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Casper 4.0 – the supporting pillars for a digital future

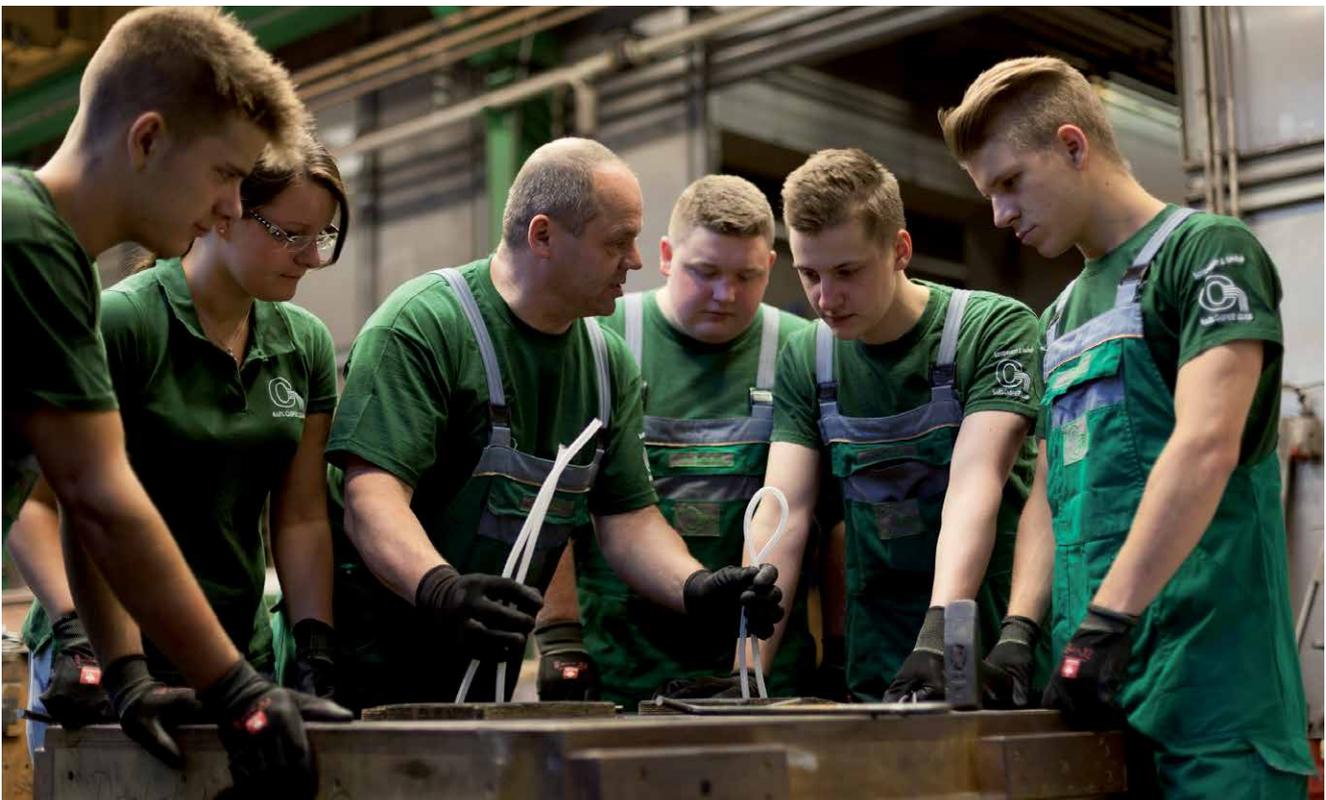
Industry 4.0 is a hot topic in the media and in political discussions. While most German foundries are still hesitant, there are indeed some pioneers who are actively pursuing the concept of Foundry 4.0 as a strategic objective

The foundry industry is presented with challenges of a new nature. “Industry 4.0” is a hot topic in the media and in political discussions. Under the motto “Safeguarding the future of Germany as an industrial location”, various bodies and organizations have set out to define new standards for what is called the fourth industrial revolution. The central element is the concept of the “smart factory”, in which humans communicate with machines

and products of any kind. Also at GIFA 2015, “Foundry 4.0” was an omnipresent topic among German foundry operators. For good reasons, because international competitors are not sitting back and just watching. While most German foundries are still hesitant, there are indeed some pioneers who are actively pursuing the concept of “Foundry 4.0” as a strategic objective. Karl Casper Guss in Remchingen is taking a pioneering role

