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Focusing on the Human Being – Knowledge and Assistance in Production

Even though artificial intelligence and autonomous solutions are increasingly conquering manufacturing, nothing works in production without qualified employees. Providing the best possible support for people in production, transferring their knowledge and maintaining their ability to work for as long as possible is becoming increasingly important for companies, a trend report by Fraunhofer IPK makes clear.

With raw material shortages, supply chain problems and climate neutrality, industry is currently facing many challenges – but one of the most pressing is the shortage of skilled workers. Without qualified people, the other tasks cannot be tackled either. Automated and autonomous systems can cushion the problem, but not solve it. One key aspect: The human ability to react flexibly to disruptions and unexpected or new situations is far from being technically replicable, even with AI. Especially in crisis and exceptional situations, employees are therefore a crucial resilience factor.

Against the backdrop of demographic change and a shift in values among younger generations, the problem is not expected to ease in the near future. Creative solutions are therefore needed to recruit, retain and upskill staff, but also to support the existing workforce. It is necessary to increase the attractiveness of jobs in production, by making tasks diverse and allowing workers to make decisions, but also by reducing physical stress. Highly complex, integrated technologies must be made manageable for operators, even if their initial qualifications for handling them are not perfect. And the know-how of process experts must be secured within the company and made accessible to other employees. Fraunhofer IPK has created comprehensive solutions to overcome the existing challenges.

Human-centered, context-sensitive assistance

Data-driven solutions offer a variety of approaches. If manufacturing processes become so complex that average machine operators can no longer identify ideal parameters to set them up with experience alone, interactive assistance systems can help. Based on sensor data or knowledge from specialists, they suggest suitable settings or guide people through the process in a context-sensitive manner.

The large field of assistance systems can be roughly divided into two groups. Indirect assistance operates in the background, while direct assistance involves immediate human-machine interaction. Indirect assistance is essentially selection guidance based

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on data analysis. To prepare difficult decisions, data from sensors in machines, for example, are intelligently evaluated. The result is a context-sensitive selection of possible options. Direct assistance presents information with models and dashboards in such a way that people can work with it – for example, to optimally set up a process or maintain a system with which they are not familiar down to the last screw. The challenge here is to design assistance in such a way that it can be operated intuitively and neither underestimates nor overwhelms the person using it. »At Fraunhofer IPK, we address both types of assistance. Our field of activity ranges from solutions for semantic data networking and interpretation to user assistance systems appropriate to individual situations for a wide variety of applications,« says Prof. Dr. Jörg Krüger, head of the Automation Technology division. »Identifying new and used components for assembly preparation or for reusing old parts belongs as much to our portfolio as supporting service personnel in maintenance operations.«

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Example: Mobile maintenance support via smart device

In the field of maintenance, repair and overhaul (MRO), mobile decision support applications are becoming more flexible and more predictive with the help of AI. When servicing machines and systems, it is particularly important to transparently document the steps that have been implemented so that other workers know what tasks have been performed. Mobile digital applications therefore support maintenance processes not only operationally, but also facilitate downstream documentation by automating it partially or even entirely. A context-sensitive MRO decision support system based on digital twins developed by Fraunhofer IPK and CONTACT Software helps, for example, to accurately classify the condition of a machine or system, select known solution strategies, and efficiently rectify errors. During the MRO process, the system incorporates situation-dependent information into the specific work instructions for maintenance personnel at each work step and makes it possible to flexibly adapt maintenance procedures to constantly changing process conditions. »The more precisely the condition of the machine or system can be described, the more selectively damage can be analyzed and repaired. In addition, the solution developed by Fraunhofer enables even non-qualified staff to operate machine tools and entire systems«, explains Claudio Geisert, deputy head of the Production Machines and System Management department at Fraunhofer IPK. »By documenting these solution strategies in the digital twin, intelligent algorithms can not only assist service personnel with mapping solutions to problems in specific use cases. For company management, they also pave the way towards an intelligent, sustainable maintenance strategy, in which faults can be detected at an early stage and ideally be eliminated preventively.«

Maintaining health with ergonomics support

As it is becoming increasingly difficult to recruit junior staff for production, industry is undertaking great efforts to design work environments in such a way that experienced personnel can operate in them for a long time. Ergonomically optimized working conditions make a significant contribution to keeping employees in the company well into old age. In this context, wearable sensor and robot systems for ergonomic and force support that prevent injuries to the musculoskeletal system are playing an increasing role. The ErgoJack® orthosis developed by Fraunhofer IPK uses motion

detection sensors to inform wearers when they are moving in an ergonomically critical way. In activities where an ergonomic posture is not possible – for example when working on objects at overhead level – exosuits for strength support such as Power-Grasp, also a development of the Berlin Institute, come to aid.

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Knowledge management and qualification

The knowledge of process experts is as essential a resource for companies as energy or raw material for products. Making this knowledge available throughout a company requires effective knowledge management solutions. In addition, digitalization and networking in particular, as well as tailoring them to a company's specific requirements, create an increased need to further develop employees' skills. Intuitive training methods play an important role here. Technology-oriented training courses as well as serious games and realistic learning factories, in which production management and control methods are taught interactively, enable employees at all hierarchical levels to experience learning content first-hand and develop skills in a targeted manner.

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 www.ipk.fraunhofer.de/en/expertise-and-technologies/industry-trends.html. We will be happy to send you a free print copy of our publication on request.

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