



Fast Forward Tooling

2015

Günther Schuh
Wolfgang Boos
Martin Pitsch
Michael Salmen
Tobias Hensen
Thomas Kuhlmann
Felix Rittstieg



Huf Tools



rathgeber
tyrol



BMW
GROUP



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Werkzeugbau



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Laboratory for Machine Tools and Production Engineering (WZL) of the RWTH Aachen University

Across the world the Laboratory for Machine Tools and Production Engineering (WZL) of RWTH Aachen University with its 900 employees is standing for successful and forward-thinking research and innovation in the area of production engineering. In four different fields, research activities not only relate to fundamental theories and findings, but also to the application of findings in an industrial context. Furthermore, practical solutions are developed to optimize production. The WZL covers all sub disciplines of Production Technology with its four chairs Production Engineering, Machine Tools, Metrology and Quality as well as Manufacturing Technology.



WBA Aachener Werkzeugbau Akademie

The WBA Aachener Werkzeugbau Akademie develops industry-specific solutions for the sustainable competitiveness of the tool making industry in a network of leading companies. The activities focus on industrial consulting, further education, industry solution as well as research and development. Its own demonstration tool shop enables the WBA to test innovative approaches in the laboratory and make them accessible quickly for its partner companies. Key issues are further addressed in the current studies. These provide information about trends and developments of the market and competition.

Imprint

Fast Forward Tooling

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Authors: Prof. Dr. Günther Schuh, Dr. Wolfgang Boos, Dr. Martin Pitsch, Michael Salmen, Tobias Hensen,
Thomas Kuhlmann, Felix Rittstieg

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Laboratory for Machine Tools and Production Engineering (WZL)
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Steinbachstrasse 19
D-52074 Aachen

www.wzl.rwth-aachen.de

WBA Aachener Werkzeugbau Akademie GmbH
Karl-Friedrich-Straße 60
D-52072 Aachen

www.werkzeugbau-akademie.de

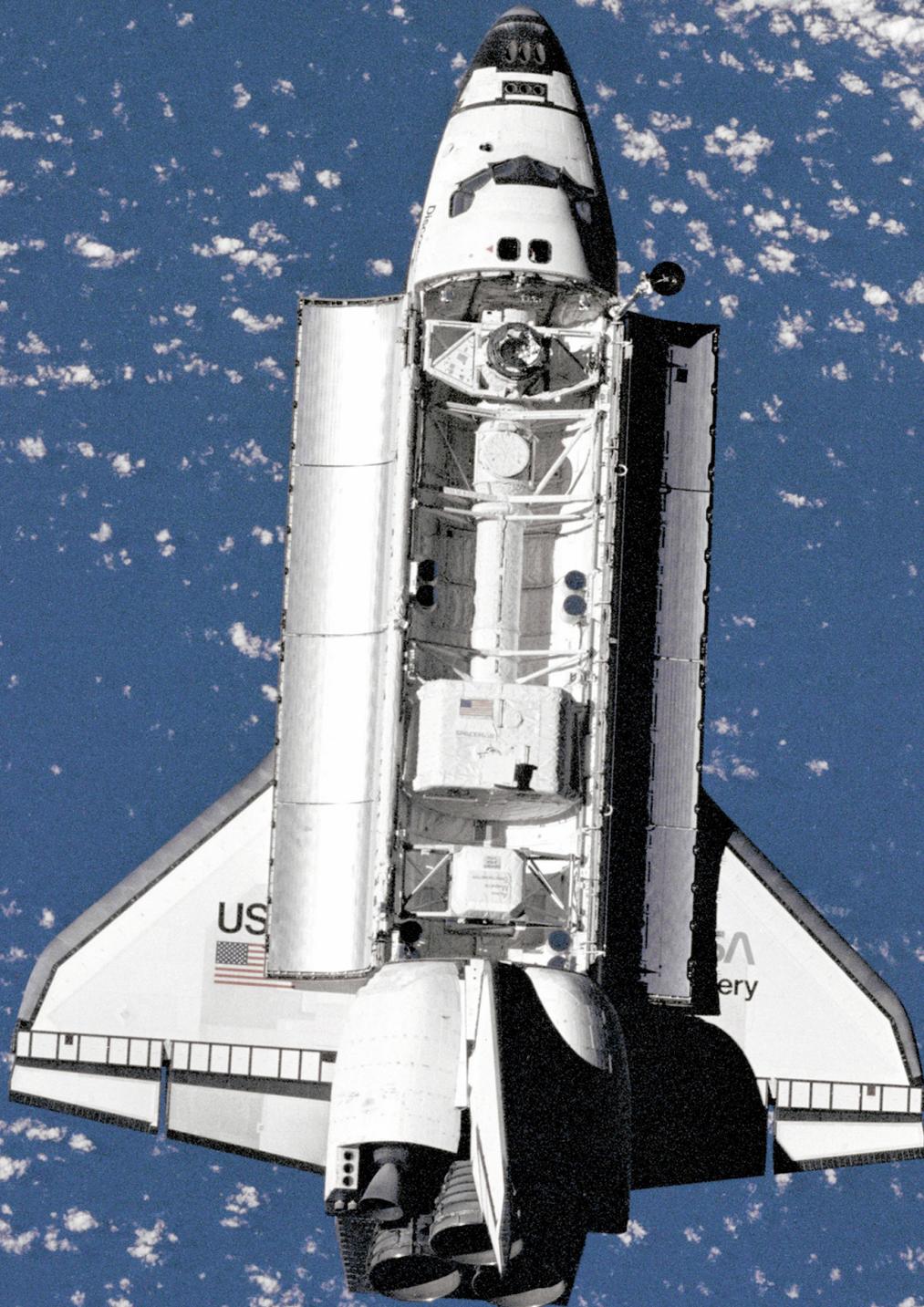


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Executive Summary

Faster, better, further! Fast Forward! These are the goals of the manufacturing industry in the high-wage country Germany. Only manufacturing companies striving towards these goals are going to be able to hold their ground in a dynamic competitive environment in the long run and become the innovation leader for technical products in the future.

The tool making industry is the central enabler of a powerful serial production and therefore significantly responsible for innovations. Fast Forward Tooling – tool making of the future! Serial producers and tool making companies alike must deal with the nine success factors in the sectors of product, process and resources. The design of these factors of success enables a future-oriented and efficient added value in the tool making industry.

Our nine factors of success

All success factors are mutually and closely linked in practical design and implementation. The exclusive focus on a single factor of success is therefore not effective. Fast Forward Tooling companies rather have to position themselves in all factors of success in an appropriate manner to achieve an efficient added value.

Emotionalization

Tools should satisfy customers at first sight with high quality and trigger positive emotions. Fast Forward Tooling links emotional design with high recognition value and emotional marketing.

Construction Kits

The product derivatization and individualization requires standardized tools to control the diversity of components. Fast Forward Tooling defines modular construction kits and combines them with modular performance kits.

Smart Services

Digitalization enables a new range of services. Fast Forward Tooling creates innovative business models with the help of data based services and develops a simple tool manufacturer into an advanced knowledge manager.

Synchronization

The large number of different types of orders in the tool making industry presents the central challenge in order processing. Fast Forward Tooling utilizes high-resolution planning and thereby enables flexible clocking.

Glocalization

Globalization influences the tool making industry and therefore offers many opportunities. Fast Forward Tooling has a global market intelligence and uses this competence for a quality tool supply.

Automation

Tool making represents the supreme discipline of crafting and presents difficult circumstances for industrialization. Fast Forward Tooling automates manual processes and combines them into automated process chains throughout the entire production.

Innovative Engineering

The cost-intensive reduction of optimization loops is challenging the tool making industry. Fast Forward Tooling integrates itself into the customer's product development by using Virtual Engineering early and utilizes innovative additive manufacturing technologies.

Digitalization

Gathering data from manufacturing and serial production leads to unique knowledge. Fast Forward Tooling utilizes data for Smart Process and Smart Data.

Working Culture

The boundaries between work and leisure time are becoming increasingly blurry. Fast Forward Tooling is supporting this trend by designing flexible working arrangements as well as promoting and demanding innovations.

Product

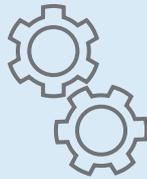
Process

Resources

Emotionalization

Synchronization

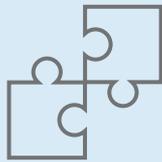
Innovative Engineering



Construction Kits

Glocalization

Digitalization



Smart Services

Automation

Working Culture



Fast Forward Tooling

Where do I have to go?

Global customers, short development cycles, individual products, low willingness to pay, demographic change - these are the central challenges of the manufacturing industry in Germany. In short: complex value creation! The complexity is high, especially at the interface between product development and serial production. At this interface the tool making industry is the enabler and driver of innovation of the manufacturing industry. It allows cost-effective production of products with very complex geometries and different materials in great quantities. In order to ensure sustainable competitiveness and control value creation in the future, tool making companies need to integrate themselves into the product development and serial production.

Fast. Forward. Tooling.

German tool making companies have to rely on their strength: Engineering. It stands for the methodical and goal-oriented solution of challenges. However, today it covers a wider range than in the past: product design and product engineering, process design and process engineering as well as interpersonal behavior – social engineering. From this perspective, the Fast Forward Factory emerged as the manufacturing company of the future. This also includes Fast Forward Tooling. Fast Forward Tooling is successful! Fast Forward Tooling controls the complex value-creation of the tool making industry – faster and better!

The system of success

To master efficient value creation tool making companies need to consider three areas: product, process and resources. Products form the interface to the customer and generate value. Processes enable the creation of these products and therefore use resources. As the core part of the tool making industry they enable fast processes and develop innovative products – in short: efficient value creation! The combination of product, process and resource bundles the structure of the tool making industry and represents its system of success.

Become Fast Forward

The nine factors of success are crucial for the future and the sustainable success of all tool making companies. They are closely interconnected as the sectors product, process and resources in the value creation itself. To master all of them – impossible! To position oneself in all – promising! For this reason tool making companies have to decide to what extent they want to develop the individual factors of success. The analysis of the factors of success indicates that the factors can be developed in many different ways. The task at hand is to improve the efficiency of value-creation by using factors of success. Become faster, become better – become Fast Forward Tooling!

Success requires role models

Made in Germany! A seal of approval, which is a synonym for quality, innovation and progress since its inception. The competition has never been as tough as today. Tool making companies in high-wage countries such as Germany must learn to seize the opportunities of challenging trends and to manage their value creation more efficiently. The best way to learn is to learn from the best! Although tool making companies are only acting in the business-to-business relations thus do not approach consumers directly, they represent the backbone of the manufacturing industry. It is necessary for them to develop new solutions in the areas of the factors of success in order to stay competitive in the long run. Successful tool making companies already control some individual factors of success and can serve as best practice models for the tool making industry. Learn from the best and become even better! Faster, better, further! Fast Forward!

Study design

The study Fast Forward Tooling is based on findings of the study “Fast Forward Factory” and on the results of an extensive evaluation. A survey was carried out by the Laboratory for Machine Tools and Production Engineering (WZL) of the RWTH Aachen University and the WBA Aachener Werkzeugbau Akademie with experts and staff from the tool making industry for evaluation purposes and to emphasize the relevance of the nine factors of success. Employees of 72 tool making companies from Germany were interviewed. This survey was supplemented by an intensive exchange with a best-practice company in each of the nine factors of success.

Half of the study’s participants are employed in internal tool shops (53 %) whereas the other half is working in discrete tool making companies (48 %).

Due to the structure of the German tool making industry predominantly small and medium-sized companies are exhibited in the study to maintain maximum representativeness. 39 % of the participating companies employ less than 20 workers. Companies with a size of 21 to 50 employees are represented with 43 % and companies with 51 to 100 employees with 14 %. The smallest amount of participating companies employs more than 100 employees (4 %).

