry and the tasks they now have to fulfill are changing due to the increasing complexity of the issues they now face, not just in terms of the real estate and financial markets but also due to marketing factors and economic influences – all of which play a crucial role. To enjoy a successful long-term career in this area, it is becoming more and more essential to receive good training and gain experience in specific areas of front-line business. Against this backdrop, the CRES Steinbeis Transfer Institute offers state-approved bachelor's and master's degree programs to provide professional academic training in the real estate industry.

Aside from offering continuing professional development, the institute also works in the field of real estate market research. The CRES is currently also supporting several research assistants towards a PhD in different fields of real estate.

The Steinbeis Transfer Institute, Center for Real Estate Studies (CRES) offers the following degree programs:

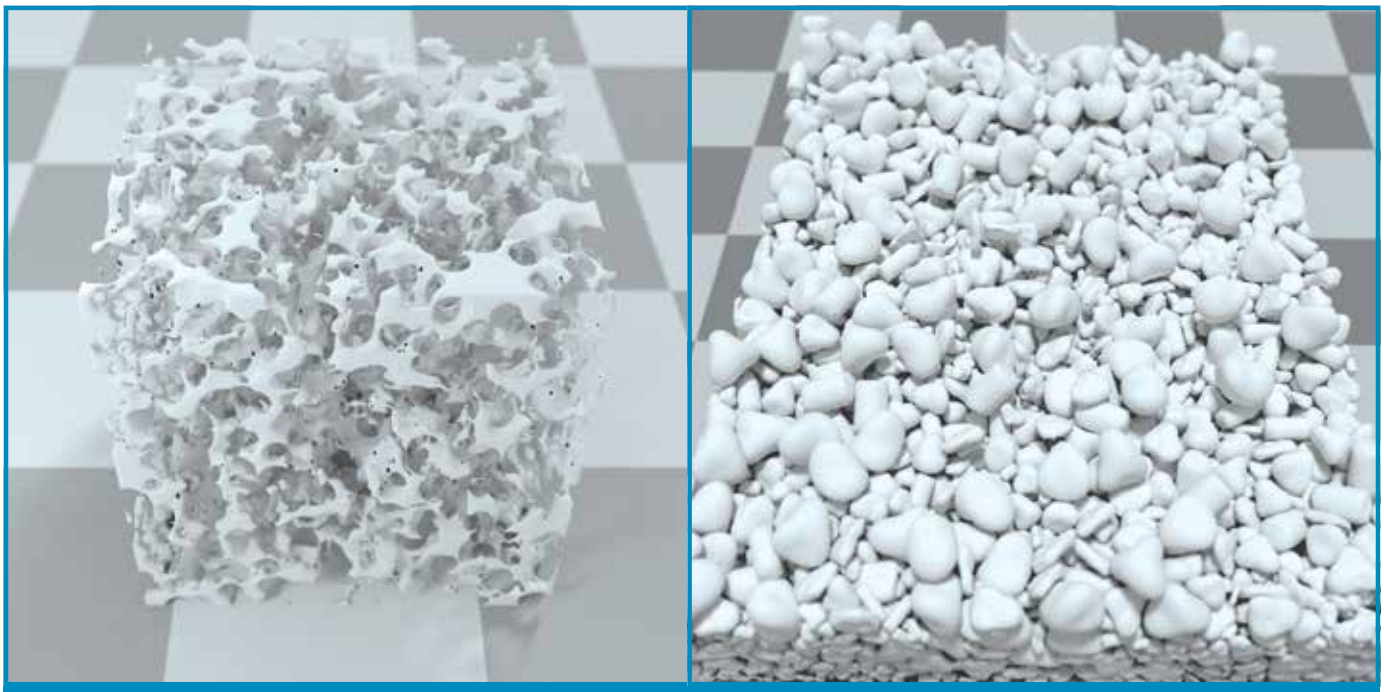
Bachelor of Arts: 3-year executive project competence degree (PCD) culminating in a Bachelor of Arts (B.A.)

Field: Business Administration
Field: Professional Skills and Management
(with a major in Real Estate)

Master of Science: 2-year executive project competence degree (PCD) culminating in a Master of Science (M.Sc.)

Image: © iStockphoto.de/The Guitar Mann

Prof. Dr. Marco Wölfle, Bernardin Seitz
Steinbeis Transfer Institute Center for Real Estate Studies (CRES) (Berlin/Freiburg)
su1477@stw.de | www.steinbeis-cres.de



3D computer models of porous and particulate structures

Computer-Aided Design of Medical Membranes

Steinbeis experts develop simulation software

Membrane technology plays a crucial role in a variety of industrial applications, especially medical technology, where porous membrane structures are used in processes like microfiltration, ultrafiltration and dialysis. They are needed to pressure-induce liquids like blood by passing it through fine porous structures. Liquids have different levels of viscosity and contain elastic or rigid particles of different sizes. As these pass through membranes, the porous structures act as a filter and retain large crystalline particles, allowing small elastic constituents to go through. Scientists at the Institute of Materials and Processes (IMP) at Karlsruhe University of Applied Sciences are now able to offer the simulation of porous structures using 3D computer modeling, and simulate liquids in capillary as well as flow processes. These services are offered in a simulation framework called Pace3D via the Steinbeis Transfer Center for Material Simulation and Process Optimization.

Medical diagnostics sometimes involve using synthetic membranes to conduct lateral flow testing. This is done by applying small quantities of a liquid medium to a membrane, whereby the capillary effect works like a chemical indicator strip. Liquid propagation in the membrane is dictated by a number of microstructural factors affecting dispersion rates: the surface properties, the complexity of the porous structures, and the anisotropic orientation. Capillary effects are influenced directly by the wetting properties of fluids on the membrane surface and the surface curvature. In turn, surface curvature is dictated by pore sizes. Small pores and high levels of surface curvature have an accelerating effect, but on the other hand, small pores result in a larger specific surface of the microstructures and this raises viscous friction. To achieve the optimum membrane design even with the lowest possible volumes of fluid and the most efficient level of transportation, it is extremely important to understand the mutual impact of microstructures and the properties of fluid propagation.

New 3D computer models now make it possible to create specific kinds of porous membrane structures, control the distribution of pore sizes, and define the geometry of web structures. These computer-generated membranes can be used as a starting point for microstructure simulations of capillary-driven or pressure-induced fluid dissipation in porous structures. The results of fluid simulations reflect the direct correlations between pore structures within the membrane and the efficiency of fluid exploitation. This information can then be used in diagnostic processes or to design the function of a filter on a computer by optimizing membrane structures. The 3D computer models can subsequently be shared with membrane producers for use in their manufacturing processes. All of this modeling is possible thanks to the Pace3D software, and these methods can also be applied to the computer-aided design of other porous microstructures such as foams and granular powders. Typical areas of application include heat storage systems based on zeolite particles, metal foams used as a material for lightweight construction, and powders used as a basic ingredient of sintered materials found in ceramics production and metallurgy. So in a nutshell, these simulation techniques make it possible to examine a whole variety of materials.