Foundry 4.0 pioneer in the industry

The medium-sized foundry produces a wide range of hand-molded castings. Flexibility, on-time delivery and good customer relations are the company’s strengths. Under the term “Casper 4.0”, the company pursues clearly defined targets and strategies leading to the implementation of what is associated with Foundry 4.0 and what is represented by three supporting pillars (**Figure 1**):



Industry 4.0 is omnipresent at the foundry Karl Casper Guss but without good workmanship and well trained junior staff it would have been impossible to implement the new technologies in practice (Photos: Karl Casper Guss)

- » VISU – network between all operating assets
- » ERP – planning/controlling of the processes with 100% trackability
- » EXTRANET – the “transparent foundry” – customers have access to information related to the manufacturing of their products

VISU - networking of operating assets

Long before the current Industry 4.0 hype, had the Karl Casper foundry started to link various equipment and operating assets within a network. Casper decided to use technology from Siemens. The first project was started in 2010, when network links and a control system were implemented for a newly installed continuous mixer and the existing sand preparation plant. That first project was started with mixed feelings, because the company was entering entirely new territory and success was not guaranteed. What is more, in times of sluggish economy, that was quite a remarkable investment for a medium-sized company. Siegfried Schlaak from the company SSSoft

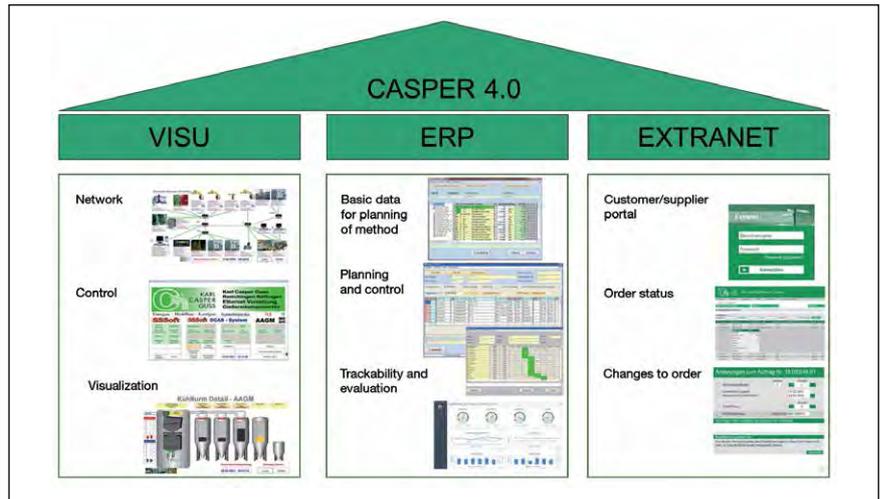


Figure 1: Supporting pillars of the Casper 4.0 solution: Casper relies on consistent, integrated systems

and specialized in Siemens technology was contracted to design and implement the network solution. Once the project “continuous mixer” and “sand preparation plant” was successfully implemented, the management at Casper recognized the potential of such a networked structure. Malte Lüking, Managing Director Technology at Karl Casper

Guss, developed a concept of how to integrate further plants and facilities into the network. Meanwhile, Casper has implemented an integrated network of all operating facilities, including the building infrastructure (e.g. charge make-up with RFID connection, and can always physically see what is going on. All links are visualized and can be monitored and



Figure 2: The system displays information on the current manufacturing status and instructions at the start of every new job

controlled via a tablet or smart phone. As the operators became increasingly experienced with the new network-based structure, the company realized the resulting benefits, for example in terms of energy saving, optimized equipment use, as a fault early warning system and for quality improvement. There is a constant flow of important data coming from the machines and facilities. These

Basic data must always be reliable: In order to come up to this requirement, a broad and consistent data base is needed. Accurate planning data for the castings and coherent cost calculations have top priority for Casper. All descriptions of castings and the associated calculations are done in the ERP system. Detailed planning of resources, such as machines, tools, processing steps, raw

Casper, on-time deliveries have top priority - and the customers appreciate that very much.