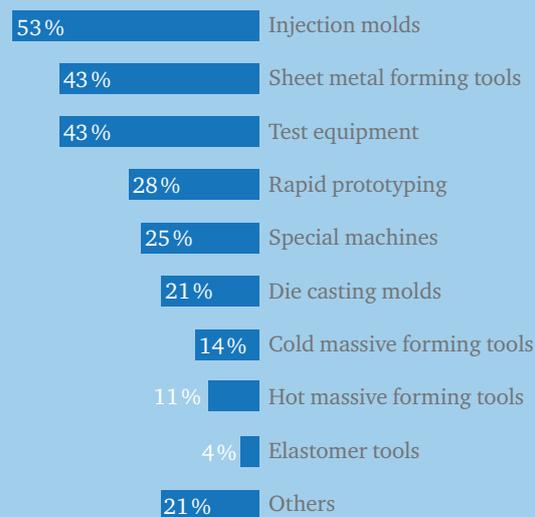
The product ranges of the participating tool making companies are as heterogeneous as the company sizes. 53 % of the companies focus on injection molds and 43 % on sheet metal forming tools. In the sheet metal forming tool sector 43 % additionally construct test equipment for appliance in serial production. In addition to other types of tools as cold massive

forming tools (14 %), hot massive forming tools (11 %) and die casting molds (21 %), the participating companies produce special machines (25 %) as well as prototypes (28 %).

The participating companies are supplying industry branches with tools that are very typical for the tool making industry. The majority of companies (82 %) manufacture tools for OEMs and suppliers of the automotive industry. The second and third most involved industries are the electronics industry (25 %) and the medical technology industry (21 %). In addition to these main industries, participating companies also operate in the sectors of household appliances (21 %), consumer goods (14 %) and other industries (11 %).

Product range

(Multiple answers possible)



Number of employees



Market access





Emotionalization

Together we are strong

Morning dew is dripping from the leaves, the first sunbeams break through the treetops. A group of men sets out to a mission, their faces filled with joy and laughter. Sweat dripping, chips flying and in the end the tree lies flat on the ground. It is a huge tree, grown over decades and cut down in a few seconds. The work is done without much effort and a lot of fun. It is the beginning of a promotional film of Stihl, which can be found on their YouTube channel. This movie is just one single example of a variety of marketing activities carried out by the company Stihl. All these activities have one crucial thing in common: They are emotional. Strong men, concentrated power and a high-tech chainsaw – the purchase becomes an experience. By directly addressing

the group of buyers, combined with a sleek and distinctive chainsaw design, Stihl became the world's best-selling petrol chainsaw brand – in the private, but especially in the industrial sector. The emotional marketing of the product enables this success. Working in the forest, the Stihl chainsaw is a must-have. It combines best quality, sophisticated technology and comfortable equipment – the guarantee for overall success. The product emotionalization has spilled over from the consumer market in the business-to-business market and even influences the manufacturing industry. But how do I convince a buyer to buy my products? With emotions or rather with technology? Success is only possible through balancing both!



How are your marketing activities characterized?

25 %

Low emotionality

33 %

Rather low emotionality

25 %

Balanced

15 %

Rather high emotionality

2 %

High emotionality

Potentials for the tool making industry

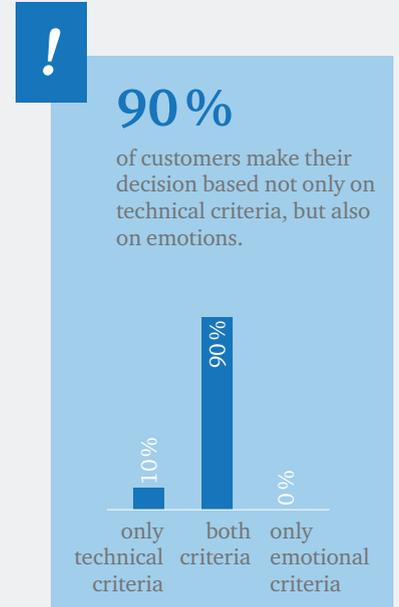
Emotional or rational? Tool making companies have to assess the buying decision of their customers. 52 % of participating companies believe that their internal and external customers decide on their purchase depending only on technical criterias. It appears that emotions associated with the product only have a minor impact. This cannot be accurate! According to a study in the manufacturing industry from 2013, 86 % of purchasers cannot differentiate their suppliers on the basis of functional criteria. This suggests that emotions play a much greater role than we thought, even in the purchase of industrial products. The best way companies achieve emotionalization is by creating their own brand and a professional marketing concept. Nowadays it is easy to determine how buyers identify new

suppliers: Google! The first impression on the homepage – either professionalism, tradition and staff expertise or machine lists, technical tool data and CAD models. What do you remember? Identification with the brand and the company! Linking the brand with a positive property and therefore with a positive emotion increases customer loyalty and enables the acquisition of new customers. Paired with a contrasting, different design there is possibility to increase its visibility. After all technical quality has to be presented through an appealing design. Creating a brand with the combination of an individual design and an extensive marketing concept presents tool making companies with the opportunity for to increase visibility.

Emotional design

“German tools are of significantly higher quality than Chinese tools“. This might be the case, but how does the buyer know? German tool making companies are convinced: “The price always counts“. Don't they mean price-performance ratio with price? How can a buyer recognize at first glance whether a “steel block“ is of high or low quality and whether its high price is justified? How do you know whether a gas grill is of good quality when you are buying it? Through its design! Stainless steel, black paint of the frame, coated grill, chrome flame regulators... The first thing that counts is the appearance and thereby the emotion that is associated with the grill! The value of the product is emphasized by the design. Represent technical superiority

and make it visible to the buyer. Why not following this approach in the tool making industry? 61 % of surveyed tool making companies precisely see this potential in the external appearance of their tools – emphasize quality and delight the customer. Even if a tool cannot be compared to a gas grill, surface coloring, logos and other design elements can increase a tool's individuality. Of course, all tools are individual, but in most cases it cannot be seen immediately. When visiting a serial production you are able to identify at first glance who manufactured the tool used – this is the beginning of establishing a brand. A tool making industry brand! Qualitative, powerful, ambitious and above all: impressive!



Emotional marketing

Is Apple better than Samsung? Opinions differ. But which of these companies' products stand like no other for design, innovation, status and progress? The iPhone! This does certainly not mean that the iPhone is better than a Samsung smartphone! However, Apple has been focusing on emotional marketing for the iPhone! If you own a Samsung smartphone, you own a functional device, but if you own an iPhone you are part of the circle. This small difference distinguishes between successful companies and legends. No tool making company wants to become a legend, but the basic idea of emotional marketing can be applied in the tool making industry. For this reason comprehensive marketing is necessary, which goes

beyond technical description of tools in brochures, exhibitions of a tool at a fair or simple advertisement in journals. Attract attention and leave a big impression! This is the goal of emotional marketing and a necessary condition for the long-term establishment of a brand. Humans do not decide rationally, the decision is always emotional to a certain extent and of course buyers are also humans. Awaken emotions and thereby gain an advantage. Reliability, diligence, punctuality and tradition are values that distinguish us from Chinese tool making companies. These values must be acknowledged by the buyer – over and over again!

External appearance:



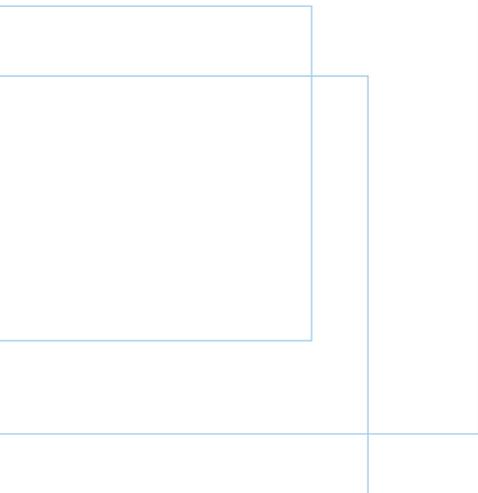
23% of customers are willing to pay for the external appearance of a tool.



The Emotionalization of a metal block



rathgeber
tyrol



Different! Be different and demonstrate the difference! This is the motto of Rathgeber GmbH based in Tyrol, Austria. A visit of Rathgeber's homepage reveals a marketing video: impressive, emotional and in the lead role: An employee of Rathgeber. But instead of being at work, he enjoys skiing, mountain climbing and living the Tyrolean lifestyle! The video does not aim at presenting the company, but it communicates its values commitment, flexibility, reliability, friendliness and warmth, which are embodied by the employees of Rathgeber. You cannot fight the positive feelings when watching the movie! The association of Rathgeber with positive emotions should be imprinted in the audience's minds. Professional and elaborate movies of employees are made by Rathgeber two to three times a year. There is also a film about the values of the company, which is based on the book of values created by Rathgeber. One would think for the purpose of selling more tools, but not at all! Due to the numerous marketing activities performed by Rathgeber, not one additional tool is sold! But those who buy tools from Rath-

geber know exactly why they choose this manufacturer. Authenticity! The comprehensive, tailor-made marketing concept focusing on employees and the company's tradition is authentic. From employee movies to the design of the homepage and the own CE label, which guarantees the tool's quality with a signature of the responsible toolmaker – handcrafted by... The identification of employees with their work and the company is the key to success. Initial doubts could be eliminated quickly by regularly informing the employees in terms of marketing activities, strategy and the likes. Furthermore, despite of the high initial and ongoing costs for marketing and intensive cooperation with marketing agencies, marketing is worthwhile for external appearance as well as external and especially internal employee advertising. The increasing visibility and identification of employees with Rathgeber was significantly increased by emotional marketing. Mainly because of Rathgeber's employees, who are committed, flexible, reliable, friendly and welcoming!

Rathgeber GmbH

The Rathgeber GmbH is a tool making company operating in the field of complex injection molds for more than 70 years. Over 100 employees are responsible for construction and production on a production area of 3,000m² in the fields of mold and plant construction and automation technology. The company relies on diverse and ultramodern machinery of more than 40 machines to produce tools weighing up to 12t. The machinery has

the ability to process metal in 15 different ways. Rathgeber with its headquarters in Innsbruck is focusing on the automotive industry with its OEMs and suppliers. As a medium-sized family business, they stand for tradition and special values to their customers – true to the vision: "We always offer the best solution in our core competencies to our customers! We are the quality leader!"

• CE

rathgeber
tyrol

Baujahr: 2015

Herst.-Nr: 130865

Handcrafted by

Stefan Popus



Rathgeber GmbH · Trientlgasse 45 · 6020 Innsbruck · Austria

Potentials:

Increasing visibility and strengthening internal and external employee advertising

Obstacles:

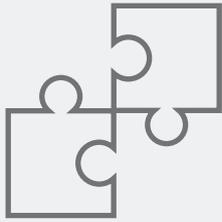
High investment costs

Key Factors:

Early and regular information and involvement of employees

Next Steps:

Stabilizing marketing measures



Construction Kits

Exclusive design for 10 million customers

A total of 12 brands offering approximately 300 different derivatives. Volkswagen AG - the largest automobile producer in the world! Volkswagen is a genuine standardization expert and sets new standards through the introduction of modular transversal and longitudinal as well as modular standard drive construction kits. Hatchback limousine, sporty coupe or pick-up: Every model series is covered by one of the three construction kits. The former platform strategy has become a modular construction strategy, which uses synergies across vehicle classes. Construction kits have been standardized and combined into modules for internals, electronics and even entire drive system components. Standardized kits enable the standardization of the manufacturing process. As a result, the flexibility of production increases: The change from Golf to Polo in the assembling department can be carried out quickly thanks to similar

assembly sequences. The only thing becoming more difficult is the customer's decision for one model, because the range of vehicles is not restricted by standardization anymore. Driven by customer demand, the VW Group now offers more vehicle types than ever! The individuality is enabled through clever combination of modules. An example: The driver's seat, consisting of three modules. The basic module provides the base-seat structure that is identical in all vehicles. The panel of the basic module is limited and standardized. It is customized according to customer requirements, for example through electrification. The visible "uppers" can be entirely individualized with standardized components. The customer receives an individually designed seat yet completely standardized. You thought individualization and standardization were mutually exclusive? Volkswagen proves you wrong!