Prof. Dr. Britta Nestler, Michael Selzer
Steinbeis Transfer Center Material Simulation and Process Optimization (Karlsruhe)
su1272@stw.de | www.steinbeis.de/su/1272

Technical Education Bolsters Germany's Innovative Power

Steinbeis team conducts research with the IMP at Karlsruhe University of Applied Sciences

In April, eight young researchers at the German Association of Technical Education (DGTB) were invited to tour the manufacturing technology labs of the Karlsruhe University of Applied Sciences. The invitation came from Prof. Dr.– Ing. Rüdiger Haas, managing director of the Institute of Materials and Processes (IMP) at Karlsruhe University of Applied Sciences, and Director of the Institute for Transfer Technologies and Integrated Systems (SITIS), a Steinbeis Transfer Center. The group of young researchers was accompanied by the chairman of the DGTB, Prof. Dr. Christian Wiesmüller and Dr. Maja Jeretin-Kopf, who chairs the Young Scientists Committee at the DGTB.

The researchers took part in a discussion round with experts to hear more about the status of technical education in non-vocational schools. They explored issues resulting from insufficient education in technical areas and discussed the impact this has on young scientists. Christian Wiesmüller highlighted the importance of research in the field of technical education, saying that not enough progress has been made in recent years with plans to establish general technical education in Germany. He believes that there are plenty of sophisticated teaching methods and concepts, but far too many children and teenagers are not being given the chance to discover their personal interests and abilities. His hope is that more intensive research will influence this.

Rüdiger Haas drew the researchers' attention to the situation at manufacturing companies, where rising demand for continuing professional education at companies is being fuelled by demographic change and skilled worker shortages. Younger generations are likely to work until they are older and they need to be prepared for this. At the same time, the rich experience and specialist knowledge of older people is gaining in importance, and this is being seen as a valuable resource within the process of value creation. Haas said that German competitiveness is largely dictated by the country's ability to safeguard specialist and management resources, despite the shrinking population of workers – and this is only possible by gearing training to different age groups. Mechanical engineering and the machine tool industry are central to the German economy. Innovative manufacturing processes and rising levels of digitalization at the workplace require appropriate training and qualification measures to enable older workers to learn how to work with new technologies, still remain active at an older age, and determine their own workplace activities. The IMP has taken upon itself to look further into these issues. In collaboration with the University of Education in Karlsruhe, it is researching issues related to technical education and educational methods in keeping with the concept of "life-long technical education."

Prof. Dr.-Ing. Rüdiger Haas
Steinbeis Transfer Center Institute for Transfer Technologies and Integrated Systems SITIS (Karlsruhe)
su1289@stw.de | www.sitis-karlsruhe.de

Dr. Maja Jeretin-Kopf
Karlsruhe University of Applied Sciences
Institute of Materials and Processes (IMP) (Karlsruhe)
maja.jeretin-kopf@hs-karlsruhe.de

The 2015 Steinbeis Day

Friday, September 25, 2015
Steinbeis House for Management and Technology (SHMT), Plieningen (Stuttgart)

09:00 **Arrival |** We would like to welcome you with coffee in the Steinbeis House for Management and Technology (SHMT)

09:30 **Official opening of the 2015 Steinbeis Day**

09:45 **Award ceremony: The Seifriz Award 2015**

10:30 **Steinbeis Arena: Is Industry 4.0 making the grade in industry?**
An interactive debate support by audiovisual technology

Starting at
12:30 **Steinbeis Discussion Forum |** The Steinbeis House will be transformed into a forum for a variety of discussion groups, allowing the speakers at the arena to take part in Q&A sessions, expand on their ideas and engage in face-to-face conversation

14:30–16:30 **Internal event for members of the Steinbeis Network**

13:30–16:00 **Alternative cultural program |** for partners of Steinbeis directors

16:30 **Day program ends**

Starting at
19:00 **Evening event |** Internal event for Steinbeis Directors and their companions and clients (Stuttgart's Liederhalle Convention Center, Beethoven Room)

(Version dated June 2015)

Attendance at the Steinbeis Day is free but visitors are kindly requested to register. To find out more and register online, go to **www.steinbeis-tag.de**.

Our Digital Memory

Experts discuss the long-term archiving of our cultural and scientific heritage

There is no doubt – today the internet is the most important means of communication as well as a key tool for obtaining information both at work and at home. In Germany almost 100% of people under thirty are online, sometimes the entire day. Cultural and scientific institutions are responding to this societal shift by making increasing amounts of information available online. Not only is existing cultural property being digitized and published, but there are also growing amounts of digital research data – data that is not based on any documents, books, images, sound recordings, works in museums or similar materials in non-digital form. The Rosetta Stone can still be read today, as can literary correspondence between Celan and Rilke. But how can the availability of digital data be safeguarded in the long term, or emails, blogs and online commentary archived for posterity? The fifth meeting of a conference series called "Digitale Bibliothek" in Graz was dedicated to the question of how research and cultural data can be archived in a way that will allow reliable access in the long term. The Steinbeis Transfer Center for Information Management and Cultural Heritage Informatics in Graz co-organized the event.

The workshop discussions focused on the topics of audiovisual archiving and 3D digitization. Joining forces and coordinating knowledge in these areas makes it easier to restore endangered cultural property or understand contextual links to other related objects. The examples of music archiving projects in Afghanistan and Brazil and the DISMARC portal illustrate the potential conservational function of the internet. They also show how important it is for cultural institutions to have the courage to blaze new trails when it comes to making material available online. In the field of music, searches are still logocentric so they take an indirect route via language. Here research and development must move beyond the current limits of searchability. With this in mind, there are already projects in place to explore the DNA of world music so that the derivation of music can be worked out by its source.

As data storage capacity grows, infrastructure costs are decreasing and this helps make it possible even for small, regional facilities with limited budgets to network their research activities and establish archiving systems in the long term. In the field of 3D digitization and the archiving of 3D objects, however, we are still at the start of the journey into the online world. In many cases there are still a multitude of different processes for 3D generation, and putting 3D models online often fails because not all formats are web-compatible. Integration of WebGL in the new HTML5 standard means that dynamic 2D and 3D graphics will be better supported in the future, however, and it is expected that this form of online presentation will develop and spread rapidly.

