

PRESS RELEASE

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Manufacturing without Takt and Assembly Line – Networking Brings Flexibility and Agility to Production

For a long time, there was no alternative to rigid production structures when fast throughput was required. Now they are becoming obsolete, as Fraunhofer IPK shows in its trend report. Instead of highly integrated, firmly linked lines, manufacturing experts increasingly favor modular production systems that can be flexibly combined.

The efficiency of serial processes and firmly linked production lines is undisputed. If one process step reliably follows the next, orders are processed in a short period of time. But rigid production structures also have disadvantages. The biggest is that it is costly or even impossible to realize customer-specific special orders. However, these have long been part of everyday life in many companies, even in the classic series production business. Some suppliers operate with 50,000 system products at annual repeat rates of 1.4.

So much need for agility makes highly integrated systems uneconomical. Companies that manufacture a large proportion of their products only once carry out many process steps by hand. Extensive automation is not worthwhile for them; instead, they favor smaller, highly flexible systems technology. Machine builders and system suppliers are now responding to this demand and designing machines to be product-agnostic: The same equipment is used to produce different variants of a product – or different products.

Partially autonomous process chains up to self-organizing production

In such a flexible factory, production steps are interlinked by information technology. This is a major task since it involves bringing systems into dialog that originate from different manufacturers or use heterogeneous standards. One option to achieve this is using IT adapters to open up the machine control system for networking. Ideally, the result is a self-organizing production as is being promoted by Fraunhofer IPK. Here, all manufacturing entities – people, workpieces, machines and tools – communicate and cooperate directly with each other. For example, a workpiece can independently organize its path through production by requesting suitable machining resources. Machining stations offer free capacities or reject them, if their data indicates a need for maintenance.

The level of automation can vary widely from one company to another. Some companies benefit most from digitally supported process control. In the simplest case, such process control can just pass on knowledge from one station to the next – about the type of

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order, which components belong to it and how they are to be processed in the next step. More autonomous process controls address equipment directly to orchestrate processes. With model-based, modular concepts process steps can be combined into ever new sequences. This makes production variable and customer-specific production or quick reactions to exceptional situations effortless. Last but not least, resilience in the face of crisis situations is fostered.

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Intra-process logistics and virtual commissioning

Comprehensive automated solutions are also needed for intraprocess logistics. Because anyone who abandons takt and assembly lines needs alternative solutions to ensure that the product gets from A to B in the production process and that the required material is available at every processing station. This is where driverless transport systems or automated guided vehicles (AGVs) come into play. They can even be integrated into the process control system – logistics becomes an integral part of the production process.

If production lines and other shop floor equipment are flexibly plugged into ever-new processes, the methods and technologies for piloting and validation should also change. Digital twins and virtual commissioning play a crucial role here. They can be used to check whether each machine fits in its intended place when it is rearranged and whether the arrangement makes sense. If a process is reconfigured, it can be ensured that it will run smoothly. This keeps downtime during commissioning and reconfiguration to a minimum.

»Our view of what the production process encompasses and how it should be designed will change significantly,« says Prof. Dr. h. c. Dr.-Ing. Eckart Uhlmann, production expert and director of Fraunhofer IPK. »Interaction with IT and logistics expands the range of tasks in system design. Experts from different domains must work together much more closely than before. And in the future, digital technologies will become domain tools of production technology just like logistics solutions.«

Further information:

Fraunhofer IPK asked industry representatives what challenges and needs manufacturing companies will face in the coming years. The result: in addition to digitization and networking, five R&D trends have top priority across all industries. All trends and background information can be found online at <https://www.ipk.fraunhofer.de/de/kompetenzen/industrietrends.html>. We will be happy to send you a free print copy of our publication on request.

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