Issue No. 7

CAMPUS HEILBRONN

Mindshift

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TUM Campus Heilbronn of the Technical University of Munich

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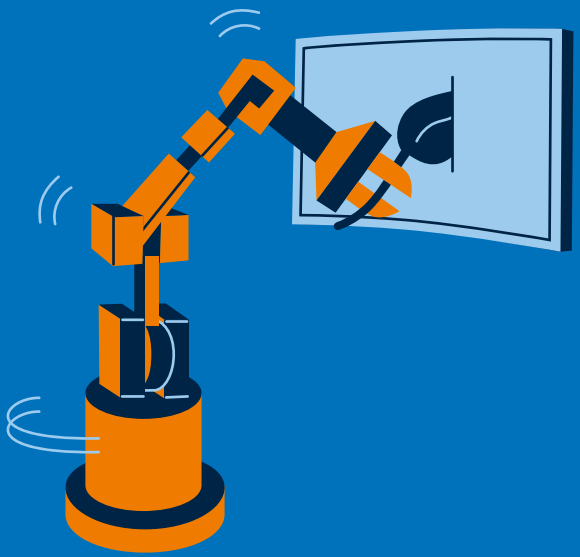


Dear Readers,

More than ever before, the world is in transition – unfortunately, not just in a positive, constructive way. The resulting impact on many areas of life is substantial. For example, companies face the considerable task of aligning their value creation processes with a number of changed circumstances. In addition to digital transformation, shifts in customers' interests and the increased use of AI and automation, these changes are about sustainability and ecologic responsibility.

Against this background, we placed the focus of this issue of Mindshift on the value creation that people and artificial intelligence can drive together going forward. There are challenges inherent in value creation, and also significant opportunities. Let yourself be inspired by how researchers at TUM Campus Heilbronn contribute – as players in the Heilbronn ecosystem, the framework for the development and testing of smart AI solutions so that the immense potential of data can be leveraged. Take TUM Campus Heilbronn's partnership with Audi, for example: The car manufacturer is transforming its Neckarsulm site into a smart factory as part of Automotive Initiative 2025.

Other interesting topics included in this issue are the move towards more sustainable company processes, ways to increase the resilience of supply chains, security and data protection within cyber-physical systems, and the current capabilities of collaborative robotics. In all this, value creation is linked to one central factor: continuous learning. On pages 10 and 11 you can read all about the respective programs offered at TUM Campus Heilbronn.

In addition, we have some news about life at Campus for you: the coveted TUM Talk, TUM Connect, and CEO Leadership Series events; the collaboration of "Bündnis für Transformation Region Heilbronn-Franken" and TUM Campus Heilbronn, and the fascinating careers of some of our graduates.

We wish you an enlightening read!

Prof. Helmut Krcmar
Founding dean (2018–2020) and representative of the president
for TUM Campus Heilbronn

Finding opportunities in crises

Wars, skills shortage, climate change and multiple other crises are causing the world to falter. The digital transformation – focus of research being conducted at TUM Campus Heilbronn following the claim “for the digital age” – is taking place during a polycrisis. We need to gear up for it.

Characterized by the mutual reinforcement of singular crises, a polycrisis poses numerous challenges for the political and business world – all at the same time. This stage of transformation demands a lot from individual decision-makers and from society as a whole.

Now needed all the more, digital transformation is taking place in a type of perpetual crisis mode where no one crisis can be viewed in isolation from any other. Prof. Helmut Krcmar, Founding Dean and Representative of the President for TUM Campus Heilbronn, summarizes the situation by saying: "Climate change, power supply, and skills shortage, to name just a few, impact many companies' actions and thus the indispensable transformation process."

The situation revolves around the question of attitude and tools are needed not only to survive in the maelstrom of crises, but to be able to respond appropriately. How do companies have to change to weather current and future crises successfully? Prof. Krcmar says: "Empowering all involved parties allows organizations to master these many topics, including the journey of digital transformation."

He is certain that for the transformation to be a blessing instead of a burden, two main points must be considered: "First," he points out, "every journey has a destination, a vision. The company's strategic orientation is expressed in this vision. And then, to begin any journey you have to know the starting point so you can plan the next steps."

Disruptions can be opportunities for change

In addition to training future experts, TUM Campus Heilbronn has made offering effective continuing education programs and stimulating knowledge sharing part of its mission to advance the necessary digital transformation in corporate settings. Ultimately, companies need to implement the respective measures themselves, first and foremost the cultural transformation required for crisis management. John F. Kennedy has been quoted as saying: "The Chinese use two brush strokes to write the word crisis. One brush stroke stands for danger; the other for opportunity."

To facilitate shaping and implementing in unison, the tasks at hand are to design digital innovation from the top down, to promote it, and to introduce it to and anchor it among staff members. Staff members remain a crucial factor for success. It is an investment in their future and in the company's future so everybody can gear up for the digital transformation journey.

As part of the study titled "Fortschrittsbarometer Digitale Transformation" (Progress Barometer Digital Transformation), researchers at TUM Campus Heilbronn collected data concerning the extent to which companies in the Heilbronn-Franken region already have seized the opportunity to introduce the digital transformation.

Leveraging potential for value creation

The results of the study published in June 2023 show that on a broader basis companies are aware of the beneficial potential of the digital transformation; however, there are marked differences when it comes to implementing it. Despite diverse initiatives being launched, there has not (yet) been any comprehensive digital transformation to speak of.

The initiatives that are in place mainly are pragmatic ones that lead to visible results quickly. Only a few businesses are using digital technologies such as artificial intelligence and their potential for value creation, which can be significant. This must change. Also, we need to anchor the willingness to change and to invest in continuing education, knowledge sharing, and skills development.

Prof. Helmut Krcmar

Empowering all involved parties allows organizations to master these many topics, including the journey of digital transformation.

Prof. Helmut Krcmar

Sustainably into the future

Companies are operating in increasingly complex markets. They are expected to function economically and profitably and at the same time act sustainably and be resource-efficient. How can the level of sustainability of business processes become measurable and how can a transformation to more sustainable processes be accomplished? These are the areas of Prof. Luise Pufahl's research at TUM Campus Heilbronn.

Prof. Luise Pufahl

According to Prof. Pufahl, business processes must be thought about and defined backwards. She says: "The most important questions are these: What is the goal of the process? What do we want to achieve as a company?" When answering these questions, companies must keep in mind that because of the various requirements regarding the quality of products and services, cost pressure increases or decreases depending on market segment. The process chain of discounters, for example, varies from that of manufacturers of premium products. "And then you have to consider new technologies and other external influences that may require changing or adjusting existing processes," explains the professor of information systems and adds, "A third area which must not be neglected is legal regulations." Documentation plays an increasingly vital role. "Take hospitals, for example. It is crucial that they comply with the relevant laws and that they can prove they are doing so."

Processes mainly become complex through interconnections. Prof. Pufahl says about the challenges: "Most companies do not make their products or services independently; they collaborate with partners." If these partners fail to deliver data about how they execute processes, analysis only can focus on internal data. "Companies have vast amounts of customer data saved in CRM systems and information about company-specific processes saved in ERP systems. This data and information should be leveraged." The people participating in the process play an equally important role because, she says: "While IT has many advantages, it also has limitations."

However, the human component also can result in inconsistencies: "How and at what time in the process the staff members input the data is decisive," Prof. Pufahl states. The expert provides an example from healthcare, a field in which she has done extensive research: "If nursing staff members do not document the diverse medical procedures until the end of the shift because they lack the time and input masks are complicated, entries will be inaccurate and time stamps will be incorrect."