Despite lower infrastructure costs, cultural and research institutions are continuously faced with the decision of what data to archive and in which format. What is the source? Do both the text and the layout need to be archived? Should a library or an archive also store social media content? The conference presentations explored answers to these questions and attempted to outline good practice. In the process, visualization of research data, long-term archiving and long-term availability were defined as the three most important tasks facing the Digital Humanities. A new job profile – research data curator – is currently being drafted to serve as a liaison between departments and IT. Making cultural and scientific data available online also makes it necessary to initiate a number of projects aimed at networking research and cultural institutions in Austria, Germany and Europe. Among the examples cited in the best-practice session at the end of the fifth Digitale Bibliothek conference were the German Digitale Bibliothek, the Swiss Memobase platform for audio-visual cultural property and the DURAARK project for archiving architectural data.

The Digitale Bibliothek conference series...

... has been organized since 2010 by the Steinbeis Transfer Center for Information Management and Cultural Heritage Informatics in Graz, in cooperation with the Universities of Graz, Vienna and Innsbruck as well as the Content Service Centre Austria association. For more details on the conference and individual presentations, please see the conference website, http://conference.ait.co.at/digbib. The sixth Digitale Bibliothek conference will be held in Graz on February 25-26, 2016.

The Steinbeis Transfer Center for Information Management and Cultural Heritage Informatics is headed up by Univ.-Prof. Dr. Walter Koch and deals closely with business and science documentation and information systems, especially with respect to cultural heritage. Its aim is to share experiences and insights involving modern information technology.

Services
- Consulting on system planning and system development
- Cooperation in local and regional projects
- Planning, definition and development of information systems
- Applied R&D
- Seminars, workshops and in-house training

Key areas
- Analysis of information flows in information systems
- Scientific drafting of meta-reference models to capture company-wide data models and business processes
- Metadata and ontologies
- Design of (primarily) Web-based information and documentation systems
- Access to distributed databases
- E-business and cultural heritage
- Digitization
- Application and integration of modern technology, methods and application-based development tools used to set up information systems
- Testing and adaptation of open development platforms
- Drafting of procedural models in systems development

Gerda Koch
Steinbeis Transfer Center for Information Management and Cultural Heritage Informatics (Graz)
gerda.koch@stw.de | www.steinbeis.de/su/651

2014 Readers' Survey

Outstanding response will help make TRANSFER even better

At the beginning of the year some 800 readers shared their opinions with us – and we send you our heartfelt thanks! By participating in our Readers' Survey, you provided us with valuable feedback on the aspects of TRANSFER you particularly value, where there is room for improvement and what you would like to see in the future.

Quality of articles
91% of respondents scored our articles as "good" or "very good." Feedback included not only requests for more in-depth information, but also for fewer technical details. We will continue to try to strike the right balance here.

Magazine layout and photos
95% of respondents rated the images and diagrams in TRANSFER as "good" or "very good." We're pleased with this response, but will also use your feedback to make improvements in this area. Readers suggested more images and larger photos in proportion to the amount of text; while expanding the digital version was also on your wish list.

What article format do you most enjoy?
At almost 51%, the respondents' clear favorites were our project reports detailing what has been happening with the transfer activities of our Steinbeis colleagues and partners in the private sector. Almost a quarter of the responses named news updates or interviews as their favorite article format.

Many participants also sent us suggestions, praise and criticism. Wherever possible we will your suggestions as a springboard for making further issues of TRANSFER even better and we're always happy to receive your feedback at media@steinbeis.de.

Claudia Pülicher is the lucky winner of the iPad Air2 in our prize drawing for survey participants. A graduate of Steinbeis University Berlin (SHB), she received the iPad from Dr. Felicitas Mocny, director of the Steinbeis Transfer Institute for Corporate Responsibility Management at SHB. We hope you enjoy your new digital sidekick!

Image: Claudia Pülicher (left) receiving the iPad from Dr. Felicitas Mocny.

Anja Reinhardt, Marina Tyurmina
Editorial team, Steinbeis Transfer magazine
media@steinbeis.de | www.steinbeis-transfermagazin.de

Honoring Commitment to Compliance

Birgit Galley receives Sigurd Pütter Service Medal

Awarded by AKG (Pharmaceuticals and Cooperation in Healthcare), this year the Sigurd Pütter Service Medal went to Birgit Galley, director of the School of Governance, Risk & Compliance (School GRC) at Steinbeis University Berlin (SHB). The medal honors Birgit Galley's many years of service promoting compliance in Germany. For more than 10 years the Steinbeis director has headed up institutes at SHB which offer a part-time executive MBA program in compliance, helping prevent financial crime. In addition Birgit Galley is a founding member of DICO (the German Institute for Compliance), which was established in 2012.

AKG is an association of pharmaceutical companies headquartered in Germany which aims to prevent and, if necessary, penalize anti-trust violations through voluntary self-regulation. The Sigurd Pütter Service Medal comes with Euro 2,500 in prize money. "I plan to invest the money in training and continuing professional development and make it easier for a student to attend the MBA program in compliance and financial crime at School GRC," says Birgit Galley, thanking the award sponsors. The award ceremony was held on April 22 as part of the public session of the AKG's ninth general assembly. Dr. Hans Joachim Marschdorf, one of the first auditors in Germany to specialize in fraud investigation, delivered the award presentation speech.

Birgit Galley

The School of Governance, Risk & Compliance was founded in 2007 as a research and training institute at Steinbeis University Berlin. School GRC provides training and continuing professional development for executive managers and specialists, and coaches top managers in specific cases – up to and including changes in company management. Its partner institute, the School of Criminal Investigation & Forensic Science | Institute for criminalistics (School CIFoS), has offered a master's degree in criminal science in Germany since 2012.

Melanie Reichelt
School of Governance, Risk & Compliance
Steinbeis University Berlin (Berlin)
su1142@stw.de | www.school-grc.de

Steinbeis training course in EU funding applications

Certificate in "The basics of application submissions"

The Steinbeis-Europa-Zentrum (SEZ) is once again offering a three-day certificate course in 2015 on "The basics of applications submissions." The program is being offered in cooperation with the School of International Business and Entrepreneurship (SIBE) at Steinbeis University Berlin. Its aim is to improve skills related to international innovation-funding applications and this fourth round of the course is on October 12 and 13 and November 6, 2015 in Karlsruhe.

During the three days of the course - and time for private study - the participants learn how to successfully manage and write an application for EU funding. Numerous key issues are explored and answered in a practical and pragmatic manner:

- Which is the right funding program?
- How do I move from idea to application?
- What sets a good application apart?
- What is important with respect to the concept and formulation of the different parts of the application?
- How do I find international partners?
- How do I best coordinate international partnerships, in terms of both project organization and communication?