Single-item orders are immediately scheduled and series parts are managed via item accounts, i.e. the scheduling module recognizes any shortages and initiates corresponding production orders. As part of order planning and scheduling, the ERP system plans the production cycle and performs a feasibility check. Any bottlenecks will be immediately indicated. When an order is being planned, each casting will be assigned a unique item number (consisting of a part number and a serial number). This code serves as the central reference during production and for tracking purposes. The item number is cast into the product. Meanwhile, Casper has installed a seamless and consistent feedback system, which allows the operators to know at any time the exact position of each individual product, identified by its specific item number. Important tracking positions include: collecting the pattern, making the cores, filling, coating, assembling, casting, ejecting, fettling, QA inspections, priming/varnishing, contract manufacturing, packaging and readiness for shipment. The planned parts are indicated on the feedback terminal according to the first-in first-out principle as work in stock. Depending on the specific requirements, all tracking positions are equipped with foundry-proof touch PCs or normal thin-client PCs with bar code scanners. This keeps the walking distances for the operators short. Casper also uses department-specific job tickets which can be printed right at the production line. Placed in dedicated magnetic bags, the job tickets are assigned to the respective flask or castings. This organization requires a good deal of discipline from the staff. However, this extra effort will pay off soon in the form of additional transparency, which provides a much clearer view of what is going on in the foundry. The feedback information is checked for plausibility in order for the production process to run as planned. For example, the ejection times and curing times defined for the plausibility checks are accurate down to the hour.

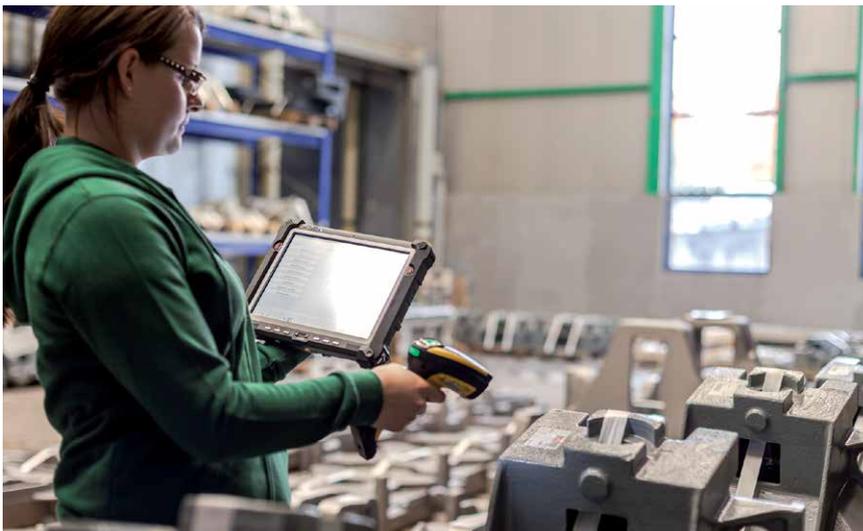


Figure 3: The new mobile dispatch management system implemented at Casper clearly identifies each packed and barcode labelled casting during loading

data are directly stored in the MDC (machine data collection) database of the ERP system. This type of data management supports the production managers in preventing and analyzing defects.

ERP system serving as central planning and management system with 100 % trackability

When it comes to planning and managing orders and products, Casper believes that consistent and transparent processes are extremely important. Casper has been closely working with the German company RGU Expert, based in Würzburg, specialists in software solutions for foundries. More than 30 years ago, Karl Casper Guss was one of the pioneering foundries participating in a pilot project involving the application of the integrated foundry-specific ERP system “structura FORM”. Ever since, the foundry has constantly improved its processes and expanded the application of the systems.

materials and auxiliary materials, relies not only on the definition of the technological features and specifications but, most importantly, also on the planning of the production methods. The system supports the calculation of times and quantities through planning formulae, which in turn are the result of the acquired production data (PDA). Lükling is highly appreciative of the system because he knows that a valid data base and reliable calculations are indispensable tools in today’s competitive environment.

