TRUSTING THE MACHINES

Self-organizing production is possible. But not without changing our way of thinking.

In many industries, product life cycles are becoming shorter and shorter. However, new generations or versions of products can only be ready for the market if the production systems needed to make them are available. A paradigm shift is occurring: self-organizing digitized manufacturing promises faster delivery cycles, because it eliminates setup times and minimizes in production statuses.

Nicole Steinicke of *Industrielle Automation* in an editorial interview with Dr. Martin Steyer (left), Head of Integrated Solutions, and Botond Draskoczy (right), Expert in Material Flow Simulations, at the high-tech machine manufacturer Manz AG in Reutlingen.

Dr. Steyer, what's behind the vision of self-organizing production?

Martin Steyer: There are two demands we're being confronted with more and more often, from two very different industries: build us a highly-standardized and automated production line we can use to produce even small quantities reliably and inexpensively. And second: ongoing production needs to be highly flexible and be able to be converted within a very short time period and switch models within minutes or even seconds, due to our increasing variety of product versions. Down to a batch size of one, which means completely customizable mass production, or mass customization.

Of course, a production line needs to be fully digitized to fulfill these two requirements. That's the basis. Building on that, our vision of self-organizing production has two levels: the production process level and the production logistics level.

For production processes, we use “toolless” processing plants that can be converted through purely software-controlled procedures. Examples of this are laser cutting or laser welding. Another thing to keep in mind to achieve the best possible material efficiency: additive is better than subtractive. As series sizes grow smaller, the point of amortization shifts towards additive processes, such as patch placement developed by Manz. In this process, various flexible materials come off the roll, are laser cut, and then attached using a layered production principle. This lets us create components in an endless variety of geometries, colors, or material combinations – with stability optimized for lightweight construction.

Botond Draskoczy: The second level of self-organizing production is production logistics, or the way process plants are linked together: in a world of mass customization, there will no longer be any central production planning and controlling. There will be no fixed assignment of specific production steps to certain machines. Instead, production is dynamic and can change its processes flexibly and independently.

However, the only way to master the increasing complexity that comes along with this change is to be able to exchange processes. That's why process plants need to be configured so that they can replace one another. A product moves through the line until all the processing steps are completed and it's finally ejected onto its carrier.

The technologies necessary for this kind of production have been available for quite some time. What are the hurdles you have to overcome to turn your vision into reality?
Martin Steyer: Anybody who wants to try this kind of production model needs to change their way of thinking. If a product's pathway through production is no longer governed by any fixed rules, then no one can know what pathway it will take. Leaving the decisions up to the machines – as a production manager I have to get used to that loss of control a little bit.

But we now know that a flexibly linked system is more tolerant of errors than a rigid interlinked line – because the process plants can jump in for one another as long as I've planned in a certain amount of redundancy. In addition, a self-organizing system runs more stably the bigger it is. This is a kind of built-in self-healing.

Botond Draskoczy: But that also means that simulations are becoming more and more important in production companies, simulations of entire processes or material flows. I have to trust those simulations. For example, I can simulate how processes with different cycle

speeds can be linked together: for slower processes, I have to plan more plants than for faster ones in order to keep the system in an ideal balance.

So let's say a company decides to use this kind of concept – only very few companies will be able to invest unlimited resources in it. Can it be introduced step by step?
Martin Steyer: Yes and no – there's no way to get around fully digitized processes. That's the only way to exhaust the potential of a self-organizing production line. Nevertheless, companies can start small with just a few machines and only a short time to start operations with the process. That means they'll go into production much more quickly than before. A system that's been debugged and optimized can be scaled up later, since we're assuming we'll be using the same kinds of process plants so they can replace one another.

Botond Draskoczy: Scalability also applies to new functions I want to replicate: users can test new processes or new materials on one process plant first while the others continue production as before. A new function can then be integrated into all of the plants. Being able to link the plants in any way you want is another huge advantage if the production space isn't optimal.

In your opinion, what process technologies will be needed to implement self-organizing production systems?
Martin Steyer: I would consider flexible technologies, automation and handling systems like robots or laser scanners – all with freely programmable axes – as sort of "enablers." Like we've said: the focus is always on reducing setup time. Measurement technologies and visual inspection systems are also extremely important: no one can predict how a product will pass through a production line, but of course I want to know precisely what path it took so I can ensure quality. The spectrum of processed materials is gigantic: we've already gathered lots of experience with plastics, CFC, off the role textiles, foils, or magazines.

What importance would these types of dynamic production systems have for supply chains in various industries overall?
Botond Draskoczy: In the future, customers, as well as consumers and developers, will be involved much more directly: through web-based product configurators, developer platforms, or digital material databases and logic-based sample creation. That means terms like "networked production" or "open source" have a much broader meaning than before. Examples of this are customized mass production in the shoe industry or custom-tailored sports equipment and medical walking aids. In all of these applications, customer data on the

height and weight of the consumer or the desired color and equipment can be both transferred to production and processed digitally.

Martin Steyer: I see three big trends in the industry: self-organizing production lines will catch on everywhere large-scale manufacturers have difficulty handling the number of versions of their products, and need the highest possible flexibility from their production because of it.
Just as in the semiconductor industry, we will continue to see a division into product developers and independent, highly flexible contract manufacturers that can deliver, for instance, small series of up to 1,000 pieces within 24 hours. These contract manufacturers could develop into larger digitally connected production centers or clusters.
Third, with a continuously increasing degree of automation and the independence this offers from low-wage countries, I expect that production will once again grow closer to customers in many industries. That's a good opportunity for "Made in Germany products," which offer local, networked production.

Company profile:

Manz AG – passion for efficiency
As one of the world's leading high-tech equipment manufacturers, Manz AG, based in Reutlingen, Germany, is a pioneer in innovative products for fast-growing markets. Founded in 1987, the company has expertise in six technology sectors: automation, laser processing, screen printing, measurement technology, wet chemical and roll-to-roll processing. Manz deploys and continuously develops these technologies in three strategic business segments: Electronics, Solar and Energy Storage.

The company has been listed on the stock exchange in Germany since 2006. It currently develops and produces in Germany, China, Taiwan, Slovakia, Hungary and Italy. It also has sales and service branches in the United States and India. Manz AG currently employs around 1,700 people, about half of which are in Asia. Manz's claim "passion for efficiency" offers the promise of production systems of the highest efficiency and innovation to its customers in dynamic, future-oriented industries. With its comprehensive expertise in developing new production technologies and related machines, the company contributes substantially to reducing production costs for end products and making them accessible to large groups of buyers the world over.

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