Days one and two of the course include presentations with interactive sessions individually and in groups. Using case studies from European research projects, approaches to tackling individual questions are explored. In the following two-week private study phase, participants prepare their own grant applications. Ideally these should be based on their own funding idea and describe an actual research project. This application is then submitted for review by experts.

On day three of the course the participants defend their application in an individual examination. The course closes with a discussion round focusing on the (anonymous) sample applications. There is also the presentation of an overview of project management and intercultural issues. After successful completion of the course, participants receive a university certificate worth four official credit points.

Dr. Jonathan Loeffler, Hannah Schöberle
Steinbeis-Europa-Zentrum (Stuttgart/Karlsruhe)
Hannah.Schoeberle@stw.de | www.steinbeis-europa.de

When a Town Becomes a Classroom

Steinbeis project fosters sustainability education

Education in the field of sustainable development, the use of innovative learning methods and real-world applications relating to specific issues – these are the areas covered by an ongoing educational project run by the Steinbeis Innovation Center for Logistics and Sustainability (SLN) in Sinsheim. The project involves four schools and one non-school partner, the municipal administration of Sinsheim.

Currently, the participants from the schools are busy with the practical phase. For example, a team of twelfth-graders from Max Weber School in Sinsheim are working with the Lokale Agenda group on "Promoting and Optimizing Bicycle Traffic." Project participants cycled along the two main axes of Sinsheim's bicycle network, documenting what they discovered in photographs. The aim was to call attention to road safety hazards. As a next step, the team of students is planning to conduct a survey of bicyclists to identify their requirements for a municipal network of bicycle tracks. They will then work with SLN and the municipal authorities to develop a set of recommendations.

Two teams from the twelfth-grade seminar at Friedrich Hecker School are looking at the green energy revolution on a regional level, using the example of a city to see how it is being implemented. Jens-Jochen Roth, director of the Steinbeis Innovation Center, organized an expert discussion with the head of the Department for Building Management in Sinsheim and the Energie-Raum-Architektur engineering firm. Department head Tobias Schutz of the city administration and Daniel Ziebold of the engineering firm spoke to the student teams about the plans for the upcoming renovation of the Sinsheim civic center. The meeting made it clear that measures to optimize energy usage and improve energy efficiency have top priority.

Twelfth-graders from the Wilhelmi Gymnasium prepared a mobility study under the guidance of SLN experts. The study centered on an empirical analysis of visitor flows at the Sinsheim pool and spa. The students looked at the means of transportation used by visitors, as well as examining whether they took the opportunity to visit other attractions in Sinsheim. This analysis could be useful to the municipality in developing attractive services for tourists on day trips or short breaks. Another class focused on the "Ecology of a Natural Region," looking at changes in the flora and fauna of a nature conservation area which now borders on an industrial and business park in Sinsheim.

A class of ninth-graders from Kraichgau Realschule also participated in the project, focusing on public transportation as illustrated by the example of the Sinsheim city bus service. Working with the Steinbeis Innovation Center and the Sinsheim Municipal Regulations Office, the student teams examined the attractiveness of public transportation services in Sinsheim city center. The students surveyed passers-by in downtown Sinsheim, bus passengers and bus drivers. Municipal representatives were also involved. In the planning phase of the activities, students were shown a city bus equipped with the latest technology for improving energy efficiency.

The practice-based focal areas form the basis for long-term activities involving participating schools and the municipality. Ongoing dialog with employees in the municipal administration helps creates a network between all participants. This approach ensures that knowledge is not only transferred from the schools into actual practice, but that direct feedback also flows in the other direction at the same time. Both the students and the professionals benefit.

Initiated by the Steinbeis Innovation Center, the project is funded by the Baden-Württemberg Ministry of Environment, Climate and Energy using lottery revenues. The lead partner of the project is the Baden-Württemberg Department of Environment, Measurement and Nature Conservation.

Jens-Jochen Roth
Steinbeis Innovation Center Logistics and Sustainability (Sinsheim)
jens-jochen.roth@stw.de | www.sln-sinsheim.de

Steinbeis Business Coaching

2014 – 2020 funding program

In March 2015 the new European Social Fund (ESF) Funding Program for Baden-Württemberg was released. The ESF Funding Program for coaching aims to help businesses help themselves by providing consultation on how to survive fluctuations in the economy and boost their competitiveness. The Steinbeis Network offers coaching services in a wide range of areas.

The ESF Funding Program covers:

- Innovation projects/restructuring
- Climate-friendly business practices
- Company transfers
- Effective training
- Growth-oriented women-led enterprises

Small and medium-sized enterprises (SMEs) headquartered in Baden-Württemberg with up to 250 employees and turnover in the previous year of Euro 50 million or less are eligible to apply for funding. Grants amount to 50% of expenditure for coaching, up to a maximum of 400 euros per working day (eight hours). A maximum of 15 working days can be funded in each topic area, setting a maximum grant amount of Euro 6,000.

Interested consultants from the Steinbeis Network can offer these coaching services to their customers through the certified and authorized Steinbeis Consulting Center for Business Coaching.

Lukas Breucha, Nadine Hooge
Steinbeis Consulting Center Business Coaching (Stuttgart)
lukas.breucha@stw.de, nadine.hooge@stw.de | www.steinbeis-uc.de

Start-ups in the Age of Digitalization

Steinbeis at the CeBIT 2015

It's full speed ahead with digitalization in the economy. At CeBIT 2015 it was apparent that the "d!conomy" is a tremendous opportunity – but will also require tremendous effort. The trade fair showcased digital transformation, the Internet of Things, IT-security und unified communications. Steinbeis was represented in hall 16 as an event partner to CODE_n, organized by GFT GmbH.

This year's CODE_n innovation contest was called "Into the Internet of Things." It was on the lookout for company founders and startups whose ideas are helping usher in the era of the Internet of Things. The 50 most exciting business models were on display throughout the 5,000 sqm. hall 16 during the CeBIT.

After CeBIT, the Steinbeis team declared the event a resounding success. Over the five days of the trade fair, the team held conversations with numerous attendees and were able to present them with a well-rounded picture of the Steinbeis portfolio of services. The key message of the Steinbeis stand was the support Steinbeis can offer entrepreneurs starting up their own businesses or founding an enterprise within the Network.

Lukas Breucha
Steinbeis Headquarters (Stuttgart)
lukas.breucha@stw.de | www.steinbeis.de

Effective Entrepreneurship with Steinbeis

Steinbeis financial results 2014

Ferdinand von Steinbeis, the man who lent the Steinbeis Network his name, was dedicated to fostering entrepreneurship as well as knowledge and technology transfer. Today, more then 150 years later, Steinbeis remains committed to these goals – and, with its more than 1,000 enterprises, successfully pursued these goals in 2014.