Share of diverse components that can be manufactured with one single tool:



Causes for the lack of designation of services offered*:



*Multiple answers possible

Potentials for the tool making industry

Meet individual customer demands without facing enormous complexity. This is the high art of manufacturing companies. Across markets customer's demand in products that exactly meet their ideas and expectations gets increasingly important. Competitive pressure increases and innovations for greater customer benefits become more meaningful. Producers react with increasing product variety, shorter innovation cycles and a wider range of services. The tool making industry has to manufacture more tools in shorter time, which enable the production of even more individual products. A high efficiency in small batch sizes will become crucial! Tools are unique in general. The complexity in production increases exponentially with the growing number of tools. However,

a decrease of the increasing product and process variance can effectively counteract complexity. The key to this is standardization of tools and processes. Standardization is furthermore a necessary condition for industrialization in tool making. The tool making industry has to shape individual tool components as uniformly as possible in order to generate economies of scale. Components are combined in modules and can be used in different tools. By combining the defined modules from a tool kit, supplemented by part-specific components, new individual tools can be designed. In combination with service modules in standardized forms as well, modular service kits can be offered. Standardization allows mastering the individuality of components!

Modular construction kits

Customers request more individual products in every sector and batch sizes continue to shrink. Given the circumstances, why pursue the construction kit strategy? Because alike the construction kit systems of automobile producers, identical parts can be used extensively, without limiting the product range in the tool making industry. Some tool making companies construct each tool from scratch and assume the use of uniform standard parts such as screws and pins is already standardization. However, successful tool making companies strive to break up entire tools in modules. This is done by separating tool components in contour and not contour components. Due to the individuality of the parts a standardization of shaping components is only partially effective. Not shaping components however promise great potential. When producing injections

molds, for example mold frames, ejectors, inserts and anvils can often be easily standardized across a variety of tools. The combination of standardized components and modules increases the potential once again. The aim is to build a tool construction kit! Constructors therefore use the existing tool kits for new tools and mount them with suitable modules. This allows time and cost savings! In addition, the constructor can concentrate thoroughly on the important components for the demoulding process of the tool - because this makes the difference after all. Additionally, standardized modules and components result in positive effects on manufacturing. Similar components imply similar sequences and processing times. This allows the significant optimization of process flow and planning of components.

Modular service kits

Services in the tool making industry are gaining in importance. Services such as the supply of machine parameters from try-outs as well as repair work, maintenance and supply of spare parts are already included in the tool purchase. However, services, allowing customers differentiation from the competition, will be crucial for the tool making industry in the future. Digitalization makes it possible. It allows tool making companies a deep integration into the customer's processes – both in production development as well as in serial production. The aim is it to sell the existing knowledge about tools and processes to customers. Possible offers include almost everything from tool maintenance, tool management and guarantee of tool availability. But again: Every customer wants individual services! The standardization of services

allows the individual combination through the customer while simultaneously upholding the high efficiency of tool making companies. However, the problem is often the customer's lack of understanding for additional services of tool making companies. Whereby nobody has as specific and in-depth knowledge as the tool making companies themselves! This has to be demonstrated to the customers with the support along the entire life cycle of a tool with a range of services from one performance kit. Thus, the customer can decide individually which services provided by tool making companies it deems necessary and wants to pay for. For this purpose tool making companies use specially compiled performance kits to demonstrate the customer benefits of different packages. As a consequence, turnover and customer loyalty increase.



The biggest obstacles to the implementation of modular tool making kits:*

71 %

Too different products

19 %

Too high initial costs

19 %

Unclear process of implementation

8 %

Too low benefit

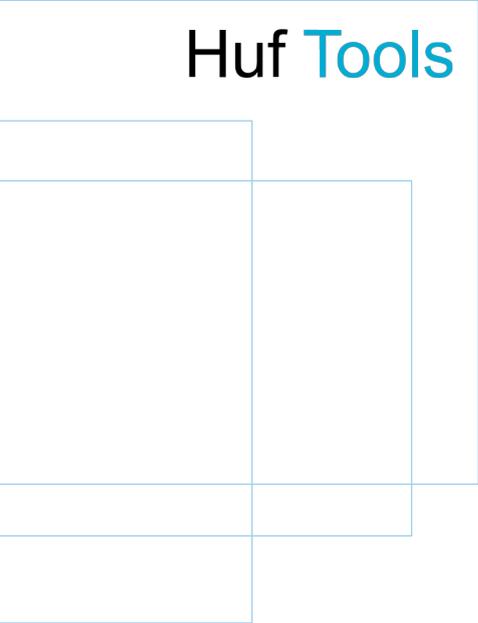
23 %

Others

*Multiple answers possible

Bravely setting the standard

Huf Tools



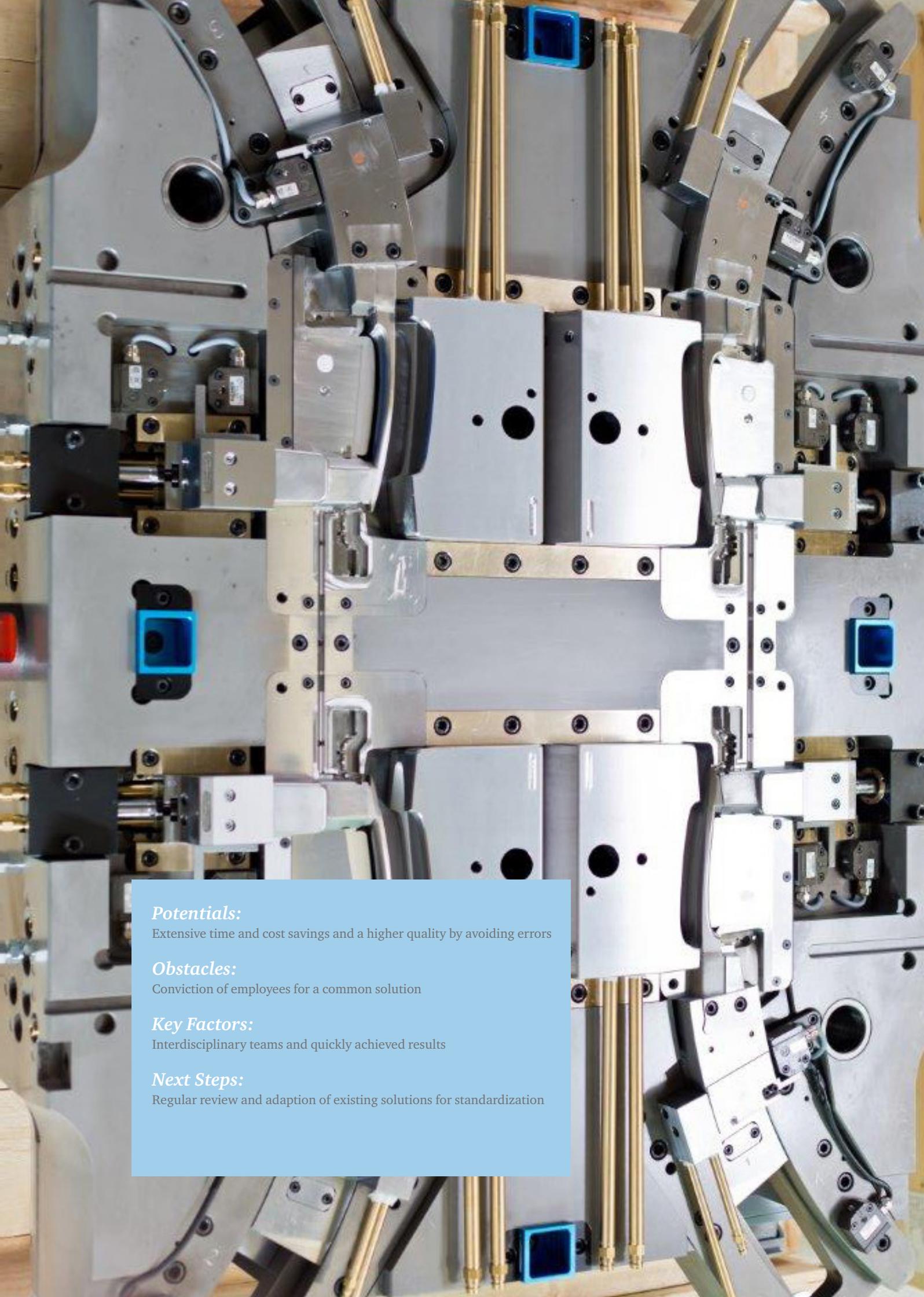
Why reinvent the wheel over and over again? This was the question employees of Huf Tools asked themselves about 10 years ago. They recognized that very similar tool components were constructed quite differently. Often only slightly different, but still different! Each constructor had his own methods and ways to reach a similar result. That is why feeders were constructed very differently for a narrow range of products. As a consequence, a regular working group was established. The relevant question that needed to be answered was: How to design a feeder, which can be installed in 80 % of the tools and thus replace all others? To answer this and similar questions more working groups with employees from all departments were introduced. The core challenge was to convince the employees that the uniform solution is better than their own. Once started, an increasing number of employees' ideas

came together concerning many different parts. Following individual components standardization, producing processes were standardized. Throughout the entire process chain main processes were consistently defined. Deviations from core processes are exceptional and have to be avoided. For milling processes, there are only few electrode sizes and milling programs have only one procedure. With small effort, great success could be achieved. Step by step, Huf Tools could standardize greater and greater volumes of their tools in this manner. Today only the contour parts of different tool types are made individually. All other parts are standardized modules. This combination allows Huf Tools to deliver customized tools quickly and cost-efficiently. Whereas the defined standards are not set in stone: It is necessary to scrutinize existing solutions over and over in the future and adapt them to new circumstances.

Huf Tools GmbH

The Huf Tools GmbH is a subsidiary of the Huf Group and employs about 110 employees in Velbert, Germany. The company manufactures customized and high quality injection molds as well as automated assembly systems primarily for the automotive industry. Huf Tools has specialized in the production of multi-component and gas injection molds for remote control key components, vehicle handles and locking systems. As an external spin-off, the tool making

company is in competition with other suppliers and founded a location in Yantai (China) in 2009 to raise cost potentials as well as operate in the Asian market. Mixed calculations, expertise exchange and close connections to the customer markets represent the benefits of the tool shop network. The Huf Tools GmbH was a finalist of the competition "Excellence in Production" for tool making companies in 2012.



Potentials:

Extensive time and cost savings and a higher quality by avoiding errors

Obstacles:

Conviction of employees for a common solution

Key Factors:

Interdisciplinary teams and quickly achieved results

Next Steps:

Regular review and adaption of existing solutions for standardization



Smart Services

Harvesting operation on the field of the 21st century

Even agriculture, as the last bastion of traditional mechanics, is not immune to technology trends anymore. When visiting a modern farm in Germany, you will find only few workers and a lot of high-tech equipment. For example: agricultural equipment manufactured by Claas. An engineering masterpiece from the outside and a datacenter equipped with high-tech components inside. The customer benefits in every phase of the agricultural cycle: Historical weather data and current measurements from relevant weather stations are used to suggest the optimum sowing date. Soil quality and moisture determine the correct output quantity of seeds, which is adjusted in

real time. The agricultural machines drive precisely on autopilot to seep between the stubble rows directly into nutritious soil, while autonomously coordinating their work. The use of agricultural engineering equipment reduces the time for harvesting operations by 5-10 %. The driver is only passively involved in the process. The cloud, which is fed by Claas and the machines themselves with data, makes this possible. This combination of data-based services and the actual product is called Smart Service. The created value will be rewarded accordingly by the customer: The revenue due to Smart Services has been increasing consistently throughout recent years.

Biggest obstacles in offering Smart Services:



27%

Customers do not want to share any data

22%

Complexity of data management is too high

18%

Cost of sensors/actuators too high

11%

Smart Services are unmarketable

7%

Data security is insufficient

15%

Others



Potentials for the tool making industry

Let's face it: In the future the majority of value will still be added physically in the tool making industry. The heart of the production world cannot be digitalized; however the surroundings can be. A great chance for the tool making industry to expand its own business model: Through its role as an enabler of serial production it can create the technical conditions for further digital value creation after tool purchase. Offering Smart Services allows the tool making industry to extend service provision even far beyond the purchase. Prerequisites for Smart Services are interconnected products, processes and services in the process of digitalization. Digitally linked products are used as data source as well as interface to the further provision of services. Tool and process relevant data can be analyzed in real time during tool use.