Transparency in production: Increasingly smaller inventories and ever shorter delivery times demanded by their customers require foundries to ensure pinpoint deliveries. Given the wide range of products made by Casper, this is a genuine challenge and impossible to cope with without the consistent use of the production planning and scheduling software “structura FORM”. At

Process supervision even includes a function that automatically triggers a complaint message indicating that curing times have been exceeded or QA inspections have been omitted. The feedback system comes with an integrated information system which sends all relevant information about the production process to the work places and can be retrieved in text form, as images or as video sequences. Or it may automatically pop up as compulsory information when logging in for a job. The employees highly appreciate the added value provided by the information system and autonomously enter additional useful data (**Figure 2**).

QA data are captured as part of the feedback messages or are automatically fed into the system as process-related data by establishing a network link to the testing device. In the background, structura FORM compares the actual QA data with the nominal values from the inspection plan and will indicate any deviation as an internal complaint, which will be automatically signalled to the QA department. This procedure ensures that at the end of the process chain the QA certificates can be printed out together with the delivery note without any extra effort simply by pushing a button. Casper is proud of the newly established logistics centre and the modified organization in the dispatch area. Picking is made at the terminals of the system, which pre-plans the castings based on deadlines and routes. The system gives notice to the carrier about a freight to be picked up via a freight portal. The pick-up time schedule is accurate down to the hour. Each casting ready for shipment will receive an adhesive label, which in the form of a QR code may contain additional information requested by the customer concerning his product and order. This service simplifies the incoming control process for the customer. Such straightforward organization of the production chain and of the dispatch procedures pays off in terms of good customer ratings for delivery reliability. Also here, Casper leaves nothing to chance but constantly checks its own delivery performance rating calculated by the ERP module “delivery reliability” (**Figure 3**).

Integration of process data in the ERP system: As mentioned above, the results obtained from the network of operating assets (VISU) are closely intermeshed with the ERP system. All relevant plant data are fed into the MDC database of structura FORM. This process runs automatically in the background. Consumption data for sands, resin, hardeners etc are transmitted to the material management system. Technical data such as operating times and downtimes of the plants, energy input, temperatures, emissions, etc. will be used for evaluations. For example, the calculations for the charge make-up, including the cranes, are controlled by VISU. The containers for making up the charges are equipped with special RFID tags (protection class IP 68). Structura FORM receives not only data about the exact material consumption figures, but also spectrometer data, data from the thermal analysis and energy consumption figures. Structura FORM visualizes all important information in graphical form in a dashboard display, which can be configured to meet the requirements of the operator’s work place. Casper has been constantly advancing the integration of the two applications and will continue to do so in the future.

Extranet - the transparent foundry provides customers access to information related to the manufacturing process

Karl Casper Guss is a “transparent” foundry. It offers its customers access to selected information concerning the manufacturing process via a web portal (Extranet). The customer may take a look at his orders in process and see in which processing state the products are. He may enter additional information or change deadlines and quantities directly via the portal. In order to exercise maximum data security, all relevant manufacturing data from the productive ERP programme are replicated in a downstream web database. After an initial phase of reluctance, this service has been well accepted and actively used by the customers. Managing Director Malte Lüking knows that some of his customers use the Casper Extranet as a platform for their own planning.

Prospects and further projects

Casper does certainly not rest on their accomplishments. Further projects are being implemented or planned.

- » Flask management via RFID. A new building for the storage and management of the flasks via RFID is under construction. Besides optimized manufacturing processes, the space situation in the moulding shops will be dramatically improved.
- » Pattern managements via RFID. A new high rack will be installed for the management of the patterns. Today, the management of the placements and retrievals is still based on a procedure that relies on the manual acknowledgement of the activities at the PC. In the future, this process will be optimized by means of RFID tags attached to the patterns and a mobile touch PC on the forklift truck.
- » Visualization of the manufacturing process representing the plant layout. The linking of the feedback data and the MDC database via an integrated and realtime network provides high-quality data. The information provided by these data is to be used for comprehensive evaluation procedures, such as searches based on item numbers, as well as for an enhanced visualization of the manufacturing processes in a plant layout setting. The system will graphically indicate the position of a certain casting at a certain point in time (e.g. search for a certain item number) or the jobs in process in a department.

Summary

At the transition to the fourth industrial revolution, the Casper foundry takes on a pioneering role as it has already implemented numerous technologies that other foundries have just started to think about. Especially for small to medium-sized foundries, Casper may serve as a positive example of how the challenges of a digital future can be successfully coped with.

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