At the board of trustees meeting held in April, Dr.-Ing. Leonhard Vilser, chairman of the board of trustees, thanked all employees in the Steinbeis Network for their commitment to bringing about this success over the past year.

Prof. Dr. Michael Auer and Manfred Mattulat, board members of both the Steinbeis Foundation and Steinbeis GmbH & Co. KG für Technologietransfer, welcomed 79 new enterprises to the Network in 2014. As of December 31, 2014, the Steinbeis Network had grown to encompass 1,006 Steinbeis Enterprises, all working to promote knowledge and technology transfer. Under the Steinbeis umbrella, they carry out projects in research and development, consulting, evaluation and expert reports and training and employee development. More than 6,000 dedicated employees (1,744 employees, 3,691 independent contractors and 717 professors) were involved in these Steinbeis projects in 2014, achieving total turnover of Euro 144.4 million.

The more than 1,000 enterprises in the Steinbeis Network span all Steinbeis Enterprises (SEs). Depending on the specialist discipline and the focus of work, these SEs employ experts in legally dependent Steinbeis Transfer Centers, Steinbeis Research and Innovation Centers, Steinbeis Consulting Centers, Steinbeis Transfer Institutes or companies of an independent legal nature. The Network also includes Enterprises operating under franchising arrangements or minority shareholdings. The majority of SEs are located at research institutions – particularly at universities and universities of applied sciences – placing Steinbeis at the source of original research and expertise.

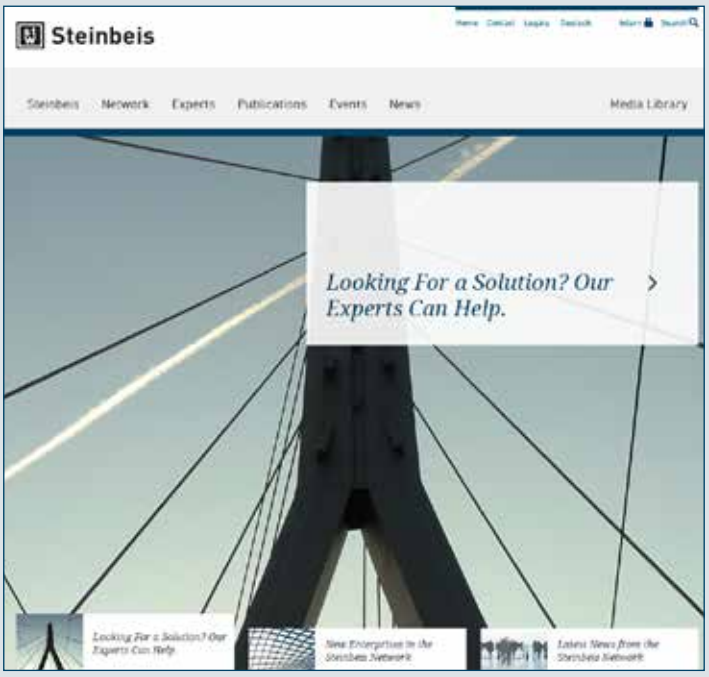
Steinbeis-Stiftung (Stuttgart)
stw@steinbeis.de | www.steinbeis.de

Welcome to the Steinbeis Network

Steinbeis know-how: There are currently more than 6,000 experts actively involved in knowledge and technology transfer at around 1,000 Steinbeis Enterprises. The portfolio of services offered by the Steinbeis Network ranges from research and development to consulting, expert reports, training, and continuing professional development for all fields of technology and management. And this network continues to expand. For an overview of the most recently founded centers go to www. steinbeis.de/en/news. Welcome to the Steinbeis Network!

Information on recently founded enterprises in the Network on www.steinbeis.de

More on recently founded enterprises in the Network on www.facebook.de/Steinbeisverbund



Learning How to Learn

Steinbeis team crafts continuing professional development strategies for production technology companies

In German companies, learning most commonly takes place in informal settings. In order to add value for the employees, it is essential to adhere to systematic learning strategies. Educational concepts for continuing professional development (CPD) in production technology are being developed at the Steinbeis Transfer Center Institute for Transfer Technologies and Integrated Systems SITIS at Karlsruhe University of Applied Sciences.

German companies understand the value of continuing professional development (CPD) [1]. Almost three-quarters of German businesses offer their employees continuing professional education and development activities. At 80%, the mechanical engineering sector [2] is above average. Here the participation rate in CPD courses was 58.6%, making this sector of industry the frontrunner in CPD participation [3]. Most CPD involves in-house training activities (66%) held in informal settings, which means that learning more often takes place through information events, job rotation and self-directed learning than in training seminars and courses [4].

However, it is not always apparent how effective and efficient this form of in-house learning is. Like in-house training activities, learning in informal settings is usually managed by other employees with specialist skills or knowledge. Sometimes these people are also higher up in the company hierarchy. One advantage of this kind of informal learning is how close it is to actual practice – the problems are not theoretical, the solutions can be applied directly and the event takes place in the location where it's actually needed. However, the advantages of these informal learning models can quickly turn into disadvantages. The immediacy of the real problems often means things are rushed, which doesn't allow for trying out new things or weighing up different alternatives. In addition, successful teaching not only requires knowledge of the subject matter, but also didactic knowledge and teaching skills that most employees simply do not possess. Furthermore, the communication takes place between individuals who are bound by their specific roles within the company and cannot stand above personal issues – often crucial when moderating discussions or discourse. These are only three reasons why learning processes in informal settings often do not produce the desired results, although they meet some of the prerequisites for successful learning. Loss of time, delay in the company's processes and the associated costs are only a few consequences that can result from this type of CPD activity.