Therefore help tool making companies to understand their own tools better. This additional knowledge is used to optimize the utilization of supplied tools and thus to increase customer benefits. Furthermore it is incorporated in the production of future tools, in which case the customer also profits. In order to exploit this potential, innovative business models that rely on Smart Services and offer value creation to the customer are needed. But the tool making industry has to convince its customers: 27 % of companies surveyed the hesitation of customers to release their data as the greatest challenge in the use of Smart Services. This should not be a problem anymore! Encryption methods and secure connections prevent sensitive knowledge from being spread on the internet.

Data-based services

The increasing digitalization connects tool making companies closer to their customers through fibre optic and copper cables. The tool making industry is provided with the opportunity to merchandise established knowledge as well as gain new insights. Core knowledge should be identified in a first step. The aim is to use established knowledge for the development of new techniques for customers, which competitors are unable to offer. Furthermore data is acquired through products which e.g. use sensors or RFID-chips to communicate with other products or systems. They are able to collect tool data – in the case of injection molding processes this could be pressure curves, temperature allocations or the relative motion of the tool. The acquisition is followed by an automatic evaluation. The evaluated data of tools

in use at customer sites generates unique knowledge of the tool behavior during serial processes. Subsequently the question arises how this knowledge can be used as a service. Regarding the assurance of productivity, the knowledge is particularly used to monitor tools throughout their entire life-cycle. Real-time data enables us to do so: Monitoring process relevant data can be used for targeted and precise adjustments of tool or process parameters. Preventive maintenance that is scheduled based on the received data makes serial producer profit from fewer process deviations and fewer costly production blackouts. Tools adjusting process parameters autonomously are called “smart tools”. They use evaluated data to adjust process parameters immediately and consequently optimize the production process.

Innovative business models

The identity of the tool making industry is changing: The product itself loses importance while its benefit increases in relevance. Thus tool making companies have to adapt appropriately. A milestone must be the digital refinement of the existing business model. This can be accomplished by so called hybrid business models, which include the offering of Smart Services. Tool making companies have to shift their focus rather on the production process than on the tool itself. One major incentive are high margins in the service sector. German tool making companies are aware of this change: Two thirds of the surveyed enterprises stated that their established business models will change fundamentally through the involvement of Industry 4.0 over the next years. Nearly half of the enterprises (46 %) expect a balanced value creation

through the product on the one hand and offered services on the other. Due to the close link between tool making companies and their customer, new knowledge can be generated. This knowledge can then be used for commercial purposes through the offering of services. Tool making companies are developing from simple suppliers of tools to knowledge managers along the entire tool life cycle. Services as rapid response units for repairs, support of component development or acquisition of the tool management in serial production will gain in importance in the future. The development of Smart Services helps tool making companies to integrate themselves into processes of their customers even stronger and thus be closer linked to them than the competition.



66%

see a need to change the current business model in the wake of Industry 4.0.



How do you see your tool making company in the future?



0%
100 % tool making company

36%
Rather tool making company

46%
Balanced

10%
Rather service provider

8%
100% service provider

Progress through technology ... and through knowledge!

Audi
Werkzeugbau



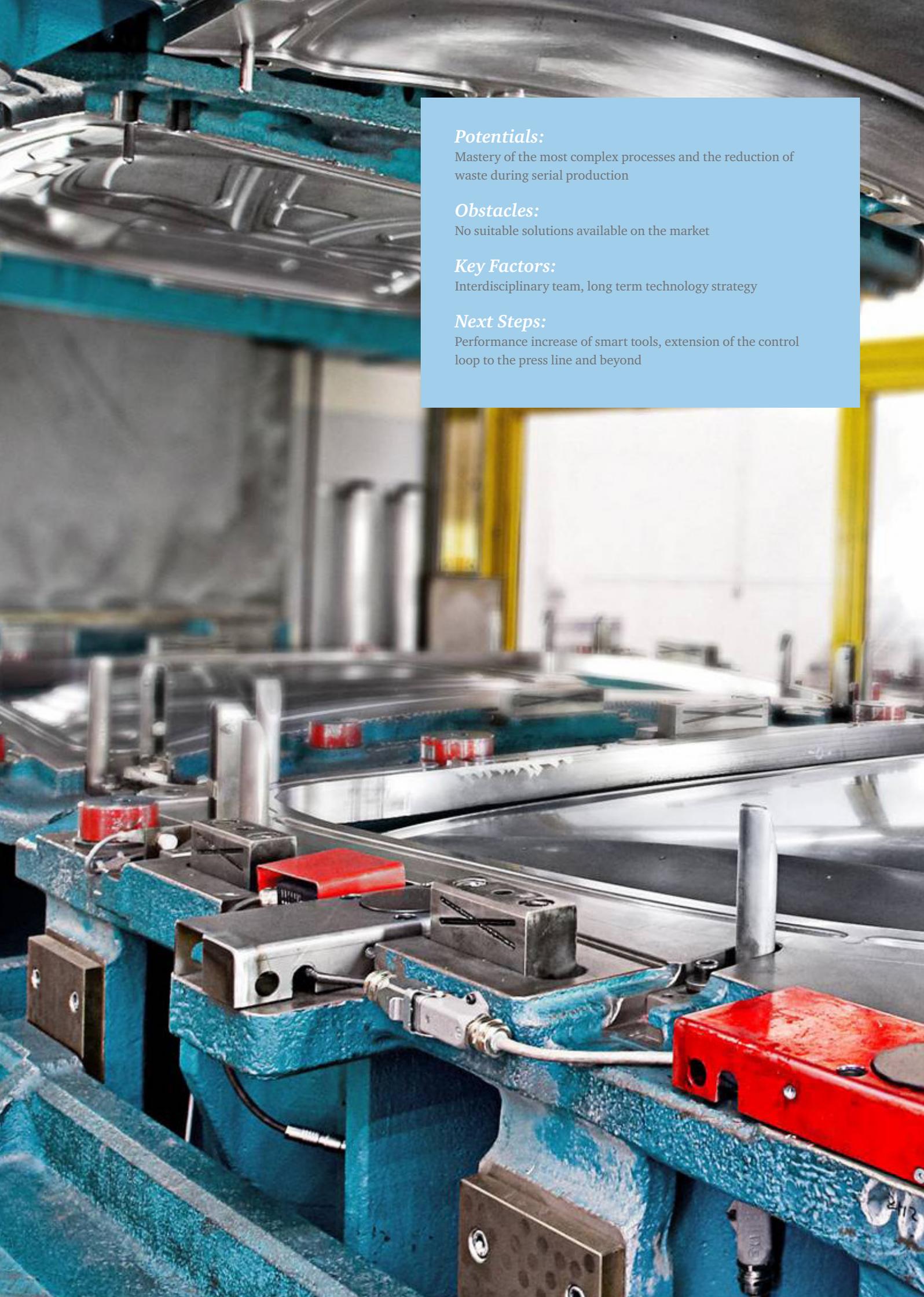
With the ever more demanding specifications from body designs and rising quality requirements process windows for forming of sheet metal are shrinking. Due to the insufficiency of conventional solutions to control process variations in the press shop, Audi developed the smart tool. It records actual process signals and performs variance analysis during its use. Variations are immediately interpreted and balanced by integrated actuators. The customer benefits through higher efficiency, less waste and a higher tool availability. Remote access to the tools in the press shop enables the transmission and analysis of data. Thereby the press shop staff can be supported in stabilizing the processes. The tool shop benefits from serial extort data likewise. Insights based on generated data may be used in new tool projects as well as in the further development of the smart tool. In many challenges such as the creation of support tools for the design of sensors and actuators as well as missing hardware standards on the market, Audi's tool manufacturing ventured into unknown territory. The key to success proved to be

the cooperation in an interdisciplinary team. This cooperation has encouraged the development of durable and real-time capable measuring computers for the control and evaluation of the forming process. Furthermore the team developed new simulation software for the efficient design of smart tools. Again, there was one aim to achieve: Efficient and reliable processes. About a quarter of all the tools made by the Audi tool shop are smart nowadays. The decisive factors are whether the forming results show a sensitive reaction to process variations and if they can be stabilized by actuators. In the future learning must be the main focus of tool making companies. The performance of smart tools is steadily increasing, because their use generates more and more knowledge which in turn enhances the tool's performance. In addition the extension of the control loop beyond the production plant is targeted. This can be achieved by the consistent application of the existing smart tools' acquired knowledge. This is how knowledge becomes progress!

The tool shop of the Audi AG

The tool making of the Audi AG is responsible for development, manufacturing and procurement of tools and devices within the Audi Group. 2,184 employees are working in the tool manufacturing at five locations in Ingolstadt, Neckarsulm, Győr, Barcelona and Beijing. Its portfolio involves the manufacturing of press tools for automotive bodies, body production devices, hot forming, style consulting as

well as standardized framing stations. Although facing market competition as an internal tool shop, it is the innovation leader when it comes to the development of key technologies and guarantees the highest product and process qualities in the Audi Group – According to the philosophy: “Our success is the sum of precision, competence and innovation.”

A photograph of industrial machinery, likely a press line, with a blue overlay containing text. The machinery is painted blue and has various components, including red and silver parts. The background is slightly blurred, showing more of the factory environment.

Potentials:

Mastery of the most complex processes and the reduction of waste during serial production

Obstacles:

No suitable solutions available on the market

Key Factors:

Interdisciplinary team, long term technology strategy

Next Steps:

Performance increase of smart tools, extension of the control loop to the press line and beyond



Synchronization

Show me your car and I tell you who you are

Nearly 1,000 per day, 40 per hour, and every 88 seconds a new one. This is the output of the Audi A3's vehicle assembly in Ingolstadt. Every 88 seconds a new car moves off the assembly line. 88 seconds corresponds to the clocked production time of the assembly line. Regardless of the assembly step, the employees have 88 seconds to assemble the seat, apply the windshield or mount the tailgate. Within this period, the entire production step has to be finished. Otherwise the assembly line stops – and when it stops, it gets expensive. Very expensive! For this reason every employee has the duty to timely report a delay via the Andon-system, so a solution to the problem can be found in a team. The clocked production requires a detailed scheduling to ensure that all

parts are at the right place in the right amount and quality at the right time. This logistical masterpiece is achieved by the integration of supplier processes and is the central necessary requirement for the clocked production. This coordination, let alone, is very complex, but by far not the tip of the iceberg. Observing the end of such an assembly line one will quickly realize: No car is like the other! Left-hand drive, right-hand drive, 3-door, 5-door, leather steering wheel, plastic wheel, white color, blue color... Looking at this diversity, clocking only succeeds if it is flexible and the assembly processes can be standardized despite the different special features. Only flexible clocking enables the production of individual parts by standardized processes.

Character of scheduling:



2%
No scheduling

24%
Rough scheduling

66%
Rough and detailed scheduling

8%
Tool making is clocked

36%

machine operators do not know the entire process chain of the component production



Potentials for the tool making industry

The typical tool making company in Germany: Founding of the company in the 50s with four employees – One foreman, two tool makers and one person to operate the milling machine. In the 80s, the company, which already employs 20 workers, is handed over to the next generation. In the 90s the company moves into a new building, builds up new capacities and internationalizes the business. Either this or at least a similar story reveals when looking at most tool making companies' past in Germany. Summed up in two words: Traditionally grown! But what is the outcome of such growth? Rigid structures, isolated IT-applications and one man responsible for everything – the foreman! He controls the plant, keeps processes running and makes sure orders will be completed in time. However this control by one person – the foreman – leads to a lack of transparency

and high personnel dependence. To crack these structures open and to meet the complexity of today's order processing, scheduling at component level is required – A high-resolution scheduling, at best supported by an appropriate software system, enabling tool making companies to plan the process steps for their components transparently, precisely and flexible. Flexible means that orders can be separated in predictable and unpredictable orders, using a tailored scheduling system connected to a segmentation of the production and based on the standardization of processes. This is how the two divergent objectives high utilization and availability can be achieved. Taking this to the extreme, even individual and small batch production like tool making can be flexibly clocked.