Ideally, documentation of steps in the process is supported by novel technologies and complies with predefined guidelines at identical points in the process. The framework set by target definition, the challenges of new technologies, data entry, and legal stipulations is highly complex as it is, and now it is exacerbated by the hard-to-measure sustainability factor.

No profit without the blue planet

While companies used to define the success of processes based on cost or lead time, for a while now a change in decision-makers' thinking has been observed. Sustainability has come to play a significant role in business decisions. Prof. Pufahl ventures a guess as to why this is so: "Companies realize they need to protect our planet over the long term if they want to continue operating. They are confronted with the risks and consequences of floods, fire, and other environmental disasters, and these are associated with a much higher cost than investing in sustainability now."

A clearly measurable value in production is product-related CO_2 emissions, but far more comprehensive data is available now. "Lifecycle assessment databases consider all the activities within a process including materials, transportation, and even the emissions generated by zoom meetings. The result is not just a CO_2 footprint, but an all-inclusive sustainability cost factor," explains the professor.

That is why a sustainable future is worth looking at. Prof. Pufahl notes: "CO2 emissions and investment in sustainability can make the difference between whether a customer opts for or against a company." All the more so because Informatics Professor Pufahl expects legal regulations concerning measurement and transparency in this area to be introduced over the short or medium term. Plus, she comments, it never hurts to be an "early thinker."

A digital twin for business processes

Laws are made by governments, but the expert and her team can provide the required level of transparency. Prof. Pufahl brings her research interest to the point: "We want to make business processes measurable." To this end, she and her students are developing SimuBridge, an innovative process simulator that makes it possible to simulate business processes and also to transparently present the sustainability costs of existing processes and future scenarios.

Prof. Pufahl explains that the first step has to be to map reality to the greatest extent possible based on the data already available. Complementing this data with the costs of sustainability activities is achieved, she says, as follows: "We create a link with the lifecycle assessment databases so that existing information can be retrieved automatically. In this way, we build a digital twin for business processes. This digital twin can be used to play out diverse scenarios and ultimately to define the cost factor of potential sustainability measures at every step of the process chain."

However, if collaboration partners are involved in business processes, obtaining reliable information regarding sustainability tends to be tricky. This is where transparency reaches its limits. What could provide support is blockchain technology which helps share trustworthy data among companies and obtain even more data for evaluation.

Prof. Pufahl's goal is to expand the values of traditional process simulators – cost, lead time, quality, and flexibility – to include sustainability as a fifth component. "This is where we want to merge process simulation and sustainability analysis of business processes, our two areas of research."

A pilot project is being developed along an internal university process, but the professor would like to see it extended to other applications. "We are interested in actual use cases and in collaborating with companies. Starting to establish sustainable processes today means making a sound investment in the future."

Data economy – a question of logic

The Heilbronn ecosystem brings together entrepreneurs, academia, research institutions, and new talent. In this unique value creation hub, smart artificial intelligence (AI) solutions are developed and tested to leverage the immense potential data has to offer.

Who hasn't heard the quote about data being the new oil? Just like oil, data takes time, money, and effort to localize, tap, and recover before it can be processed further. Without oil, the industrial revolution would not have taken place. Without data, there would not be the digital transformation we are experiencing today. Data is the raw material of the future – and a very valuable one at that.

The Federation of German Industries (BDI) estimates the value creation potential of the data economy at up to 425 billion euros by 2025 for Germany alone. For the whole of Europe, the value is forecast to go as high as 1.25 trillion euros. Dr. Bernd Bienzeisler, Head of Research and Innovation Center for Cognitive Service Systems (KODIS) at Fraunhofer IAO in Heilbronn, knows why the enormous potential of the data economy has not yet been tapped: "At the end of the day, no one will pay 425 billion euros for data. The issue at hand is the transformation of value creation as a whole; for that, we need a change in the logic of value creation."

> **The issue at hand is the transformation of value creation as a whole; for that, we need a change in the logic of value creation.**
>
> Dr. Bernd Bienzeisler,
> Fraunhofer IAO in Heilbronn

Added complexity calls for data economy

Whether to address customers with more accuracy, render processes more efficient, make more sustainable business decisions, or develop new products and services, data is a central value creation factor and the foundation of entrepreneurial resolutions. "Data in itself does not have any value. It is not until it is transferred to entrepreneurial action that value is created," explains Dr. Bienzeisler. What is needed to achieve that goal is a critical mass of data, that is, big data. This is where AI and automated data evaluation come into play.

For companies to be able to benefit from the diverse value creation potential of the data economy, they need to start by collecting data. "When I begin, I may not even know if I will use the data at all at some point or if maybe I will use it for some entirely different purpose," clarifies Dr. Bienzeisler. "In our projects, we call it the world

Dr. Bernd Bienzeisler is Head of Research and Innovation Center for Cognitive Service Systems (KODIS).

of options: If you have a lot of data, you have a lot of options. These options drive decisions which can be made based on specific data."

For example, quality-related data collected at the front of a customer's supply chain leads to improvements in service at the back – and not in sales. In addition, there are regulations to be considered. "The regulations concern certification and risk management. The European Artificial Intelligence Act is underway, and companies will have to deal with it," says Dr. Bienzeisler. "This brings us back to the logic of value creation; it complicates things for large companies, and especially so for small companies that struggle with scarce resources."

Elevating the site and the region

Highly qualified technical staff members at mid-market companies have their hands full with day-to-day operations and cannot find time to learn about data products and data processes. In turn, data scientists are in short supply. What the industry needs is new talent.

This is one reason why Fraunhofer IAO is working closely with TUM Campus Heilbronn and in particular with its Center for Digital Transformation. The Head of KODIS appreciates the synergies this partnership brings about: "TUM Campus Heilbronn has excellent students we would like to take on board as staff members at some point. There also is an interest at TUM for graduates to go into applied research." Regional companies can draw from this talent pool and benefit from the international networks TUM and Fraunhofer IAO have established.

Bildungscampus and IPAI: a powerful alliance

Ultimately, the partnership is about assisting companies in the development of innovative digital business models over the course of projects. The research activities focus on developing data-driven solutions for complex service systems based on AI processes and machine learning. Dr. Bienzeisler illustrates: "TUM places more emphasis on fundamental and strategic topics, while the work of Fraunhofer IAO is implementation-oriented and can even include developing software."

There are many reasons demand on the side of companies is growing. For instance, as part of the Automotive Initiative 2025 (AI25), Audi is transforming its Neckarsulm site into a smart factory. This is an example of outstanding collaboration within the Bildungscampus ecosystem that is under development at Innovation Park Artificial Intelligence (IPAI) Heilbronn with state-of-the-art infrastructure and test fields for AI-based products and services. (Read more about AI25 on pp. 20 through 23.)

According to Dr. Bienzeisler, companies first must be sensitized to the topic of research and development. "You have to talk to the companies, build trust." He noted that ChatGPT has been the latest to demonstrate that AI stops for no one and in principle affects every workplace. "That has flicked the switch in people's minds," he says. "It is similar to the introduction of the internet – some believed it would pass."

Keep learning and evolving

Continuous learning is crucial. We asked Caroline Hoffmann, Division Director Continuing Education, about the program of bespoke courses offered at TUM Campus Heilbronn gGmbH.

Ms Hoffmann, knowledge is suspected to have an increasingly short half-life. How can continuous learning counteract that?