Steinbeis experts emphasize that the full potential of informal learning scenarios should not be squandered. "It's a hidden resource of in-house continuing professional development that is not fully exploited," explains Prof. Dr.-Ing. Rüdiger Haas, director of the Steinbeis Transfer Center Institute for Transfer Technologies and Integrated Systems (SITIS). However, learning does not take place on its own. It requires methods and strategies that are appropriate to the situation and topic at hand. To develop educational concepts for CPD in production technology companies, it is

Sources

[1] Data provided by the 4th round of the European Union's Continuing Vocational Training Survey (CVTS4).
[2] This includes other segments besides mechanical engineering: manufacturing of DP equipment, electronic and optical products, electronic equipment, repair and maintenance of machines and equipment.
[3] German Federal Statistical Office (ed.) (2013): Weiterbildung 2013. Wiesbaden.
[4] Vollmar; Meike (2013): Berufliche Weiterbildung in Unternehmen 2010. Methodik und erste Ergebnisse. Ed.: Statistisches Bundesamt, Wirtschaft und Statistik.
(German Federal Statistical Office, Wiesbaden)
[5] Armbruster, Christine; Jeretin-Kopf, Maja (2015, in progress): Intergenerationelles Lernen in fertigungstechnischen Unternehmen.

necessary to have a good working knowledge of the CPD situation within the company. For this reason the team from SITIS worked in cooperation with the Karlsruhe University of Education to conduct interviews as part of study looking at production technology companies in Baden-Württemberg. The target group included executives as well as people in charge of production. An initial analysis of the interviews shows that in-house training and on-the-job learning are the most common forms of CPD and are viewed by the participants as particularly beneficial [5]. In addition, the majority of those interviewed felt that processes could be improved by optimizing communication. Heavy workloads and a wide spectrum of responsibilities were singled out as reasons for insufficient communication. For example, the majority of senior employees are tasked with providing instruction to employees who do not yet possess the necessary experience or skills, but are also responsible for a wide variety of other tasks which often have to be carried out at the same time. All levels of the hierarchy identified the need for training in interpersonal and teaching skills. The results of the study were used to plan certified CPD activities. SITIS will offer these in collaboration with the Institute of Materials and Processes (IMP) at Karlsruhe University of Applied Sciences and Karlsruhe University of Education.

Image: © fotolia.de/Monkey Business

Prof. Dr.-Ing. Rüdiger Haas
Steinbeis Transfer Center Institute for Transfer Technologies and Integrated Systems SITIS (Karlsruhe)
su1289@stw.de | www.sitis-karlsruhe.de

Dr. Maja Jeretin-Kopf
Karlsruhe University of Applied Sciences
Institute of Materials and Processes (IMP) (Karlsruhe)
maja.jeretin-kopf@hs-karlsruhe.de

SME Coaching Days in Baden-Württemberg

Steinbeis-Europa-Zentrum advises on EU grant writing

To boost the participation of innovative small and medium-sized enterprises (SMEs) from Baden-Württemberg in the European SME funding instrument, Steinbeis-Europa-Zentrum (SEZ) is offering information events and intensive coaching for SMEs. These are backed by the Baden-Württemberg Ministry of Finance and Economics for a two-year period.

In 2015 and 2016, SEZ will hold coaching days and workshop discussions in cities and towns throughout Baden-Württemberg. In addition, SEZ is helping SMEs write proposals of high quality, identify project partners and clarify property rights. Besides financial support, SMEs benefit from international cooperation by partnering with the best companies from other member and associated states to compete for European funding. At the same time they can grow their export activities.

The new SME funding instrument is open to all sectors and is aimed exclusively at SMEs with growth potential or international business activities with the potential to lead innovation in their field in the future. SMEs have the opportunity to develop their concrete ideas into market-ready products. Individual applications are also accepted.

The first SEZ coaching dates have already been scheduled:

- July 13, 2015 in Villingen in cooperation with the Black Forest-Baar-Heuberg IHK chamber of commerce
- July 14, 2015 in Pforzheim in cooperation with the Northern Black Forest IHK chamber of commerce
- October 15, 2015 in Mannheim in cooperation with the Rhine-Neckar IHK chamber of commerce
- March 2016 in Freiburg in cooperation with the Southern Upper Rhine IHK chamber of commerce

Isabell Kraft
Steinbeis-Europa-Zentrum (Stuttgart/Karlsruhe)
isabell.kraft@stw.de | www.steinbeis-europa.de

Outstanding Innovation and Quality Management

Baden-Württemberg Competence Prize awarded for 8th time

The jury has decided: The 2015 Baden-Württemberg Competence Prize for Innovation and Quality in the Company category goes to the Reichle GmbH engraving and laser-welding center. Eugen Hehl receives a lifetime achievement award for entrepreneurship. Other honors go to Roche PVT and LÖSOMAT Schraubtechnik Neef GmbH. Initiated by the Ulm-based Steinbeis Enterprise TQU Business GmbH and the trade fair organizer P.E. Schall GmbH & Co. KG, for the 8th time the Competence Prize is honoring product innovations, innovative business models, processes and services, and organizational and marketing innovations. The prize is sponsored by the Steinbeis-Stiftung and is awarded annually in cooperation with the Südwestmetall Employers Association, the Association of Industry in Baden-Württemberg (LVI) and the Association of the Chemical Industry (VCI).

The 2015 award recipient in the Company category, the Reichle GmbH engraving and laser-welding center, beat more than 25 competitors to claim the prize. Its outstanding and innovative surface-engineering process, specially designed for tools and molds used in foam molding, injection molding and pressure die casting, is a new and impressive demonstration of the innovative power of Reichle GmbH and its almost 50 employees. For the jury of the Baden-Württemberg Competence Prize, the fact that the company developed the innovation independently played a decisive role. The development project lasted more than two years and was funded by the company itself. The resulting innovation has major market potential. Reichle GmbH stands the shining example of medium-sized industry in Baden-Württemberg – a family business in which the transfer to the next generation seems to have worked particularly well.

The Competence Prize honors Eugen Hehl, Senior Partner of ARBURG GmbH + Co. KG., for his lifetime of entrepreneurship. The lifetime achievement award for entrepreneurship recognizes qualities such as corporate vision, innovation, social responsibility and sustainability. Eugen Hehl, who still serves an advisory role in the company today, worked with his brother Karl Hehl to make the family business what it is today. ARBURG is one of the world's leading manufacturers of machines for plastics processing. As the longtime chairman of the board, Eugen Hehl played a significant role in the global success of the company. Having received a technical education, he was still able to apply his talent for sales for over six decades to conquer markets with innovative machinery and take the family business global.

The jury of the 2015 Baden-Württemberg Competence Prize is bestowing two additional awards for the first time. These go to Roche PVT GmbH and LÖSOMAT Schraubtechnik Neef GmbH. Part of the Roche Group, Roche PVT is the center of competence for automation systems in the pre- and post-analytical phases of laboratory work. A new process was rolled out in the company acting as a catalyst for innovation, particularly in the development of devices. The company submitted its development of a new decapper in LCP1 systems for the jury's consideration. The decapper opens sample tubes automatically in accordance with requirements.

In a joint project involving LÖSOMAT and DB Bahnbau Gruppe GmbH, a completely new device was developed for use in railway track construction, the LÖSOMAT Railway Torque Wrench. The railway torque wrench has to deal with extreme demands. The tool has to be quiet, light and easy to operate. The results are impressive: weighing only 17.2kg, the Railway Torque Wrench LDB series has a rechargeable battery and delivers torque of 150 to 1,100 Nm and approximately 160 revolutions per minute. One time-saving new feature of this series is a color display that allows the operator to select the type of rail system being bolted.