High-resolution scheduling

The scheduling of tool projects in the construction, manufacturing and assembly is a standard approach in the tool making industry. But this schedule is usually very rough and often made without comparison to capacities. This frequently causes bottlenecks and delays particularly in the mechanical production. A systematic planning approach however helps to avoid delays as well as time-consuming controlling. Proactive scheduling rather than reactive control is the motto to aim for! The transfer from rough to detailed scheduling is a crucial point, where plenty fail. Only half of the surveyed enterprises schedule tool making projects on a very detailed level focusing on components. Indeed such a detailed scheduling requires standardized process sequences

and its great component variety to reduce the complexity of tool making. This represents the major obstacle for many tool making companies (47 %). However standardized main processes enable components to pass production following an exact schedule to the hour and lead to the best possible machine utilization. This requires a comprehensive understanding of the process by the employees especially in the work preparation department. This high-resolution scheduling achieves high transparency along the entire tool making process and enables a systematic knowledge return. Only through such a high-resolution design scheduling times can be accurately determined and optimized.

Flexible clocking

Is a clocked production in the tool making industry impossible? No! Successful tool making companies (8 % of the surveyed companies) show that it is possible and how it is done – by means of clocking pallets. The first step for clocking is the definition of a machine park, which can be utilized up to 100%. To save flexibility, machines, which are frequently used for repairs or changes, have to be excluded from the clocked system. Afterwards the cycles and the main process sequences must be defined. Unlike in serial production the cycles in tool making are longer: five hours, one day or even a week. But how can components with different processing times be clocked? Clocking pallets! Components with different geometries and processing times are placed on cycle pallets in a way which generates equal process sequences of their manufacturing steps requiring at the most one

cycle time. Thereby sophisticated logistics are obsolete, because every clocking pallet is passed on to the next clocking station after processing. This bundling of individual components requires complex planning. The clocking obtains flexibility through the interposition of decoupling points. At these decoupling points clocking pallets can be redefined and assigned to different clocking lines based on the pending production steps. Furthermore they allow flexible clocking of components as well as the integration of suppliers. Which leads to another success factor of clocking: Suppliers have to be reliable and on schedule as their actions are also clocked in the process. Reliable suppliers, defined clocking lines, segmented machines and focused employees allow a clocked productions – even in the tool making industry.



Which are the central obstacles of a clocked production in the tool making industry*?

53%

Process disturbances caused by repairs and changes

47%

Too diverse processing times

27%

Obstructions by process disturbances

12%

Uncertain implementation measures

12%

Other

*Multiple answers possible

The king of the component jungle



Clocking represents the pinnacle of planning and controlling in the tool making industry – and the tool shop and measuring equipment shop of ZF Friedrichshafen AG have reached it. The production according to the job shop principle did not meet the production system requirements of the ZF Group any longer. This realization led to a radical change in the order processing: The clocking of the batch manufacturing. This change aimed at the stabilization and reduction of lead times, the reduction of planning efforts and resources as well as an increase of transparency through production according to the flow principle. All set goals were achieved! Currently 80 % of all orders at ZF flow via clocking lines, 12 % on rail lines and 8 % via FIFO controlled production areas. The basis for this was segmentation, enabling the two divergent objectives utilization and availability to be addressed simultaneously. Thereby the clocking works as follows: Various components are assembled to clocking pallets by means of a mathematical algorithm. The processing time of one clocking pallet precisely corresponds to one determined clocking time and all

components have the same processing sequence. After processing, the clocking pallets are moved to the next clocking station according to cycle times. Despite the clearly defined process sequence, the tool shop has to react flexibly to machine failures or the like. This is achieved mainly through the involvement of suppliers. With a two week lead, the suppliers share the amount of free capacity, which ZF can access if needed. Rail lines are managed differently. Here synchronization gets even more complex, because suppliers are integrated in four out of eight rail lines. The introduction of clocking lines and rail lines brought radical changes to ZF. In addition to an analysis of 1.4 million work plans, the core of these changes has been the early involvement and training of the employees. This required the managers to be convinced and won over. Initiated in 2007, the process was completed in 2009 and has been improved by countless CIPs since then. This way the king of the component jungle, the tool and measuring equipment shop of ZF Friedrichshafen AG, will also produce the last 8% of all components on fully synchronized production lines by the end of this year.

The tool and measuring equipment shop of ZF Friedrichshafen AG

The tool and measuring shop of ZF Friedrichshafen AG in Schweinfurt with its 177 employees is the central point of contact for the entire ZF Group. In its function as the center of competence for sheet metal and cold solid forming tools it supports both, the worldwide operating forming sites as well as the affiliated tool making departments. The “tooling factory” has gained special reputation. Due to its

clocked production, it has become a role model for industrial order processing in the tooling sector. Partly as a result of this clocked production the tool and measuring equipment shop of ZF Friedrichshafen AG was selected as the overall winner of the competition “Excellence in Production 2012” and could proudly name its production “tool making company of the year”.



Potentials:

Increase of machine utilization up to 85 % and reduction of lead time variations

Obstacles:

High financial and organizational effort, local circumstances

Key Factors:

Will and conviction of the executives, as well as the employees, preceding detailed analysis of the variation range, clear rules regarding behaviours and processes

Next Steps:

Collaborative synchronization for further flexibility of clocked lines, introduction of scanners for the actual positioning of components



Glocalization

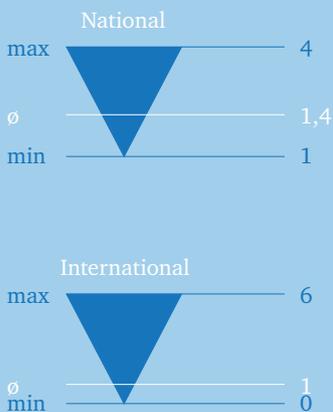
Beat the competition locally

Flashback: 1983, Gene Haas decides to shake up the tooling machine market. His goal: Competitive tooling machines “made in USA“ for less than \$ 50,000; furthermore worldwide availability of services and the shortest response times. The price for individually designed tooling machine of Haas Automation is still at less than \$ 50,000 and the delivery times usually cover a few weeks. Meanwhile Haas Automation has grown to one of the largest tooling machine manufacturers worldwide by turnover and numbers of sold machines. Nevertheless, Haas remains a largely unknown company in Western Europe. Haas branded machines are not utilized by tool making companies in the Germany. However, this should not be taken for weakness. The company has used uncovered territory of supposedly well-known manufacturers to its own ad-

vantage and intelligently conquered those regions early on. Today, the manufacturer exports approximately 60 % of the more than 14,000 produced machines; a large share of them in emerging countries, such as Asia, South America and Africa. There Haas is the machine tool manufacturer of choice. In globally spread Haas Technical Education Centers the use of their machines and control technology is taught locally, thus strengthening early brand loyalty. Individual prices and discount schemes in international markets supported by the sale in Haas Factory Outlets guarantee an ideally balanced supply. Through global service availability, especially in the low developed target markets, Gene Haas is now closer to his goal than ever. Haas Automation’s recipe for success is composed of global presence and locally tailored supply.



At how many locations do you manufacture tools?



Potentials for the tool making industry

Tool making companies are struggling in a globalized world and the current development of the sector does not lower the pressure. The increasing competition from Asia and Eastern Europe has been mentioned in tool making related papers and studies for years. Competitors have always been cheaper and they were advancing continuously regarding technology and organization. This is still true nowadays. The widely acknowledged solution for European tool making companies was process control and integration into the customer’s processes: Face the competition in low-wage countries with operational excellence and enhanced service offerings. This still applies nowadays, but how about beating international competitors at their own game? You think it is impossible to do so? Frankly one could

say you don’t know. Only 2 % of the local tool making industry is completely aware of its international competitors, barely 6 % have insight in international procurement markets and 13 % see no need to be informed about international markets at all. An opportunity is being squandered or not even recognized! It is important to take advantage of factor cost differences instead of being afraid of them. This requires the intelligent distribution of value creation steps along the entire value chain. New markets should be identified and addressed purposefully. This requires outstanding knowledge of global markets and in particular intelligent local networking. Glocalization is the success factor that exploits the opportunities of increasing globalization through specific locality.

Global market intelligence

The tool making industry is one of the most challenging industries to acquire market intelligence in. Compared to the size of the worldwide mechanical engineering sector, tool making is a niche sector. Additionally, it is a small and heterogeneous. Small companies with changing product ranges are a uniform feature of the global tool making industry. The study confirms: 33 % of those surveyed indicate that excessive efforts discourage them to gain international market insight. There is a noticeable increasing demand for tools and a emerging global competition with still considerably high cost advantages. Nevertheless companies are forced to deal intensively with international markets. These are increasingly available; Hence the ideal cooperation partner for the tool making industry and serial production in general will not be located in Europe. Global market intelligence is core competence as well as competitive advantage, particularly in

the tool making industry. The international tool procurement for the supply of local production sites or for maintaining cost efficiency and innovation are not necessarily conflicting goals. An international benchmarking will reveal internal competences as well as potentials and thus strengthen the own competitive position. Market intelligence, however, is not only helpful for procurement. New markets are increasingly encountered outside Europe. Whether in Southeast Asia or in parts of Central and South America: Increasing production capacities will result in an increasing demand of high quality tools. Partnerships must be built at home and locally to take advantage of this development. Thus, markets can be accessed with reduced efforts and mistakes can be avoided. Knowledge and contacts of locals are the key factors to a low-risk strategy of internationalization in many countries.

Tool supplying that satisfy the requirements

Besides global economic growth the derivatization of products and shorter life cycles are directly linked to the increased demand for tools of producing companies. The internationalization of production sites spreads this demand on a global scale. Today 9 international production sites have to be supplied with tools and provided with service in average. This is almost as much as the average of 11 national sites. Internationality is demanded of tool making companies, since the support exclusively from Germany is usually too complex and inflexible. Tool making companies already operate almost as many international as national production sites, but still cannot guarantee the worldwide supply of tools yet. Local value-creation partners are required to cooperate and

the operational production support has to be partially decoupled in the tool making industry. This is already implemented successfully by a lot of producing companies. Concerning the support of their international sites more than two-thirds rely either on external companies or on specialized internal maintenance units. In this case the understanding of production capability is changing. In the past tool shops and tool procurement were two separately operating cost centers of one production, whereas nowadays the tool supply is a competitive function for a producing company. Internal or external procurement – national or international use – these questions lose their relevance. Instead, fulfilling the requirement means to ensure efficiency, innovation and flexibility for each production site.



Share of tool making companies with good to excellent market intelligence:

National

67% (customer market)

57% (competitor market)

60% (supplier market)

International

45% (customer market)

25% (competitor market)

28% (supplier market)



Why is there no improvement of the market intelligence*?

39%

No capacity

33%

Excessive efforts to increase insight

26%

Unclear procedure for improvement

22%

No responsibility

13%

No need for improvement

20%

Other

*Multiple answers possible

Local value adding in global competition



What is the value of an internal tool shop? Whether protected from the external competition, or independently and profit-oriented, the goal dimension of internal tool shops are always identical: Flexibility for production support, innovation capacity for product optimization and simultaneously short processing time and low costs for the tool manufacturing. The “Global Tooling“ at the Takata AG found and implemented an approach in order to dissolve the conflict of differing aims of internal tool shops. Global production sites are provided with tools and services by local internal value added networks which cooperate with global external suppliers. In Europe, technological and organizational innovations for products and tools are managed by the lead-tool shop in Aschaffenburg. At this tool shop, product-, process- and tooling-know-how in engineering and construction is bundled and new process chains for tool making are being introduced and tested. At the same time, cost potentials can be utilized by local value added in Hungary and Romania, which are direc-

tly connected to the Eastern European production sites of the Takata AG. This works well due to complete and smooth networking between all organizational and technological information and data flows. For example, constructions which are conceived in Germany can be completed in Eastern Europe or CAM programs could be created in Romania and the following mechanical processing can be carried out in Aschaffenburg. As a result, the utilization of the whole network can be levelled in an ideal way. Factor cost differences between Western and Eastern Europe can be exploited with consideration of various levels of knowledge as well as competence and the production can be supported locally. Simultaneously, the internal tool shop is facing the global competition at all times. Market knowledge and price transparency enable the “Global Tooling“ to offer the ideal service for series production worldwide. Tool making is understood as tool supply and the fundamental issue about the real value of the tool shop is being answered.

