## Process industry 4.0 in manufacturing engineering research

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Modern life science laboratories and bio production facilities are highly complex data factories. The innovation cycles in life science R&D are currently outperforming the development of supplementary systems as automated infrastructure and data processing. Furthermore, the overall complexity and required process flexibility are overwhelming human being.

For mastering the upcoming challenges of small scale bio production – may be down to a lot size of 1 - aparadigm shift towards a holistic understanding of lab processes is crucial. Current laboratories apply a lot of advanced technologies. Nevertheless most devices, reactors and platforms are pretty dull if it comes to connectivity. The next evolutionary step is the seamless data and information flow within semi-automated environments. Each individual entity in the laboratory – such as devices, consumables, applications and the human being within the process – needs to be covered. The overall order management and scheduling is done by self-autonomous smart entities. The demand for personalized bio production thus translates in smart, decentralized bioreactor modules which are controlled via simple rule-sets instead of centralized complex control units. The overall documentation for regulatory affairs and process control accompanies the product as a digital shadow.

Fraunhofer IPA will introduce a concept for mass customization in the pharmaceutical process industry which is inspired by modern social media concepts, shared economy and a service orientated economy. It combines properties of an operating system for laboratory devices with a strict service oriented approach. We will highlight how cyber-physical systems may assist logistics, quality control, staff training and overall process control within laboratories and bio production.