"Once again, the companies competing for the Baden-Württemberg Competence Prize this year are from all sectors, from medium-sized industries to corporations. The jury didn't have an easy task," says Helmut Hayer, managing director of TQU Business GmbH and co-initiator of the Competence Prize. "This once again shows that the Baden-Württemberg Competence Prize for Innovation and Quality is not only firmly established, but it's also considered one of the state's most important awards for excellence in entrepreneurship," Bayer continues. Who submits for the Competence Prize must show that the company has an excellent innovation and quality management with a proven record of success. As a result, there must have been measurable business success. A jury of experts uses the application documents and site visits to determine whether these criteria have been fulfilled.

Image: 2015 Competence Prize winners and jury

Ulla Bläsing
TQU Business GmbH (Ulm)
su1103@stw.de | www.tqu-group.com

Innovative products seek producers

Steinbeis fair at Aalen University of Applied Sciences

Good things come in (more than) threes. Following on successful events in Reutlingen, Pforzheim and Stuttgart, Steinbeis invites attendees to the fourth "concept exploitation" exhibition, Products Seek Producers. On October 16, the fair at Aalen University of Applied Sciences will showcase products, processes and services in the field of surface engineering/new materials.

Products seek Producers is an innovative event format that brings together new products and processes from different technological fields and exhibits them in a single location. The format makes it possible to match patented concepts with potential business partners, producers and sales partners, and provides a platform for quick, practice-oriented technology transfer. Providers and producers find the partners they need, while visitors to the exhibition can gain an overview of current technical developments in the field. Companies, universities and inventors are invited to participate as exhibitors.

The Ulm chamber of skilled crafts, Aalen University of Applied Sciences, the Eastern Württemberg IHK chamber of commerce, the economic development council of the Eastern Württemberg region, and the Aalen University innovation center are serving as event partners for the surface engineering/new materials exhibition in Aalen.

Would you and your Steinbeis Enterprise like to take part in the exhibition?
Then please contact Marina Tyurmina (marina.tyurmina@stw.de).

The fair is open to visitors from 9 a.m. to 4 p.m.
For free exhibition stands and visitor registration, please contact:

Patricia Hofmeier
Steinbeis-Innovationszentrum Wissen + Transfer (Villingen-Schwenningen)
patricia.hofmeier@stw.de | www.produkte-suchen-produzenten.de

Smart solutions for the city of the future

Steinbeis takes part in EU TRIANGULUM project

The EU TRIANGULUM project focuses on pioneering, innovative concepts for sustainable energy sources, mobility and information technology in three cities – Manchester (United Kingdom), Eindhoven (Netherlands) and Stavanger (Norway). This "lighthouse project," which is receiving 25 million euros in funding from the European Commission for five years, is being coordinated by the Fraunhofer IAO and the Steinbeis-Europa-Zentrum (SEZ).

At the heart of the project is an information and communication architecture that will serve as the basis for the networking and coordination of individual technologies in the city, uniting separate communication infrastructures such as sensor, information and cellular networks.

In Eindhoven, city residents have already been given access to different parts of the infrastructure via an information and communication technology (ICT) solution, allowing them to reserve carsharing vehicles or use intelligent parking space concepts. Sensors installed in locations like streetlights will collect information such as movement data, making it possible to control road lighting, public transportation or carsharing services in line with current demand. Stavanger has the highest concentration of electric vehicles in all of Europe. Together with the existing high-speed ICT infrastructure, they are the focal point of efforts to better network energy and mobility solutions. One objective is the systematic networking of businesses, residents, research institutions and physicians using IT networks to allow for better planning, more efficient use of energy and remote medical diagnosis options. Corridor Manchester, a university neighborhood in Manchester, is being transformed into a smart-city quarter. To this end, historic buildings are being refurbished. In addition, plans are in place to establish an autonomous energy grid which will provide the entire neighborhood with heating and electricity. The electricity grid will combine geothermal energy, fuel cells and district heating and storage.

SEZ supported Fraunhofer IAO during the proposal writing process and is assisting the coordinator with the administrative project management. As a project partner, SEZ is responsible for communication and marketing as well as disseminating project results.

Image: © Eindhoven municipal administration (Netherlands)

Alexandra Fezer, Saskia Heyde
Steinbeis-Europa-Zentrum (Stuttgart/Karlsruhe)
su1216@stw.de | www.steinbeis-europa.de

©istockphoto.com / Alan Merrigan

Experts.Knowledge.Sharing.

New Releases from Steinbeis-Edition

Steinbeis-Edition, the publishing arm of the Steinbeis Foundation, regularly publishes works reflecting the scope of the Steinbeis Network's expertise. All titles can easily be ordered via our online shop at: www.steinbeis-edition.de.

The commercial benefit of a kinaesthetics and significance for social welfare work and the health economy

Lieseltraud Lange-Riechmann

2015 | Paperback, B&W | 320 pages, German
ISBN 978-3-95663-031-6

About the author

Lieseltraud Lange-Riechmann graduated with a Bachelor of Business Administration in 2005, followed by a Master of Business Administration at Steinbeis University Berlin (SHB) in 2007. Aside from her vocational activities, she completed a Ph.D. at the social welfare Institute (Institut für Diakoniewissenschaft und Diakoniemanagement) at the Christian University of Wuppertal/Bethel. Her doctoral thesis looked at the economic benefit of kinaesthetics in order to lay further foundations for the transfer of scientific knowledge into practice.

Fundamentals of Aptitude Testing. Professional Methods of Personnel Recruitment

Viktor Lau

2015 | Paperback, B&W | 203 pages, German
ISBN 978-3-95663-030-9

About the author

Dr. Viktor Lau studied business, German studies, history, and philosophy. He is now considered a leading expert in the German HR industry. His focal topics are strategic HR management, aptitude testing, and HR development. Lau is also project manager at the Steinbeis Transfer Center for Technology – Organization – Human Resources.

Support instruments and services for European technology-based companies entering the Chinese market

Franziska Bergmann, Eduardo Herrmann

2015 | Paperback, color | 88 pages, English
ISBN 978-3-95663-027-9

About the authors

Franziska Bergmann has been a project manager at Steinbeis-Europa-Zentrum (SEZ) since 2011. She has been responsible for SEZ activities in China since early 2013 and is involved in EU projects aimed at fostering scientific and technological collaboration between Europe and China. Eduardo Herrmann is a team leader and Senior Project Manager at the SEZ, where he is responsible for production technology and social issues. He has also been a coordinator and project partner for a variety of projects backed by the EU and has taken part in EU funding initiatives in a variety of technical fields.