The tool shop of the Takata AG

The Takata AG is an internationally operating, worldwide leading company which produces integrated passenger protection systems for vehicles. As a part of the worldwide operating Takata Corp., Tokyo with more than 48.775 employees, the Takata AG is responsible for the European activities of the group. The strategic alignment of the global production sites contributes to the greatest possible proximity to automobile manufacturers. Currently, there are 58 production and development sites worldwide in Asia, Europe, North- and South America. Takata Global Tooling includes tool making

companies in Germany, Romania, Hungary, Japan, Brazil and Mexico. In Europe alone, they engage more than 210 employees at three sites. Takata Global Tooling manufactures die casting molds, foaming molds, injection molds and systems. The internationalization and site networking of Global Tooling has been required by the following aspects: An increasing competitive and cost pressure which results of global procurement opportunities as well as the increasing relocation of production. The latter development is accompanied by growing demands on availability as well as tool and process standards.



Potentials:

Local tool supply and production support with utilization of cost potentials through international dispersed value added

Obstacles:

Implementation of information and data consistency across international sites as well as distribution of tasks in accordance with various levels of competence

Key Factors:

Excellent knowledge about all markets relevant for Takata as well as a tool shop with technological and organizational leading function

Next Steps:

Further opening to external markets and solidification of independence as well as profit orientation of the internal organization of the tool shop



Automation

Housework is a breeze, my husband says ...

Saturday, weekend, leisure time! Leisure time? Working at home or in the garden requires leisure time on Saturdays and is considered a necessary evil and perceived as providing little benefit by most people. Washing windows, vacuum cleaning, cutting the hedge and mowing the lawn – this is work which requires time and motivation, but no know-how. It must be possible to automate these tasks with machines! Yes, said Husqvarna! The company realized this thought in regard to lawn-mowing in 1998. With the “Automower G1” an autonomous robotic lawn mower was designed. A lot happened since then. No effort, any type of weather

– always ready for work. The intelligent robotic lawn mower is equipped with sensors and creates an environment profile achieving reproducible results. A high initial investment is justified by low energy consumption, short-cut grass as well as uniform distribution of the grass on the entire lawn. If you want to check on your beloved lawn, you can access the lawn mower via app and get updates on its position and the already mown area. This way the robot saves time for things which are more fun and require much experience and know-how – on Saturdays at 3:30 pm: Time for football.

Investments in automation technology:

The willingness of tool making companies to invest in automation solutions in 2014 was on average only

2,6 pp

higher than in 2010



Main obstacles during the introduction of automation solutions:

49%

Lack of standardization opportunities

38%

Excessive investment cost



Potential for the tool making industry

A new era for the producing industry began in the 60's. The third industrial revolution, the automation, supported by the invention of robots and computing power has become indispensable in high-wage countries such as Germany nowadays. Automation solutions and robotics have developed into industry standards especially in serial production for quite some time. But also the share of unmanned production in tool making, representing batch and single production, is steadily increasing. Driven by increasing cost pressure and the need for reproducible quality of individual processes systems with very high degrees of automation have been developed. Automated machines can run 24/7 thus enabling cost-effective production despite high

investment cost. This can be achieved in particular by combining several machines and processes such as the integration of an electrode milling machine, a sinking-EDM machine and a measuring machine in one system.

On average, tool making companies have currently combined 1.7 processes, pioneers already up to five processes. There is a high potential especially regarding the automation of manual processes. This enables tool making companies to focus on processes which require know-how, while simple reproducible processes are entirely automated. The reduction of errors and the increase of planning capability of processes lead to positive effects in terms of cost, time and quality along the entire tool making process.

Automated manual processes

Deburring, polishing and drilling rang among the simple processes which do not require sophisticated know-how in the tool making industry, such as cleaning windows, ironing or mowing the lawn at home. The automation of these processes enables tool making companies to effectively use the competences of their employees for know-how intensive operations such as assembly. The prerequisite for automation are reproducible processes. Currently more than half of the surveyed companies see the reason for unavailable automation solutions mostly in non-standard process sequences and individual steps of production processes. Nevertheless, products and processes in small batch and single production can also be standardized thus enabling the

decoupling of such processes from human intellectual abilities. They are an essential prerequisite for no longer manually managing error-prone processes. Besides creating freedom for know-how intensive operations, automated processes also offer other benefits. Processes can be carried out quicker with higher predictability regardless of the presence of employees. This leads to increased capacity utilization and hence a reduction in cost is made possible. Additionally, the increased transparency of process parameters enables a systematic process analysis. Especially during the fourth industrial revolution, the recording and evaluation of large amounts of data is increasingly gaining in importance.

Automated process chains

Manual processes can be automated. But how are already automated or partially automated processes optimized? The solution is linking automated processes in one system. One classic example in the tool making industry is the integration of electrode milling with sinking EDM machines. Large volumes can be handled automatically with the help of a robotic arm which physically connects the machines with a pallet rack. Neither reclamping, tightening nor conversion is necessary. The further integrating of a measuring machine into the system enables the em-

ployees to entirely focus on programming work. The implementation of such systems is very complex and expensive and their use has negative effects on flexibility but the advantages are however obvious: High capacity utilization and reproducibility, low transition times and the bundling of the employees' competence regarding know-how intensive operations. Due to these advantages and successful use in practice, the linkage of processes in the tool making industry will continue to grow and become a central part of it, like polishing and trimming.



Which statement concerning automation solutions is true in your opinion*?

16%

In the future each manufacturing process will be automated

70%

Manufacturing process steps which cannot be automated will always exist

53%

In the future the assembly will continue to be carried out completely manually

35%

In the future the assembly will be carried out partially automated

2%

In the future the assembly will be carried out completely automated

*Multiple answers possible



Number of linked processes:



From simple idea to all-purpose tool



Handcrafted processes for the try-out of sheet metal forming tools are still popular today. These manual processes are often very expensive in relation to costs and lead time and the quality achieved is hardly reproducible. Instead of simply accepting the “state of the art in technology“ the tool shop of the Daimler AG has launched the project “The automated tool making“ in order to automate the manual processes. The project manager Johannes Wied says: “Particularly, lengthy, monotonous and ergonomically unfavorable work is the focus of automation solutions in order to use the employees’ competence for know-how intensive operations“. Polishing, deburring and drilling rank among such processes. After a long development phase a robot-based solution could be implemented which has become a universal robot processing cell. Beating instead of polishing, deburring, deep hole drilling, milling, laser welding, hardening and optical measurement are just some applications which the universal robot processing cell can provide. Due to automation, the frequency of repetition of the quality parameters can be ensured and the processes polishing and deburring can be carried out three times faster. In addition to that, the predictability of processes has considerably increased. This improved planning and the conca-

tenation of processes without tightening the pallets in the robot processing cell let it become an all-purpose tool, which combines a large number of processes in tool making. The intelligence of the cell supports the predictability. Whether a drill is broken, a wrong tool has been inserted into the magazine or there is a risk of collision: The processing cell recognizes these deviations and reacts autonomously. Despite the high development cost as well as the varied challenges linked to the process of transferring the cell from a development object to a process component in tool making, the project has become a total success due to the involvement of interdisciplinary teams consisting of competent employees. “By developing the automated small batch and single production we have shown the pioneering spirit that is typical of our brand, as in the first implementation of the clocked flow production in tool making 10 years ago,“ director of the “Center Betriebsmittel“ at Daimler AG Günter Sprecher adds. Meanwhile, five universal robot processing cells are in operation at the various tool shops at Daimler AG. In order to integrate additional manual processes as well as to introduce the automation in programming and design processes the vision of the “automated tool making“ is driven forward.

The “Center Betriebsmittel” at Daimler AG

With approximately 1,350 employees the “Center Betriebsmittel” at Daimler AG is part of the “Mercedes-Benz technology-factory“. It consists of two shops: The tool making shop with 950 employees and the shop for plant construction with 400 employees. The main tool shops are located at the two largest sites of Mercedes-Benz in Sindelfingen and Bremen.

Currently at the Sindelfingen site a new production building for tool making is put in operation, in order to satisfy the globally rising demand for tools. The sheet metal forming tools for external parts such as sidewalls, doors, bonnets, etc. and their commissioning in the press shop are the focal point of tool making.



Potentials:

3 times faster than manually

Obstacles:

Big development efforts and integration in process chain

Key Factors:

Pioneering spirit of employees and an interdisciplinary team

Next Steps:

Integration of further manual processes and implementation of automatism in programming and design processes



Innovative Engineering

The sentence all men either cannot or want to hear

Every good marriage gets to this point! The dropping of the sentence that the husband does not want to hear but is unavoidable: “Darling, your hearing is getting worse!” Regardless of the question “ability or intention to hear”: The hearing performance increasingly deteriorates at a higher age. Necessary consequence: An hearing device! Oh no! An huge, heavy, uncomfortable hearing device, visible for everyone. Horror! Is that correct? The answer is no, proved by the company Sonova. The elaborate production of hearing devices with the above mentioned characteristics belongs to the past. Today hearing devices are small, light, soft, comfortable and hardly visible. The key feature is the additive manufacturing of hearing devices. The 3D printers revolutionized the hearing device manufactures in a very short

time. The elaborate manual manufacturing of the hearing devices shells is now replaced by simple and fast printing. The silicon impression of the auditory canal is transferred in a CAD model, whereby the optimally positioning of an individual component of the hearing device can be calculated. As a consequence, the size is decreased and the comfort can be increased. The new technology enables an easier and faster development of new test innovations and above all allows – reproducibility! Defect or lost devices can be recreated with a simple mouse click – fast in the exact same quality. Sonova calls this “customized mass production”. Through the introduction of 3D printing and the associated virtual product, Sonova became the driver of innovation in the industry field.



If applicable, what do you use generative manufacturing for?*

55 %

Manufacturing of prototype components/products

45 %

Manufacturing of mold inserts

31 %

Alternative manufacturing of (small) series components/products

31 %

Manufacturing of other tooling components

21 %

Repairing of tools

21 %

Other

*Multiple answers possible

Potentials for the tool making industry

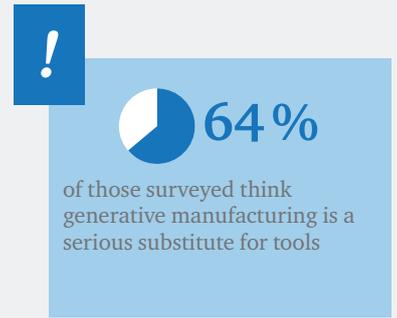
Many experts in the manufacturing industry agree: The additive manufacturing will revolutionize the production environment and will open up inconceivable possibilities. But will everything be printed in future? Will even tools be replaced by printers? Probably not! This assessment is also given by the majority of the surveyed companies. But there is one thing everyone agrees on: Tool making will also have to deal with additive manufacturing, as it offers a huge potential. The crucial problem of tool making in the product development is the ever shortening development cycle. The consequence is, that the time to develop a prototype has to be more cost-effective. However, in the future, tool making and its know-how must be early integrated in product de-

velopment to master shortened development cycles. This can be accomplished by services, which go beyond simulation of components and the manufacturing of prototypes. Enhanced simulation of processes as well as the definition of process and technology parameters are of crucial importance to increase process reliability. The virtual design of processes, coupled with a fast and cheap manufacturing of prototypes from the 3D printer will enable the tool making companies to be an innovation driver – in terms of the product and the technology. However, for this it is necessary to intensively build up required expertise in virtual engineering and additive manufacturing at an early stage.

Virtual Engineering

The world is going digital! The world is going virtual! The world is going fast, much faster! But is tool making also going virtual and thus faster? If you look for virtuality in tool making, you will hardly find applications beyond component simulation and CAD model creation. The elaborate manufacturing of prototypes with long lead times and high investment costs are the standard. But even in tool making the goal must be to become virtual, particularly in product development. By integrating the upstream customer processes, tool making companies can contribute their know-how at an early stage by simulating processes. Thus, they need to build up skills in engineering that exceed the mere development of methods

and device simulation. The future goal of tool making companies has to be becoming an irreplaceable consultant of the product development for customers. For this purpose, tool making needs to be a guarantee of innovation and process reliability. This can be accomplished through extensive simulation know-how. Simulate instead of manufacture! In the beginning of the product development process the engineering should already define shopfloor processes as well as serial and technology parameters according to this motto. This enables innovations and reduced development times – two arguments for customers to dig deep into their pockets!