Caroline Hoffmann: First of all, I would like to emphasize that not all knowledge loses relevance over time. Basic knowledge endures: It continues to develop along new insights; it is updated and complemented. This is where continuous learning comes in. Once you understand the fundamentals, you will be able to deal with things that are new to you. This means that when we speak about continuing education for specialists and executives, we are referring to proficiency at a conceptual level in the sense of upskilling and reskilling, that is, building and expanding the competencies of a company's staff.

What should companies and their staff members bring to the table to have the best possible experience on this individualized path of continuing education?

Caroline Hoffmann: Due in part to the current skills shortage, more and more companies are realizing that organizational development and personnel development must go hand in hand; the two cannot be viewed separately. This is where continuing education and qualification come into play to take people to where they need to be.

Another vital factor is "fallback management" in the form of space, time, and budget so lessons learned can be put into practice and anchored and the motivation for change does not fizzle out in everyday life. In addition, I believe reflection is an essential component of any effective continuing education.

In what way can the continuing education programs at TUM Campus Heilbronn contribute?

Caroline Hoffmann: Our portfolio encompasses several formats, from compact seminars to intensive course formats lasting weeks or months on a variety of topics – and we expand it continuously. We want the aspects of the relevant topics we convey in a custom-fit manner to be as comprehensive as possible. Our students – be they specialists, executives, managers, or business owners – should be able to take what they learn and implement it at their respective companies. The requirements regarding the continuing education format are defined by the role in the company.

Our program portfolio is made up of three pillars: seminars and certificate programs, company-specific programs, and programs for young professionals including the master's in management and innovation and the summer school program which is conducted in cooperation with HEC.

What are the thematic focuses?

Caroline Hoffmann: Our current thematic focuses are aligned with the needs of the companies in the region. When we define themes, we naturally take into consideration the topics that play important roles here at TUM Campus Heilbronn. After all, our campus is "for the digital age", that is, everything that has to do with digital transformation. The goal is to expand our offerings gradually.

To what extent do digital transformation processes and continuous learning depend on each other?

Caroline Hoffmann: Every type of transformation means (further) development. Therefore, continuous learning and the resulting increase in expertise or expansion and updating of staff members' skills are crucial for an organization's transformation. The competencies available within a company can be used to maintain and, if necessary, expand the existing level of value creation.

Sebastian Merken, Senior Coverage Specialist Wholesale, Deputy Head of Key Account Management at DVAG:

"I was looking for an adequate continuing education program in the field of sustainability. My expectations regarding the program were met fully. What stood out were the lecturers and the wide variety of topics offered over the course of the eight modules. One of my main lessons learned is that sustainability is not only a trend – we must continue to sensitize our customers to the issue and its necessity. Impact-oriented solutions are becoming increasingly important." ●

Caroline Hoffmann, Division Director Continuing Education

Sebastian Merken, participant "Sustainable Investing"

Continuous learning at TUM Campus Heilbronn

Our bespoke certificate programs offer professionals in the Heilbronn-Franken region an unparalleled, substantiated, and sustainable continuing education experience at all levels in their careers.

Our current programs:
Business Design & Innovation
Design your Business
Healthy Leadership
Mastering Digital Transformation
Sustainable Investing

For more information, please go to
tumheilbronn-ggmbh.de/continuing-education

Guaranteeing safety when dealing with CPS

Making life easier – this is often supported by so-called cyber-physical systems (CPS). They interact independently with their environment, control and monitor it, and enable our cars to drive autonomously, for example. Prof. Amr Alanwar is conducting research at the TUM Campus Heilbronn on safety guarantees and data protection of CPS.

From smart grids to self-driving cars: cyber-physical systems, or CPS for short, are highly complex physical objects. They are interconnected via networks and information technology, interact in real time and assume safety-critical control functions. This applies not only to the control of production plants, energy networks or medical equipment, but also to automated and autonomous driving, where networked embedded systems take on important planning and control tasks. But how can the safety of vehicles on the road be guaranteed in autonomous driving?

This is the main focus of Prof. Alanwar, whose research at TUM Campus Heilbronn deals with data privacy and safety guarantees of CPS. „In the case of autonomous driving, this means ensuring that the autonomous vehicle does not collide with an obstacle such as another car or a pedestrian and cause an accident," illustrates the professor from the TUM School of Computation, Information and Technology. The V2X (vehicle-to-everything communication) is relevant here. It enables the exchange of real-time information and data between a vehicle and its environment, consisting of other road users, infrastructures, etc.

Data-driven approach

The goal is to guarantee that an autonomously driving car is safe at a given location. This is where set-based calculations come into play. „Instead of a single point where the car is located, we calculate a set of all possible locations that can be expected and guarantee the safety at all locations," explains Prof. Alanwar. There is also a focus on ensuring data privacy to ensure the privacy of all participants in the autonomous vehicle's environment.

Instead of the usual models, data – such as the car's position or speed – is used to derive predictions for the future. According to Prof. Alanwar, the idea is to provide safety guarantees by building a set containing all possible models from data for the car and checking the intersection between the predicted set and possible obstacles. „If there is no intersection, we can guarantee safety. However, if there is an action in the future that leads to an intersection, it marks a safety violation."

Safety-guaranteed reinforcement learning

Reinforcement learning plays an important role in this process. In this form of instrumental learning, algorithms are trained using a system of rewards and punishments. An algorithm conditioned in this way learns without human intervention by interacting with its environment. It is rewarded for correct behavior and punished for misbehavior. „Learning by trial and error," is how Prof. Alanwar sums it up. „What is special about our system, however, is that it learns without making mistakes. We teach the machine to perform good actions to get the best control – and without making unwanted errors." He calls this safety-guaranteed reinforcement learning.

The status quo, however, is still far from the level of safety the industry is striving for. As part of a collaboration with the Royal Institute of Technology of Sweden and Swedish commercial vehicle manufacturer Scania, the professor is working to maximize road safety in autonomous driving. „The most important thing is to protect life. We must not put that at risk," the researcher emphasizes.

So it will still be some time before fully automated driving becomes a matter of course in our everyday lives. „A one-hundred-percent guarantee of safety takes time, and research must mature before it can be implemented on an industrial scale," says Prof. Alanwar, venturing a look into the future.

> **A one-hundred-percent guarantee of safety takes time, and research must mature before it can be implemented on an industrial scale.**
>
> Prof. Amr Alanwar,
> TUM School of Computation, Information and Technology

Prof. Amr Alanwar conducts research on the security guarantees and data protection of CPS.

AI with manual dexterity

People and machines make strong teams, says Prof. Sami Haddadin, Holder of the Chair of Robotics and Systems Intelligence at TUM and Executive Director of the Munich Institute of Robotics and Machine Intelligence (MIRMI). In an interview, he described the state of collaborative robotics research.

Prof. Sami Haddadin conducts research in the fields of robotics, AI, and people's motor intelligence.

Prof. Haddadin, your research starts at the interface between people and intelligent machines. What are you and your team researching at the moment?

Prof. Haddadin: Since the spring of 2019, we at the research center in Garmisch-Partenkirchen have been working on geriatronics. We develop robots that can assist the elderly with everyday chores and also help nursing staff at hospitals.

Can you elaborate?

Prof. Haddadin: Our flagship research is on GARMI, a humanoid service robot. GARMI moves on wheels and features two flexible robotic arms equipped with special functions, for example, a tactile sense – an example of tactile robotics.