Business Meet-up 2015. Proceedings.

Alb-Schwarzwald Business school (publ.)

2015 | Paperback, color | 224 pages, German
ISBN 978-3-95663-024-8

About the publishers

The Alb-Schwarzwald Business School is an institute belonging to Steinbeis University Berlin (SHB), which was founded by the Steinbeis Foundation in 1998. Prof. Dr. Dr. h. c. mult. Johann Löhn has been president of the school since its founding. With over 6,500 enrolled students, the SHB is now one of the biggest private universities in Germany, offering bachelor's and master's degrees, as well as certification courses. It also has the right to award doctorates. The SHB spans a variety of individual institutes located throughout the whole of Germany.

InnovationQuality. The Value of the New

Werner G. Faix, Jens Mergenthaler, Rolf-Jürgen Ahlers, Michael Auer

2015 | E-book (PDF), color | 174 pages, English
ISBN 978-3-95663-041-5

About the authors

Werner G. Faix, Jens Mergenthaler, Rolf-Jürgen Ahlers, and Michael Auer work in a variety of areas for Steinbeis. In their book on InnovationQuality, the authors examine the twin/coupled phenomenon of innovation and quality, posing the question: What is the value of the New?

The 2015 Steinbeis Engineering Day. Complexity. Individualization. Flexibility.

Steinbeis Foundation (publ.)

2015 | Stapled, color | 32 pages, German
ISBN 978-3-95663-035-4

About the 2015 Steinbeis Engineering Day 2015

The third Steinbeis Engineering Day looked at the impact that additive manufacturing may have on business processes, IT systems, and even business models.

The 2015 Steinbeis Engineering Study. Additive Manufacturing – Enablers of agile value-adding processes

Steinbeis Foundation (publ.)

2015 | Paperback, color | 34 pages, German
ISBN 978-3-95663-036-1

About the Steinbeis Engineering Study 2015

The study describes initial insights into reactions to the introduction of additive manufacturing in industry. The majority of findings of the study are based on small and medium-sized companies in the field of mechanical engineering and plant construction, the automotive industry and aerospace. The participants in the study also include a variety of companies that already use additive manufacturing to produced semi-finished parts and finished products. The findings provide an understanding of experiences in industrial applications.

Active Investment Funds and Passive Exchange Traded Funds (ETF) in the German Capital Market. Value Development and Integration into Portfolio Management from the Standpoint of Institutional Investors

Matthias Krautbauer

2015 | Paperback, B&W | 301 pages, German
ISBN 978-3-95663-042-2

About the author

Matthias Krautbauer studied business at Munich University of Applied Sciences between 2004 and 2008 with an emphasis on banking, the financial industry and investment. After receiving his diploma, he worked as a research assistant at the Steinbeis Research Center for Financial Services at Steinbeis University Berlin. His work at the center revolved around the fields of asset management, banking and payment transactions, and was featured in a variety of publications. Krautbauer completed his doctoral studies in 2015 at Steinbeis University Berlin (SHB).

Neuroscience – solving the mystery of the brain

Gernot Barth, Bernhard Böhm

2015 | stapled, color | 68 pages, German
Corporate Mediation 2015/02

About the publisher

Associate professor Dr. habil. Gernot Barth is director of IKOME® (the Institute of Communication and Mediation), Steinbeis Consulting Center Mediation of Business, and the Academy for Social Aspects and Law (Steinbeis Transfer Institute at Steinbeis University Berlin). The focal topic of his work is mediation, especially within and between companies. A qualified attorney and master of mediation, Bernhard Böhm is co-director of the Steinbeis Consulting Center for Corporate Mediation alongside Dr. Gernot Barth. He is also head of the arbitration committee office of Steinbeis Consulting Centers (Steinbeis Beratungszentren GmbH). Additionally, he shares responsibility for a variety of domestic and European mediation projects involving cross-border mediation.

Your successful chambers of nursing in Germany and Europe. Guarantors of nursing care for the population and legitimate self-administration of professional care workers

Heinrich Hanika

2015 | Paperback, color | 196 pages, German
ISBN 978-3-95663-032-3 (print)
ISBN 978-3-95663-033-0 (non-print)

About the author

Professor Dr. iur. Heinrich Hanika studied law and economics. Among his many roles, he is the contact person for regional governments, the German Nursing Council, and a variety of nursing associations. He also provides legal support for research at the startup committee for the establishment of a regional state nursing chamber in Rhineland-Palatinate. Professor Hanika's main interests lie in law relating to Europe, nursing and economics. He is involved in integrated research and teaching for degrees related to health care, nursing, and management. Hanika is the director of an institute and a lecturer at Steinbeis University Berlin, a visiting professor at Semmelweis University in Budapest, and a professor of law in the EU and business law at the University of Applied Sciences at Ludwigshafen on the Rhine.

You can also follow us on Facebook and Twitter!

Yvonne Hübner
Steinbeis-Edition (Stuttgart)
edition@steinbeis.de | www.steinbeis-edition.de

Steinbeis

Publication details

Transfer. The Steinbeis magazine

The magazine on tangible knowledge and technology transfer
Edition 2/2015
ISSN 1864-1768 (Print)

Steinbeis GmbH & Co. KG für Technologietransfer
Willi-Bleicher-Str. 19
70174 Stuttgart
Fon: +49 711 1839-622
Fax: +49 711 1839-700
E-Mail: stw@steinbeis.de
Internet: www.steinbeis.de

Editorial coordinators:
Anja Reinhardt, Marina Tyurmina
E-Mail: transfermagazin@stw.de

Concept and design:
Steinbeis-Stiftung

Overall production:
Straub Druck + Medien AG, Schramberg

Photos and images:
Unless stated otherwise, photos and images were provided by Steinbeis Enterprises and project partners named in this magazine.
Cover picture: © fotolia.de/Alterfalter

Steinbeis is an international service provider in entrepreneurial knowledge and technology transfer. The Steinbeis Transfer Network is made up of about 1,000 enterprises. Specialized in chosen areas, Steinbeis Enterprises' portfolio of services covers research and development; consulting and expert reports as well as training and employee development for every sector of technology and management. Steinbeis Enterprises are frequently based at research institutions, especially universities, which are constituting the Network's primary sources of expertise. The Steinbeis Network comprises around 6,000 experts committed to practical transfer between academia and industry. Founded in 1971, the Steinbeis-Stiftung is the umbrella organization of the Steinbeis Transfer Network. It is headquartered in Stuttgart, Germany.

174636-2015-02-e