Additive Manufacturing

The technology of additive manufacturing cannot substitute tools. The existing technologies such as laser sintering, polymer printing or wax printing are too immature in terms of product quality and too slow in relation to the manufacturing time. However, those technologies particularly provide a high potential for tool making companies as process-enabler. It is necessary to integrate 3D printing, etc. in the tool manufacturing process and thus to supplement existing technologies. Possible applications are prototypes, spare parts as well as tool components and single and small batch production. However, with the high flexibility of the manufacturing of individual parts comes along the biggest drawbacks of these technologies: Slowness and expensive-ness! In a nutshell, only suitable for a

small batch size! However, the additive manufacturing allows the development and testing of innovations. Therefore, the development cycle can be significantly reduced. Paired with an early integration of the tool making companies in the product development of the customers simulation processes, their results are powerful drivers of innovation. However, the elevation of the potential of additive manufacturing requires an intensive examination of materials and technology. The tool making companies must not wait until the technologies are more efficient and cost-effective! When the time comes, it must no longer be only process-enabler. Instead he also has to be technology leader – this applies to both, the material plastic as well as metal.

At which point does tool making engage in the product development process for the first time?



From tool manufacturer to service provider No. ONE

**BMW
GROUP**



The utilization of available knowledge beyond the borders of tool making – tool making as a process guarantor and engineering service. That was the goal of the tool shop of the BMW Group. In order to achieve this goal, the tool shop had to look at a bigger picture – way bigger picture. They had to question simulation tools of aerospace technology, embrace them, standardize and guarantee a simple operation. That was the beginning of the success story. The integration into the product development by simulating the processes – simulate everything possible to simulate: Manufacturability and material failure, dimensional stability and elastic behavior, microstructures and wrapping as well as the tool cooling during press hardening. By predicting the process and component behavior at an early stage of product development, the tool shop becomes an indispensable consultant in terms of product development. In the BMW Group, engineering specifies the processes in tool manufacturing as well as the technology parameters in the press shop in detail. In order to achieve this three-staged approach to industrial production in the tool shop, the development of competencies was necessary. Specific goal? No less than

a “hole in one“. Obtain process reliable tools with one attempt on the serial press and receive best components possible in the previous series. However, before that there were still obstacles to overcome. The alleged limitation of the design process through the setting of standards or defined guidelines. Today, employees are aware of the benefits: Faster working processes, higher continuity and a much higher process reliability. In addition to the establishment of standards in the software, in press shop technology as well as the conviction of employees, there was still one more essential key factor that has enabled the success of the concept: Interdisciplinary teams. These teams combine a variety of disciplines and thus guarantee success. Everybody sits in the same boat heading towards the overall optimum. In this way, the tool shop has become a single source provider for services. Its unique expertise in engineering allows the transfer of information about the manufacturing of components to the crash simulation of vehicles. Based on this detailed illustration of the chassis, some derivatives in the development phase are no longer manufactured. Instead, they are exclusively simulated - cheap and quick.

The tool shop the BMW Group

The tool shop of the BMW Group is the internal competence center for forming processes within the company. Around 1,150 employees at the plant sites in Munich, Dingolfing and Eisenach deal with the manufacture of tools and prototypes, the technology management and planning as well as the manufacturing technology in the press shops. The tool shop of the BMW Group is responsible for the global supply of the production sites for

sheet metal forming tools of body parts and complex structural components. The development and design of approximately 500 tools per year have lead the tool shop to a know-how owner and engineering service provider in the field of sheet metal forming. The portfolio ranges from the component and process simulation through the tool manufacturing to the tool commissioning and support of the press shop.

A photograph of a complex industrial robotic assembly line. The scene is dominated by a large, multi-axis robotic arm with a brown and orange body, positioned in the center. The arm is surrounded by a dense network of metal frames, pipes, and sensors. The background features a grey wall with a yellow and black striped safety barrier. The overall environment is a clean, well-lit industrial setting.

Potentials:

A much higher process reliability and shorter development.

Obstacles:

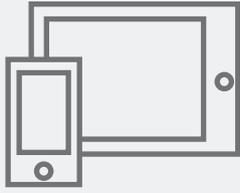
Alleged restriction for the design of tools

Key factors:

Standardization of technologies and interdisciplinary teams

Next Steps:

Dimensional and qualitative stability of the components with robust tools after the first quality loop



Digitalization

Computers are the better Drivers

Are you willing to be chauffeured around? Not by a driver, but by your car itself? Science fiction? Not really! The “science fiction“ is getting more realistic, thanks to Google. In 2014, Google has introduced an autonomously driving car, which was developed for this exact purpose. A bold step: Hardly any process is more difficult to master by technology than driving. The major challenge here is receiving and evaluating a variety of data. For recording these data, the Google car is loaded with numerous different sensors. The centerpiece is a rotating laser rangefinder. From reflected laser beams, 3D images of the environment are created, which are supplemented by ultrasonic sensors and a front camera. The obtained information is evaluated and compared to GPS signals and stored maps. No sorcery! Not quite! The variable which is most difficult to be evaluate is the human being in form of other road

users, as they do not always adhere to the traffic rules. In contrast the Google car does. The difficulty: A computer is not able to interpret human decisions. For compensation of this issue, it has to learn. The Google car has already driven 2.7 million test kilometers in order to accommodate as many environmental influences as possible. Compared to the annual path of the average German car driver, this complies with about 180 years of driving experience. The rides are still supervised by a person who can intervene in case of emergency. In this way, the autonomous drive works on freeways and highways quite well. But does it always have to be the most complex process that needs to be changed, or are there also small digital solutions that make our lives easier? The future is digital! Do you really want to be driven to your non-digitalized workplace by your digitalized car?



How is your Shopfloor-Management characterized*?

66%

Defined key figures for on-site control

56%

Functioning idea management

53%

Defined visual management

34%

Regular gemba-walks

9%

Other

*Multiple answers possible

Potentials for the tool making industry

Tool making companies should not see digitalization as a threat, but rather as an opportunity. How can we develop new products and improve old ones for additional value for my customer? How is digitalization helping me to make my manufacturing processes more efficient? These are the core issues of digitalization of tool making. This is to be understood as an ongoing process, in which it must be decided over and over again what is worth to be digitalized. The goal is the piloting of small solutions in a quick way and inspiring the employees! Because digitalization means keeping up. Since there are no complete solutions or standards on the market, tool making companies have to develop their own.

In near future, it will remain this way. Various industrial applications require different platforms and each variant of a networked production requires more in-depth knowledge of the processes. The effort will pay of in many ways. Digitalization increases the transparency which is the key to more efficiency! In a complex environment such as the single and small batch tool production, there are many control levers to introduce improvements. In this case, the decisive factor is the inclusion of data and its processing into information: Smart data. Smart data forms the foundation for improvement of products and services, but also the control of production complexity in terms of Smart Processes.

Smart Data

The basis for the digitalization is the recording of data – and there is a lot of data! A whole lot! You just have to find it. At this point, you have to ask yourself two questions first: What data can be used? And where do I get this data from? After consideration of the benefits and expenses of the survey, it is important to refine the data to smart data. Because smart data means more than just data. It means information. And information is the basis for sustainable knowledge. For data collection, however, individual system solutions are necessary. The reason: Company-specific applications and situations are so individual that standard solutions cannot simply be used. Instead, they must be adjusted. This leads to increasing costs, but also greater potential: Due to the implementation of individual solutions, data sovereignty against third-parties is ensured and the functionality is orientated towards the business processes

and not vice versa! There are more than enough possibilities for application in tool making! Incorporating process data from the serial production into the construction of future tools, using component positioning and process implications for adaptation planning in real time, or illustrating assembly instructions of complex tools step by step to young employees by a viewer. As varied as the ways of recording the data, as varied is their utilization. From construction through the planning to the series purchase, data can be obtained and used. Available everywhere and for anyone decentralized usable. For this purpose, however, a transfer of data into information is necessary. Making data smart! Whoever controls it, is a step ahead of the competition! Because tool making is based on knowledge and data provides knowledge! Whether in standard solutions or individual gadgets.

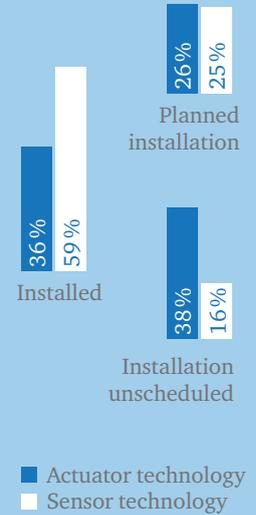
Smart Process

What will manufacturing in tool making look like in future? Completely automated, many robots, no human beings? Hard to imagine! But certainly it will look like this: Many intelligent machines working hand in hand with people and communicating with each other. Working smoothly as a Swiss watch, machines and humans know at any time, what needs to be done and by whom, so that the customer gets exactly the tool he wants. Fast, cost-effective and if possible error-free – effective and efficient! As clear as the target image is, the road leading to the situation described is still long. But today many opportunities of digitalization can already be used at least in form of individual solutions. The paperless manufacturing for example. For each long serving master craftsman this is a nightmare, for any young apprentice absolutely normal! Who is reading a printed newspaper in

times of smartphones and tablets? In the construction created data will be send into the production via viewer, available at each machine, always up to date. CAM programs for the machines are loaded automatically by scanning a QR code, which has been engraved on the particular component. The incoming control of the assembly is performed by optical systems which check the incoming goods and digitally check off the parts list. The tool making process itself is not new, but it is connected, it is transparent, it is smart! Identifying, explaining and correcting cost variances? No problem! Minimizing layovers by a flexible planning system? No problem! Integrating new employees into the process? No problem! Because a smart process is the enabler for the superiority of the process in an international comparison.



Do your tools hold actuator technology and sensor systems?



76%

of those surveyed still use 2D drawings in their manufacturing

Step by step to the digital factory



“Digitalization will decisively shape the future!” But not only the future! Schneider Form GmbH is embracing digitalization right now. They developed and implemented customized digital solutions for the tool making industry. Investment costs and the necessary development of new skills could not stop them. Another necessary prerequisite: All employees are joining forces and playing their part! Persuasive efforts were only required at the very beginning. The potential of digitalization was quickly recognized by their employees through small pilot projects. Schneider Form aims at pilot testing small solutions quickly. Applications make it possible! Here are two: Tablets are used at Schneider Form as viewer and impress with “augmented reality”. For checking drill holes after the mechanical production, the drilling patterns saved in the CAD-data are visualized on the tablet and projected over the recorded image. Thus making the early detection of deviations as easy as possible. Another digital solution of Schneider Form is the portable measuring device “OptiCheck“

that is used at customer site. Sensors are attached to defined interfaces of the tool during the startup and measure relative movements of the tool during the injection molding process. This enables the customer to detect problems and optimize the process purposefully! As a result, expensive test loops on production machines are avoided. At Schneider Form a significant advantage in the digitalization of individual work steps is seen in creating transparency along the entire process chain. This transparency increases the curiosity of its employees and encourages new ideas. The result: Many proposals for further digitalization resulting in a significant increase in efficiency. The detailed comparison of actual to budgeted costs in particular, made possible through the installed solutions, was a significant factor in identifying and mitigating vulnerabilities. The great goal for the future is to join the existing stand-alone solutions to a comprehensive overall solution. This overall solution would enable the inter-company know-how transfer. Outcome: Very promising!

Schneider Form GmbH

The Schneider Form GmbH is a tool making company, which focuses on the development and manufacturing of high quality plastic and die-casting molds with a total weight of over 25 tons. OEMs and 1st tier suppliers alike are customers of Schneider Form. 300 employees develop and manufacture about 250 tools per year at the sites in Dettingen, Great Britain, China and Portugal. True to their slogan

“Full Service“, Schneider Form offers product development for the customer, production of prototypes with generative manufacturing processes, tool packages and after-sales service. The Schneider Form GmbH was named Toolmaker of the Year in the category “Tool making company over 50 employees” of the competition “Excellence in Production”.