The plan is for GARMI to assist elderly people with everyday activities, for example, gripping a glass or cup and serving water or tea. As in physiotherapy, the robot can conduct mobilization training for patients. Also, physicians can employ GARMI as an extended arm for communication: They can talk to and directly help patients without having to be in the same room.

Modern telemedical applications in tactile robotics even include palpating people and/or carrying out ultrasound exams.

Let's take a look at other fields of application, for example, production processes. For what tasks does it make sense to incorporate machines that interact autonomously?

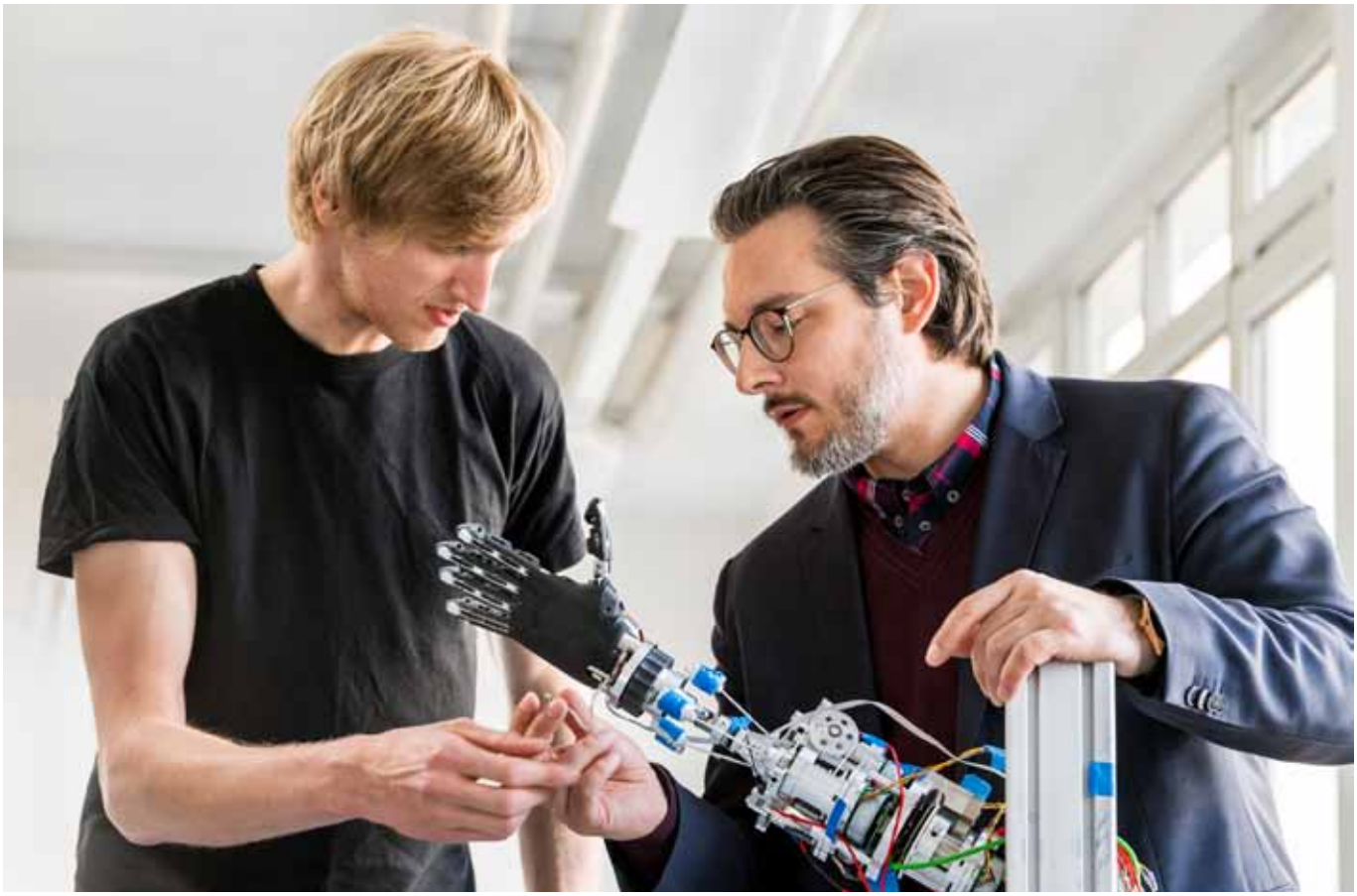
Prof. Haddadin: Generally speaking, collaborative robots, which enable people and robots to be at the same place of work, have revolutionized the options for interaction among people and machines.

The next step on the route to an intelligent all-purpose tool also is tactile robots that enable collaboration and at the same time are able to conduct processes that so far were not thought to be automatable. The main fields include assembly, inspection, and testing. Tactile robots combine power and precision with sensitivity; they can perceive their environments and thus are capable of acting autonomously in them. These robots are extremely safe because they have manual dexterity, even in their fingertips. The most recent addition is a particularly simple way to control these robots via apps to make their operation even more intuitive. Another field in which work currently is at full throttle is the self-teaching of new skills for intelligently connected robots.

What do you see as the greatest potential for application for tactile robots?

Prof. Haddadin: In production and logistics; this was not least shown during the pandemic. Tactile robots are our chance to deliver supplies cost-effectively and locally. I expect great strides will be made in this area over the next few years because the technology maps society's actual needs.

The same applies to our overstrained health and nursing sectors. In the future, intelligent robots will offer substantial support to doctors and nurses for in-home and hospital care, including in infectious or harmful environments. Other examples include the production of medication and vaccines in autonomous intelligent labs, and robot-based diagnostics and rehabilitation. An important core technology in all this is telepresence, that is, controlling robots remotely as avatars.



Tactile robots are extremely safe because they have manual dexterity, even in their fingertips. Prof. Haddadin and his team are working continuously to improve it.

What type of training do users need to be able to apply the technologies in an informed and self-determined manner?

Prof. Haddadin: The type of training depends on the target group. In geriatronics, for example, it is imperative that we allay the much-discussed "fear" of new technology, particularly among the older generation. "Roboterfabrik Senior", a project that is unique in this country, aims to train elderly people to use new technologies in a targeted manner at our premises.

In general, we are working to make the operation of our systems simple and intuitive, for example, with apps. The "Campus Geriatronik" we are planning to establish in Garmisch-Partenkirchen is the best-case scenario. The site will be an integrative campus for care, education, and research. In addition to TUM research institutions, it will feature a Caritas-operated care center including assisted living facilities. At the on-site training center, nursing staff can learn about technical robot and AI developments and be trained accordingly.

How can collaborative robots contribute to value creation now and in the future in cooperation with their human colleagues?

Prof. Haddadin: One of my hypotheses is that people and machines make better teams than teams comprised of only people or only machines. Let's take a chess-playing computer, for example: People invested a lot of time into developing this computer. When the machine defeated the human grandmaster, it exceeded human

“Humans are particularly good at identifying tools as tools and using them to their advantage,” says Prof. Haddadin.

performance. In the next step of development, however, the grandmaster working with the machine beats the machine working alone. Humans are extremely good at identifying tools as tools and using them to their advantage.

What we are doing here – by combining artificial intelligence and robotics – is moving from the virtual to the physical world; we are constructing AI with a body, so to speak. The pandemic has made it very clear how important the physical world is: Not everything can be digitized, automated, and managed on computers. Work in hospitals, in the care sector, and in numerous system-relevant institutions requires the physical presence of humans and their skills. These skills cannot simply be simulated. In terms of developmental theory, man is a generalist, a strange creature that is not good at any one thing, but is capable of achieving greatness by combining these sometimes modest abilities. Going forward, intelligent robots can have a great impact in this field.

Where might this journey lead?

Prof. Haddadin: That depends on the course we set today and on the investments we make. All the outlooks I could give you – caregiving robots, autonomous flying taxis, small intelligent drones, automated pickup and delivery services, medical assistants in rehabilitation centers, personalized medicine – cannot become fact unless we as a country and a society are ready to invest time, effort, and money and to create the required infrastructure, both technological and scientific.

All eggs in the blockchain basket?!

Crises put pressure on supply chains. Data exchange among the players involved and new financing models could make supply chains more resilient. Blockchain has the potential to ensure the required transparency.

In the spring of 2022, China's zero-COVID politics almost brought global commerce to its knees temporarily. About three percent of the world's container freight capacity accumulated in front of the Port of Shanghai. At the same time, the start of the war in Ukraine began to thwart global trade.

"Crises can bring supply chains to a halt," says Sairam Sriraman, a doctoral student who conducts research on increasing the resilience of supply chains with Prof. David Wuttke at TUM Campus Heilbronn's School of Management. "There will always be crises. The keys to restabilizing supply chains include keeping a flexible mindset and selecting suitable solutions and the right toolset," explains Prof. Wuttke.

Exchanging data among players

Prof. Wuttke believes one key is for companies to think about how they can best share data to remain effective even in times of crisis. He emphasizes two facts in this context: Data does not equal information – it only becomes information when it has relevance; and, companies need to decide what type of information they can share without detriment to themselves.

> **Blockchain can provide consistent transparency, but only if it helps all those involved.**
>
> Prof. David Wuttke,
> TUM School of Management

Prof. David Wuttke (l.) and Sairam Sriraman (r.) conduct research on increasing the resilience of supply chains.

In Sairam Sriraman's opinion, knowing which suppliers deliver to their suppliers would give buyers an edge over the sellers because it would facilitate ordering products directly from those suppliers. "This is why suppliers should only disclose information that is relevant to their business partners but does not harm the disclosing company," Prof. Wuttke recommends.

Prof. Wuttke conducted a study to determine, for example, whether suppliers should notify business partners about delivery problems. The results of the study indicated that in some cases it can be useful to share information about financial issues because the business partner may buy more product or may pay upfront to help the company through the bottleneck. "From the supply chain perspective this is a double-edged sword, of course," says Prof. Wuttke. "On one hand, using information and data jointly is a good thing if all parties involved are headed in the same direction and want to reach a greater goal. On the other hand, the information could be misused to the detriment of the companies."

Blockchain can revolutionize supply chains

This is where blockchain technology comes into play. It delivers all the relevant information in real time. The data is deemed to be reliable because it cannot be manipulated after it has been input. It is saved in a decentralized manner in spread-out ledgers, that is, recording systems that can be used to track movements of values. Because the parties involved remain anonymous, there is no danger of being ousted when the technology is used intelligently. Prof. Wuttke brings the point home: "The supplier can share all the data that is important to the transaction and encode the conditions it has agreed upon with its suppliers to avoid jeopardizing its negotiating position."

Used differently, blockchain can provide consistent transparency – but only if it helps all those involved. If this is the case, blockchain even can have a positive influence on financing in supply chains. "Blockchain is an enabler because in traditional financing systems companies only have limited access to their partners' risk profiles. The technology helps retrieve this type of information and make sound decisions," Sairam Sriraman clarifies. He and Prof. Wuttke aim their research at enabling companies to establish robust financing programs for their supply chains. Sairam Sriraman makes one thing clear: "Blockchain alone will not solve any problems; it takes good management to make sensible and sustainable use of this technology."

Regional companies have identified the need

Prof. Wuttke knows that due diligence tasks such as Know your Customer (KYC) and Anti-Money Laundering (AML) must be assured when blockchain is used. "It is time for pioneers to find out how blockchain works in supply chain networks and how we can deploy the technology in a way that makes sense," he insists, and adds, "Companies in the region have identified the need for financing supply chains." He says that while blockchain-driven supply chain financing is not on every company's agenda yet, "companies see it as a new opportunity to increase liquidity among diverse players in the supply chain and already are thinking about how to integrate it."

Prof. Wuttke and his team are working on this topic closely with globally renowned scientists. He is certain that "at the end of the day, the findings will make a difference here in this region as well."

Living the digital lead

Automotive Initiative 2025 is transforming Audi's Neckarsulm site into a smart factory. A large portion of the scientific expertise for this project originates with TUM Campus Heilbronn. The digitally well-versed staff is a key piece of the puzzle.

Böllinger Höfe play a vital role in the development of digital solutions for Audi's factory of the future.

Production processes that enable real-time communication among plants and logistics systems so products can be made as efficiently and profitably as possible without losing sight of the staff members – this is the vision of a smart factory, highly digitized and automated industrial manufacturing.

The Audi automotive group is well on its way to achieving that goal. It initiated Automotive Initiative 2025 (AI25) to build a world-leading network of digital factory transformation competencies. Audi's Neckarsulm site will be turned into a pilot factory and living lab for the digital transformation.

The car manufacturer has sought excellent support for the transformation process: At Bildungscampus in Heilbronn, Audi is working closely with Technical University of Munich (TUM) and Fraunhofer Institute for Industrial Engineering (IAO). "We are pursuing new scientific approaches," says Stefanie Klarner, Continuing

Education Officer at Audi in Neckarsulm. “When we started out, industry and science were two entirely different worlds: On one hand was the desire for simple, easy-to-implement solutions; on the other was scientific meticulousness. Over time, we have managed to strike a very good balance in our collaboration. We greatly appreciate the diversity of perspectives in this partnership.”

Supporting, understanding, and shaping digital transformation

Back in 2021, the partners prepared a whitepaper identifying topics critical to the success of production and logistics in the digital factory transformation. They defined seven fields of action concerning people, organization, and technology, one being digitally well-versed staff. (Read more in the info box on page 23.)

The goal is not to turn each and every staff member into a data scientist and AI expert; however, all staff members must gain a basic understanding of digital technology and be able to identify application opportunities and risks. Stefanie Klarner is in charge of Audi’s digitally well-versed staff project. “Staff members will always play a central role. We need broad support from people who help drive, and thus bring about, the digital transformation,” she states.

The digital transformation concerns all Audi staff members – in production and in the other departments. “Digitization stops for no one; it touches on all realms of life,” says Stefanie Klarner. She continues, “Therefore, it is on us to figure out ways to prepare all employees for the future to ensure they are well equipped and, within their work context, are able to understand the benefits of driving the digital factory transformation in a consistent manner. Ideally, digital technologies make life easier for all of us.”

Assisted by artificial intelligence, a new light tunnel in the assembly line at Böllinger Höfe detects even the tiniest irregularities in finished vehicles.

“Digitization stops for no one,” says Stefanie Klarner who is in charge of Audi’s digitally well-versed staff project.

Appetite for digital technologies

For Stefanie Klarner’s colleague Pascal Romeiss, Speaker for the Works Council, it is important to get people in a positive mood for progress and to prevent fear from arising at all: “With targeted information and communication we can counter any potential concern that digital technologies make jobs obsolete. Instead, we want our colleagues hungry to engage with new technologies,” he states.