Potentials:

Higher transparency, increasing efficiency in individual process steps and higher employee motivation

Obstacles:

No available solutions and missing client willingness to release data

Key Factors:

Faster success due to smaller solutions, persistency and inter-departmental teams

Next Steps:

Complete software solution and international know-how transfer



Working Culture

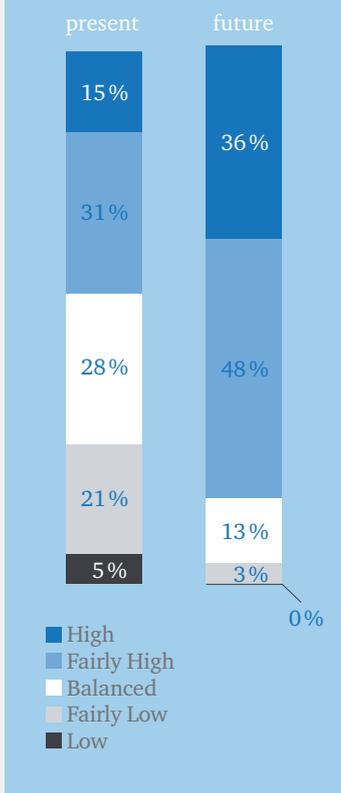
In small steps to great success

Every tenth day the entire machinery stands still. A horrible nightmare for the common producing industry, but not for the adhesive tape manufacturer Siga from Switzerland. Producing goods in Switzerland is expensive, therefore local companies are forced to come up with innovative ideas. To do so, all employees of the company are exempted of their daily business every tenth day. On that particular day, they are attending workshops to discuss ideas that enhance their products, processes and organization. This leads to ongoing improvement and innovation rather than radical restructuring every few years. Siga expects 50 ideas of each employee per year. A total of 400 employees bring forth 20,000 proposals. A majority of which relates to minor improvements, supposedly insignificant that already can be approved

and implemented in a short timeframe. Promising ideas involving major improvements are driven forward on the “tenth day”. This can be done partly in a playful manor e.g. by testing everyday processes: “Take order from faxing machine and put it into the shelf, create order in software, print confirmation, copy, staple together, fax back ... and go!” The time is measured to find potentials for acceleration of routine procedures in the organization department. In addition, idle production machines are used for experiments on the production process. The continuous improvement process at Siga has led to a new way of thinking of all employees. The opportunity to be able to try innovations has sparked the entrepreneurial courage of many employees. The agile Company overcomes crises, which break other competitors.



Factor of success Working Culture:



Potentials for the tool making industry

The tool making industry is know-how intensive thus affected by demographic changes like no other branch of the engineering industry. The workforce is aging and skilled young managers are difficult to find and train. In addition, tool making is incorrectly perceived as a “dirty workshop profession”, in comparison to the clean and supposedly highly technological mass production. The industry is forced to act. The times in which “working culture” was solely important for the media, marketing and Silicon Valley start-up scene are far gone. Nowadays and in the future, the topic is estimated to be as or even more significant to the success of tool making than for example the success factors automation or synchronization. The demands on work change with a changing supply of skilled labor as well

as a new generation of employees. The so-called Generation Y and Generation Z, i.e. the birth cohorts from around 1980, are demanding more freedoms, more flexibility and more inclusion. They are also more influenced by digital media than any previous generation. The task at hand is to spark the generation’s enthusiasm for the company and the work as well as integrate them into an intergenerational working culture. An excellent working culture is the best advertisement for a company. It can be its unique feature, a result of offered freedoms and services, but in particular the expression of trustful leadership and shared values. Therefore excellent working culture attracts the talents of tomorrow and presents a source of innovation and motivation.

Flexible working arrangements

It is certain: Working arrangements of the future are flexible. Well structured, it will bring huge benefits for companies and employees. Besides employee loyalty and image boost, the flexibilization of working hours and place of work lead to an increase in value creation and productivity. The new criteria for excellent performance are 5,000 hours of machine utilization instead of 38 hours of attendance of employees. When and where necessary activities are carried out, for this aim is irrelevant as long as the results are right. To let this fundamentally new understanding become a reality, a number of questions and problems of employees and companies have to be addressed. The flexibilization of working hours can be achieved through working time accounts, which level short-, medium- and long-term capacity supply and demand, thereby giving businesses and employees planning reliability. In

addition, flexible working hours become crucial to employees as soon as they want or have to prioritize activities outside the company for a longer period of time. Whether it is raising children or nursing elderly family members, it is important to implement simple but uniform rules which relieve employees as well as bind them to the company. This may include flexibility regarding the place of work of the working arrangement. The opportunities of digitalization allow more and more activities to be carried out from a remote workplace. But there are also limits to flexibility for a company. It increases the necessary amount of administration and coordination. In addition, joint work in a team with short coordination efforts remains an important factor of success for the organization of work. Defined flexibility with firm rules provides added value for everyone involved.

Promote and demand innovation

Employers and employees agree: Sustainable success through constant innovation. Despite the mutual aim, reservations on both sides are deeply rooted. Entrepreneurship is courage and continuous innovation. But entrepreneurship also means to have creative freedom of choice and even more so the necessity to actively shape and use this freedom. A good entrepreneur takes long-term decisions and develops the values of the company sustainably. Can there be only one entrepreneur and a few managers in the business? No! Anyone can heed the characteristics of entrepreneurship and follow them. A proverb says: "It is better if a hundred people go one step, as if one goes a hundred steps." This implies that the conditions must be set accordingly through the established decision-makers. Specifically, freedom for creativity must

be created and employee participation enabled, so employees can unconditionally contribute ideas regardless of their position and their sphere of influence. This is mainly a cultural task that reveals itself in desired discourse, diverse discussion and an innovative working environment. A corporate culture that acknowledges individual achievements and success as well as promotes personal development. Regardless of the corporate culture innovation can be demanded. Whether as functional and cross-hierarchical improvement projects or ideas competition. Instruments to do so are widely available. Decisive in their application is the speed of decision and implementation. Innovation means renewal! A process that will not stay hidden from your customers.

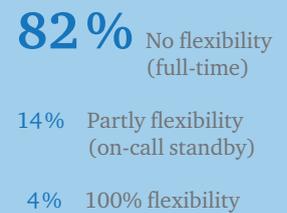


How flexible can your employees plan working schedules?

Construction



Manufacturing



One enterprise, many entrepreneurs



“The repeal of the confrontation between employers and employees.” Active and direct employee participation unifies all parties working together for a greater aim: Sustainable success for Meissner AG. The concept of “entrepreneurs within the enterprise” was born at Meissner out of necessity. During a bankruptcy in the 1990s, the workers were not willing to let “their” company break apart. Their investment should save the company and lay the organizational foundation for future success. The decision has paid off! The Meissner AG is bigger and more successful than ever. A normal hierarchy ensures the frictionless day-to-day business, whereas all crucial decisions are taken together with the employees. In doing so, an extraordinary, perhaps unique mentality prevails in the company: Entrepreneurship in good and bad years is firmly anchored in the minds

of all employees. However, innovative working culture is more than employee participation for Meissner. Flexible working arrangements render the company interesting for future generations. With demand-oriented working time corridors and overtime regulations as well as short- and long-term working time accounts needs of employees and companies alike are met. The remuneration includes both a fixed component and performance-based incentives. Furthermore Alliance hours can be demanded in case of need, which are being paid depending on the company’s success at a later time and with interest. Even the place of work can be chosen flexibly in the future. The pilot project “5-axis-competence team” focusses solely on the utilization of the machines. Work periods can be scheduled independently. Employees are the key to success at Meissner AG.

Meissner AG

The Meissner AG develops, constructs and manufactures prototypes and production tools for casting engine blocks, cylinder heads and other castings in their headquarters in Biedenkopf Wallau. The product range also includes blow molding, primarily for the production of fuel tanks and filler tubes as well as tools for the production of vehicle linings made of various materials. The company, founded in 1922, realized projects throughout

the entire world with production sites in Germany and China. Meissner is a corporation, which is majority-owned by its employees so its share ownership is widely spread. Of the currently more than 280 employees and 50 trainees and students the majority holds stocks from Meissner. This award-winning model contributes significantly to the sustainable success of the company.



Potentials:

Employees with an understanding of and active participation in business activities

Obstacles:

Overcome organizational uncharted territory in implementing the concept of “entrepreneurs within the enterprise”

Key Factors:

Compatibility of a “normal” hierarchy

Next Steps:

Transfer of the pilot project to other areas in the mechanical manufacturing



Outlook

Nine factors of success, one goal: faster, better, further! Fast Forward! Mastering these factors is the pursuit of success and more efficient value creation. The Fast Forward Tooling has recognized the future importance of these factors of success and combines them to design the entire value creation process of products through processes up to resources: Tools are emotional, modular and smart. They associate emotional design with marketing and convince at first glance. They are based on construction kits to dominate diversity. They incorporate data-based knowledge and provide opportunities for new business models.

Processes are glocal, synchronized and automated. They are based on comprehensive market intelligence and enable constant and entirely satisfying tool supply. Processes that used to be manual are automated and linked to automated process chains. They are transparent and enabled through high resolution planning and flexible clocking.

Resources are innovative, digital and modern. Their expertise will be used in an early stage of product development and supported by additive manufacturing technologies. They create and use data as a unique source of knowledge. They are tied to employees who work flexibly and boldly create innovations.

The Fast Forward Tooling shows how to face the current trends and challenges in the sector and how success is achieved in the upcoming years. However, the factors of success are not the final aim. They present the path to more efficient

value creation. This path is marked by our social, economic and technological development. The future will bring change and transformation. The Fast Forward Tooling considers this change. Openness, learning and conscious decisions enable the further development of the Fast Forward Tooling.

Changes, trends and challenges can be actively perceived at an early stage with openness. The Fast Forward Tooling records and includes ideas and concepts of mass production as well as other sectors. The learning begins by addressing external changes and corporate developments. Changes generally result in something new – not simply better, not simply worse. In dialogue with employees, customers and partners prospects are used, opinions heard and reviews formed to build sustainable solutions. All internal and external stakeholders broaden the knowledge of the tool making industry. That only supports, because this knowledge is internally reflected and a conscious decision for the Fast Forward Tooling is taken. Goals are defined out of decisions and a clear path is taken. Fast Forward Tooling navigates with openness, learning and conscious decisions a constant path dealing with the change.

The ones who are open, who learn and who make a conscious decision are more efficient, are Fast Forward!

Authors



Prof. Dr. Günther Schuh

Head Chair of Production Engineering at the
Laboratory for Machine Tools and Production Engineering (WZL)



Dr. Wolfgang Boos

Director
WBA Aachener Werkzeugbau Akademie



Dr. Martin Pitsch

Former Head Department Business Development
Laboratory for Machine Tools and Production Engineering (WZL)



Michael Salmen

Head Department Business Development
Laboratory for Machine Tools and Production Engineering (WZL)



Tobias Hensen

Group Leader Department Business Development
Laboratory for Machine Tools and Production Engineering (WZL)



Thomas Kuhlmann

Group Leader Department Business Development
Laboratory for Machine Tools and Production Engineering (WZL)



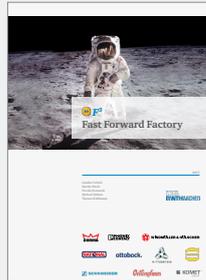
Felix Rittstieg

Research Associate Department Business Development
Laboratory for Machine Tools and Production Engineering (WZL)

Our Studies



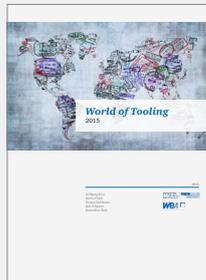
Fast Forward Tooling
2015



F³ Fast Forward Factory
2015



Erfolgreich Kalkulieren im Werkzeugbau
2015



World of Tooling
2015



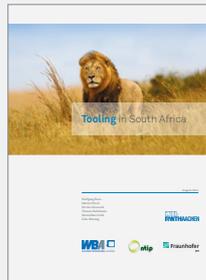
Getaktete Fertigung im Werkzeugbau
2015



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2015



Tooling in South Africa
2014



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WBA Aachener Werkzeugbau Akademie GmbH

Karl-Friedrich-Straße 60
D-52072 Aachen
www.werkzeugbau-akademie.de

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