Both Pascal Romeiss and Stefanie Klarner deem two factors to be essential: Number one is people’s mindset vis-à-vis digital transformation; number two is bespoke training and continuing education programs for employees to convey the required skills.

digital. versed. strong

In the spring of 2023, the Audi project team used scientific input provided by TUM and Fraunhofer IAO to deduce the focal topics to be considered at Audi. The goal was to implement support and education programs for all employees so they could gain the skills they need to move forward securely and autonomously in a digitized, data-driven work environment and help shape this environment actively. Through these measures, Audi is promoting a digital mindset as an enabler of the successful digital transformation of its factory.

Last fall, Audi in Neckarsulm launched a campaign titled “digital. versiert. stark.” (digital. versed. strong). Roll-ups and posters display testimonials of staff members from all departments. Stefanie Klarner clarifies: “The first step in the campaign was to make people curious. The messages are intended to explain the concept of digital mindset and what it comprises.”

Initial learning nuggets were imparted in the form of a quiz aimed at sharing knowledge about digitization. This is why participation was not linked to correct answers. The goal was that at the end of the quiz each participant would know twelve important terms regarding digitization at Audi.

Self-assessment developed at TUM

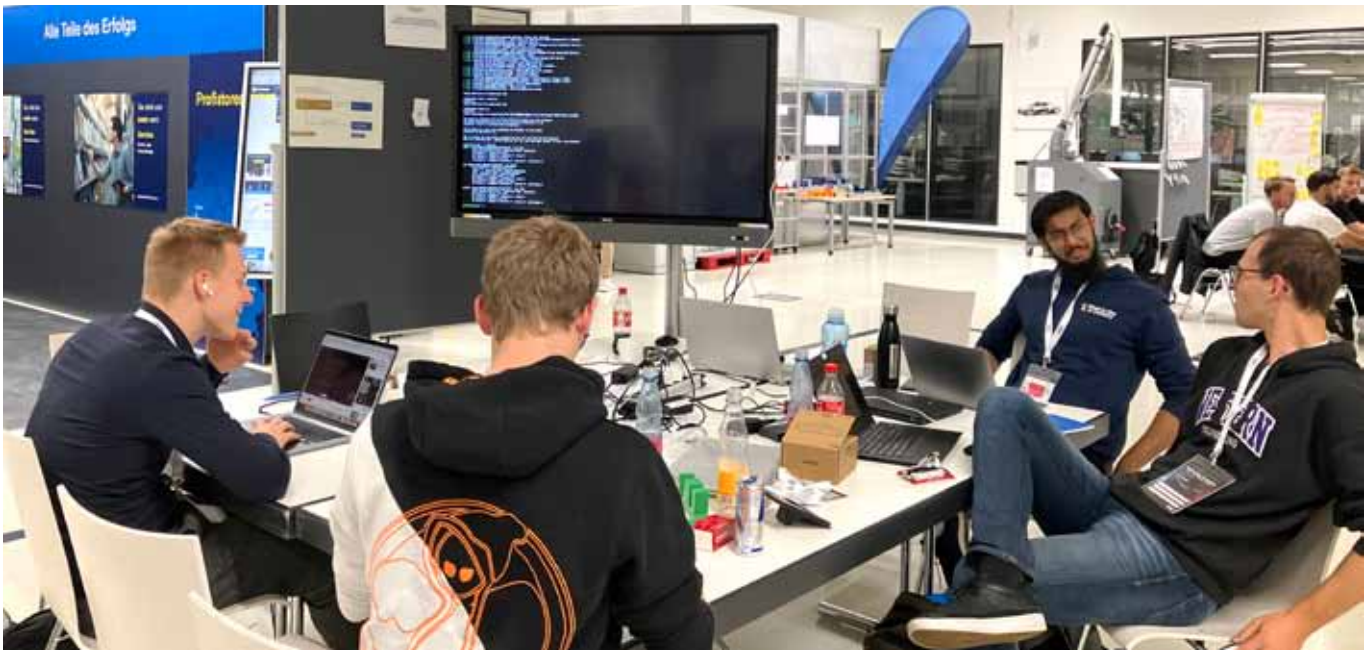
A self-assessment program being developed for Audi at TUM Campus Heilbronn will be the starting point and an essential building block on this learning journey. Users will be able to estimate their basic digital proficiency rather than their specific knowledge of individual applications or their programming skills. Basic digital proficiency refers to the simple understanding of fundamental skills for handling digital technologies in work environments and keeping an open mind towards them. “The self-assessment program is not used to test competencies. We are not interested in determining who knows what, but rather we want to support staff members and give specific advice on where they can start learning,” Stefanie Klarner clarifies. Together with Pascal Romeiss, she emphasizes that the approach is not one-size-fits-all. They want to enable staff members to design their individual learning journeys, as intended by life-long learning.

In addition to helping staff members estimate their own digital competencies, the results of their self-

Kreathon living lab

Digital transformation requires grassroots work. At the Kreathon living lab which took place from October 13 to 16, 2023, Audi gained novel ideas from creative participants. The hackathon addressed all those eager to develop smart IT products at the premises over the course of 96 hours and introduce and test their prototypes. The winning prototypes were presented by teams Clippy, AudiLense, and Nautilus. The sponsor of each project received a budget to initiate the implementation of the team’s solutions.

Organized by Audi Sport GmbH, Kreathon was held at Böllinger Höfe in Heilbronn. The Audi Sport team has assumed a vital role in the development of digital solutions for Audi’s factories of the future. Primarily with their methodic expertise, the partners of AI25 assisted with identifying the topics suitable to be processed during Kreathon from among those proposed by the departments.



For 96 hours, the teams competing at the Kreathon living lab tried their hands at finding innovative solutions.

assessments will provide them with concrete recommendations for learning and will reiterate the vital role played in digitized work environments by tools, data, and skills. Corresponding learning opportunities to help staff members expand their digital proficiency will be available in the newly developed Learning Experience Platform.

Digital transformation is a marathon

The executive dialog will be continued throughout 2024 to identify other specific demand. Focus will be on implementing learning opportunities for all. Stefanie Klarner explains: “Digital transformation is not a sprint, it’s a marathon. It is not about teaching employees just anything quickly. Instead, the goal is to impart the right thing at exactly the right time.”

The scientific foundations developed in cooperation with TUM in Heilbronn have provided useful impetus. “With an approach as novel as digitally well-versed staff, it takes time to succeed in deducing practical applications from scientific theory – and we are taking the time,” says Stefanie Klarner.

Digitally well-versed staff

Professor Helmut Krcmar, Founding Dean and Representative of the President for TUM Campus Heilbronn, views digital proficiency as fundamental to successful digital transformation. Proficiency means having extensive experience and skill in a specific area. To this effect, digital competencies play a key role for staff members to expand and complement their skills.

“Compared to skiing, digitally well-versed encompasses various levels of competence,” Prof. Krcmar explains, and adds, “Not all employees have to be able to master black runs, that is, develop new machine learning solutions, for example. However, to be digitally well-versed, they have to know about black runs and be able to master the easier blue or red runs.”

The construction line for the Audi e-tron GT body uses correlation-free measuring techniques that, for example, perfect the dimensional accuracy of gap measurements.

Ready, graduate, go!

TUM Campus Heilbronn graduates are in demand at companies in the region – or become successful entrepreneurs. Aqsa Kazmi and Andreas Köckeis show how it is done.

Heilbronn – why not?

… thought Aqsa Kazmi when her academic path led her to Germany and on to TUM Campus Heilbronn. "I attained my bachelor's degree in electrical engineering in Turkey and took German courses for extra credits. This drew my interest to Germany." Born in Pakistan, Aqsa Kazmi grew up with three sisters. As well as the convenience of the location and the courses offered, TUM Campus Heilbronn provided another critical advantage: "My twin sister applied for the same master's program in management and also was accepted – we were very lucky," she says and smiles. Having her twin sister nearby made the decision easier for Aqsa Kazmi and allayed their parents' concerns.

Aqsa Kazmi works at Würth as a project manager.

Aqsa Kazmi's preparation for Germany was target-oriented: "I studied German every day and every night for ten months." Designed for international students, the master's program in Heilbronn is conducted in English and matched Aqsa Kazmi's level of proficiency. "I wanted to study in a field where I would be able to use my technical background," she explains. She started out working at a small consulting firm in Munich and after graduating in 2021 she moved on to Digacon in Stuttgart. "What I like best about my work is being in an international environment with people who have diverse perspectives and mindsets."

Many roads lead to the region

As fate would have it, Aqsa Kazmi's path led her closer to her former workplace: "In October, I became a project manager at Würth in Künzelsau." During the first year of the master's program, she came in contact for the first time with the Würth Group, the world's largest supplier of fastening technology, when TUM Campus Heilbronn invited company representatives to visit. Aqsa Kazmi's twin sister subsequently took a job with the group and before moving on to Frankfurt, she shared information about the vacancy – and the rest is history. Aqsa Kazmi describes the region as being full of opportunities, the people as open-minded, and the businesses as

innovative. These are prerequisites for the ambitious TUM graduate: “I couldn’t survive in an environment where things don’t move,” she explains and adds, “It is not uncommon here to see people with international roots in executive positions. This young woman from Pakistan is trusted to overcome great challenges.”

“I have come to know and love the beauty of the state of Baden-Württemberg, be it the charming city of Heidelberg or the massive waterfalls in Bad Urach,” Aqsa Kazmi gushes. Two years ago, she met her partner who is from the state capital and this ultimately motivated her to plan a long-term future in Germany. However, she misses her parents a lot: “Fortunately, my twin sister lives in Frankfurt and we see each other regularly.” When asked about the biggest challenge she faces in Germany, Aqsa Kazmi does not hesitate to answer: “The tax returns – especially because I work part-time as a coach for Campus Founders and thus have two jobs. That complicates things.” On a final note, Aqsa Kazmi suggests: “Digitizing processes would make many things easier.”

The kick-start for a start-up

“Nothing brings you more knowledge, experience, and growth than being self-employed,” says Andreas Köckeis, CEO and co-founder of the start-up Univents, an online platform for event management. A TUM graduate, Andreas Köckeis was born and raised near Munich and completed his bachelor’s in chemistry in the state capital. Moving on to doing a complementary master’s program in management at TUM Campus Heilbronn was a logical step for him: “I had plans to go the entrepreneurial route and I wanted to leave Bavaria.”

Andreas Köckeis describes his initial time in Heilbronn as very relaxed and the atmosphere as familiar: “For the first time, I felt I was experiencing true student life.” In 2019, still during the master program, Andreas Köckeis joined Campus Founders and one year later Univents GmbH with registered offices in Marbach was founded. For his master’s thesis, he combined theory and practice by conducting research about his own start-up. “Being able to directly link my scientific work and its practical application in my company was a huge advantage,” he emphasizes. Despite the hardship, CEO Köckeis is positive about his path so far: “If you follow your own vision, you don’t dread working 14-hour days because you know why, and especially for whom, you are doing it.”

Every beginning is difficult

Andreas Köckeis and his three co-founders made their first money from ticketing. “The problem is that ticketers are a dime a dozen. Because we needed a unique selling point, we extended our portfolio and now we offer to take care of the overall management behind events,” the young entrepreneur explains. His company also has introduced an event operating system that prepares contracts, invoices and quotations, and controls booking management. For Andreas Köckeis, founding a start-up has its pros and cons: “There is a lot of bureaucratic work, and the General Data Protection Regulation adds a whole other level of complexity, especially for start-ups.”

Nevertheless, the young, motivated team members were not demoralized by the red tape required to bring their vision to life in a region with a number of advantages. “Heilbronn is extremely dynamic and is located conveniently between larger cities.” And there is more: “The city has a good network of investors ready to put their money into start-ups.” Even so, Andreas Köckeis says he misses having role models who can share practical experience. In his opinion, the knowledge conveyed typically is very theoretical. Surprisingly his business has been driven mainly by the club scene: “This scene is well represented in the region and relies on Univents as a partner. Ten collectives mushroomed in Heilbronn during and despite the COVID-19 pandemic.” Andreas Köckeis adds that regional providers such as Diginights can help Univents achieve its next goal. “We want to become profitable in the near future.”

Andreas Köckeis is co-founder of the start-up Univents.

Evolution through transformation

To help even well-established regional companies overcome the enormous challenges of digital transformation, the alliance titled Bündnis für Transformation Region Heilbronn-Franken has made it its mission to provide these businesses with the best possible support.

At first, the alliance was made up of the Federal Employment Agency; IG-Metall Neckarsulm, Schwäbisch Hall und Tauberbischofsheim; the Heilbronn-Franken Chamber of Crafts; the Heilbronn-Franken Chamber of Industry and Commerce; Bürgerinitiative pro Region; the cities of Heilbronn and Neckarsulm; Südwestmetall; Wirtschaftsförderung Raum Heilbronn; and Wirtschaftsregion Heilbronn-Franken. The district of Heilbronn joined later.

The goal is to accompany and provide advice to traditional industrial sectors, in particular small and medium-sized companies, on their paths to the digital age. Working together despite being competitors.

Development through research

Although the cumulative expertise from society and business players was extensive, one piece of the puzzle was missing: education and research. To fill the gap, Heilbronn University of Applied Sciences (HHN) and TUM Campus Heilbronn got on board. For Daniel A. Gottschald, Managing Director of TUM Campus Heilbronn, it was a logical step: “By partnering with the alliance we are assuming responsibility for Heilbronn and the region. We want to help shape change because this is our home!”

f.l.t.r.: Dr. Andreas Schumm (Managing Director of Wirtschaftsregion Heilbronn-Franken), Steffen Hertwig (Lord Mayor of Neckarsulm), Dr. Rudolf Luz (Deputy Chair of pro Region Heilbronn-Franken e.V. and Deputy Coordinator of Bündnis für Transformation), Dr. Patrick Dufour (Managing Director of Wirtschaftsförderung Raum Heilbronn)

Achieving this goal means sharing technical expertise and coupling the corporate sector with Bildungscampus in Heilbronn. Study, teaching and continuing education programs benefit companies and expanding the network of companies helps educational institutions. Because

TUM Campus Heilbronn specializes in dovetailing digitization, technology, and management, it is a trusted advisor for active commercial enterprises and associations. Working together to head into the future.

Advancement through cooperation

The “Transformotive” project symbolizes the speed at which Bündnis für Transformation Region Heilbronn-Franken is bearing fruit. The alliance followed the Federal Ministry for Economic Affairs and Climate Action call to promote regional transformation strategies for the vehicle and vehicle parts supply industries, submitted a convincing concept, and landed subsidies in the double-digit millions. “Transformotive” is another successful collaboration among experts from society, politics, the economy, and the education sector.

The project is focused on small and medium-sized companies facing entirely new challenges, particularly businesses in the automotive sector. The evolution from combustion engines to e-mobility, along with the ensuing transformation of production processes and the conversion to digital work, all require new knowledge and skills. To support them at exactly this stage, “Transformotive” offers programs in six areas: project management, communication, controlling, network formation, data analysis, and strategy implementation. Working together towards an integrated and sustainable mobility economy.

Upswing through data

Data exchange plays a vital role in trusting collaborations. To succeed in their value creation activities, small and medium-sized companies can draw on valuable research data provided by educational institutions. Capacity is expanded, and a wide range of opportunities opens up that these companies never would have been able to attain working alone. One important aspect is that the expert knowledge available not only concerns machine processes; staff members can become qualified specifically to carry out novel, future-oriented activities.

In turn, TUM Campus Heilbronn keeps its finger on the pulse by obtaining data relating to business practices and using it to identify and pursue even more targeted research approaches. Bundling knowledge further increases the region’s economic upswing. In the ranking of regions with the best outlook going forward, the Heilbronn district currently holds tenth place and comes in sixth in the competition and innovation category. Working together on the way to the top.

“We need to talk”

may be one of the most alarming phrases uttered in any relationship and tends to mean trouble – but not so much when TUM Campus Heilbronn invites guests for discussions at Bildungscampus. During TUM Connect and TUM Talk, representatives of the industrial sector come together with enthusiasts and experts to engage in constructive dialog.

Participants of TUM Connect and TUM Talk have ample opportunities to discuss, network, co-create, and be inspired.

Practice and science united

“Discuss, Network, Co-create”, the claim of the TUM Connect series, perfectly reflects its agenda. Once a year, staff members from companies in the region join TUM experts at Bildungscampus to discuss topics of relevance. Because the events take place in a Speakers’ Corner format that includes diverse themed stations, the content is varied, individualized, and at the same time flexible.

Practice and science are linked through direct dialog: One side is made up of company representatives having to face the challenges of a constantly changing labor world; the other side is made up of expert researchers. At TUM Campus, both groups have the opportunity to connect and solve problems together. Thus, the event series merely kicks off future partnerships; solutions will be developed in unison in subsequent sessions. This format allows everyone to help shape innovation processes actively.

Connect to talk

At TUM Talk, the institution’s three letters do not just stand for Technical University of Munich, but also for “Think, Understand, Manage”. The panel discussions unite scientists, entrepreneurs, and top managers. Dialog among clever minds at Bildungscampus offers participants and the audience new food for thought on the route to the digital age.

Listeners have an opportunity to understand factors leading to success, adapt knowledge, and learn from other people’s problems. The event turns the TUM Campus auditorium into a place of orientation and inspiration and shows once again how top-caliber scientific research can deliver crucial foundations for critical decisions. While ultimately it is left to the audience members to decide what path they want to take, having access to a reliable compass cannot hurt.

Face to face with CEOs

Nobel Prize winner Albert Schweitzer said, "Example is not the main thing in influencing others. It is the only thing." In the CEO Leadership Series, top executives illustrate how leading by example is done. The series was initiated by Chengguang Li, Professor of Strategic Management at TUM Campus Heilbronn's School of Management.

Prof. Chengguang Li again welcomed inspiring executives to the CEO Leadership Series at TUM Campus Heilbronn.

In the 2023/24 winter semester, students again had the opportunity to get up close and personal with influential CEOs from leading global companies. An extremely wide gamut of industries was represented this season including healthcare, mechanical engineering, retail, and services. Common among the top-caliber executives participating was an innovative frame of mind and future-oriented strategies for the digital age. Throughout the previous events, students just starting their careers obtained first-hand insight into the mindset of successful decision-makers, into ways to handle opportunities and risks, and into healthy leadership strategies.

Scandinavian kick-off

The guest at the kick-off event at TUM Campus Heilbronn was Swedish-born Björn Rosengren, CEO of the ABB Group which delivers solutions for electrification, industrial automation, drive systems, robotics, and discrete automation. Rosengren explained to the attending students why he is not a stickler for rigid hierarchies and instead prefers to distribute responsibility among several people.

Another highlight was the visit of Gerd Chrzanowski who was named Manager of the Year 2022 by the Handelsblatt journal. As CEO of the Schwarz Group, he continues to drive the turn of time at Lidl and Kaufland. Sustainability is this CEO's area of expertise. He remodeled the Schwarz Group's waste and recycling business from the ground up to make it climate-neutral over the long term.

Women in power

Women remain a minority in management. Christine Grotz, Managing Director of family-operated Weber-Hydraulik GmbH, and Astrid Teckentrup, CEO of Procter & Gamble in the German-speaking region, informed the students about successful female entrepreneurship.

The roster of guests included former CEO of Robert Bosch GmbH, Dr. Volkmar Denner; René Obermann, who presided over Deutsche Telekom for many years; Michael Sen, Chairman and CEO of the Fresenius Group which drives development in the hospital and healthcare sectors; and Dr. Roland Busch, CEO of Siemens AG, who finished the session off with a splash.

The insight into diverse industries and the direct dialog with the participating executives were sources of inspiration and knowledge for TUM students. They flocked to the auditorium in large numbers to speak face to face with the CEOs and soak up knowledge about the challenges facing accomplished entrepreneurs. Learning personal details about the people behind the careers was at least as exciting. On a positive final note: The CEO Leadership Series will be continued next semester.

Science pushes the envelope

“I encourage young people of any gender to follow their passions and not allow themselves to be limited by stereotypes and doubts,” says Alina Hafner, doctoral student and research assistant at the Global Center for Family Enterprise at TUM Campus Heilbronn.

At 25 years old, Alina Hafner is about to start on the path to a doctorate degree. She explains: “My work deals mainly with what is referred to as the scientific approach to entrepreneurial decision-making.” Even though Alina Hafner has attained bachelor’s and master’s degrees in business information technology, her background was less than ideal: “I had no actual role models in my social or familial environment because I was the first in my family to attend university.”

Alina Hafner says she has never felt any disadvantage in the world of information technology due to her gender: “I want to hope those prejudices no longer exist. Also, they certainly are not any more or less pronounced in science than in any other area of society.” She reports that the requirements for a career in research are the same for every person. “What you are expected to bring to the table in addition to an authentic demeanor, an interest in the topics and in challenging them critically, an intrinsic motivation, and the conviction to do the right thing, are persistence and stamina.” The benefit, she adds, is that you get the opportunity to help make the world better through new discoveries and innovations.

A pet project

Aside from her work as a doctoral student under Prof. Miriam Bird, Alina Hafner co-founded the start-up Fauna AI, an AI tool for determining the emotions of animals. She describes how it works: “To detect animals’ emotional states, we use artificial neural networks. We train a model with image, audio and video data.” Alina Hafner has learned that the more data they collect, the more precisely the AI can work.

While potential applications for Fauna AI include veterinary medicine and agriculture, the focus currently is on family pets. “People who have dogs and/or cats are very passionate, however, emotional ties to cows tend to be less strong,” says Alina Hafner, a passionate dog owner herself. She adds that it is not easy to obtain training data from farmers. “They don’t have time to waste. That is why we have to make the commercial benefits clear to them.” The AI tool could serve as a type of early-warning system for an animal’s state of health so precautions could be taken.

Driving her thesis and her start-up at the same time requires efficient time management. “I am invested in the Fauna AI project out of passion and my love for animals. I don’t mind spending a lot of my free time working with it and I don’t count the hours I spend.”

Alina Hafner’s doctorate degree will be the next milestone in her budding career. She specifies her plans: “I want to publish research findings with practical relevance and direct benefits.” She also wants to be a role model for the upcoming generation: “I have participated in Girls’Day and other initiatives that promote young talent.”

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