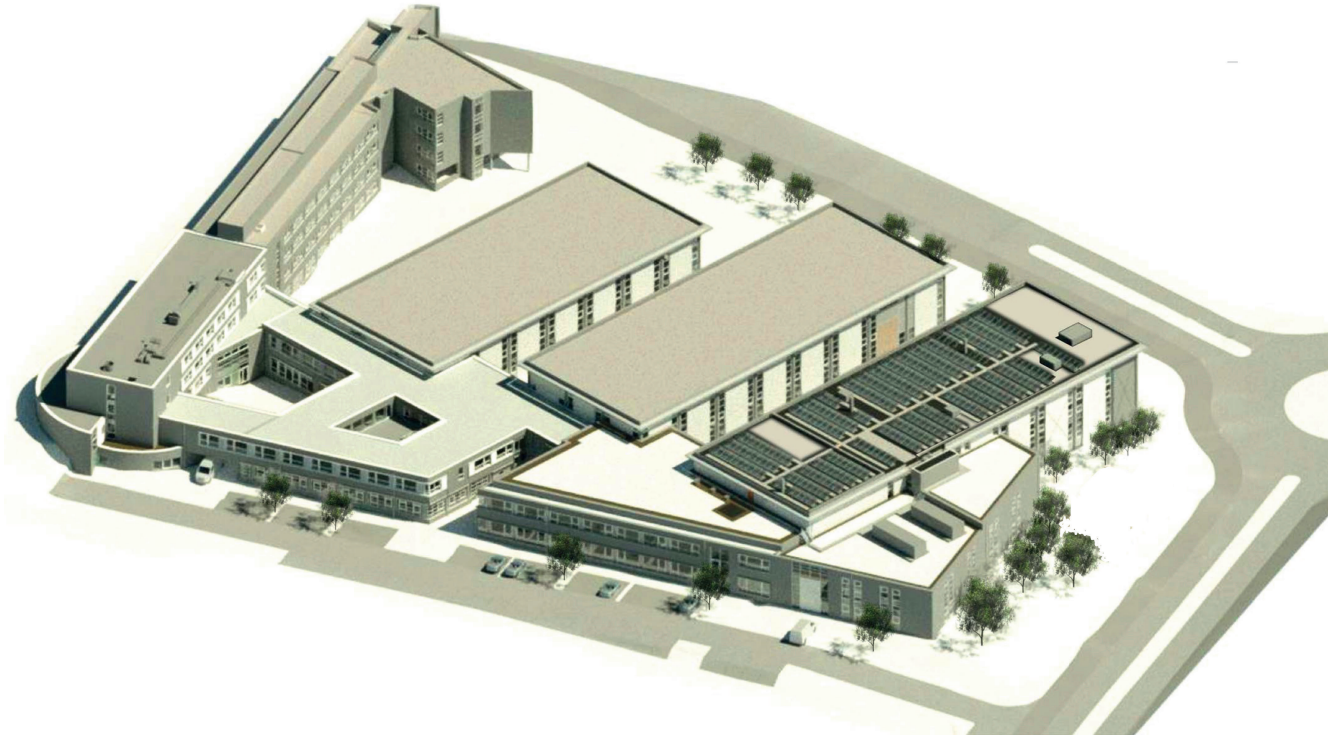
Central Hub for Digitization in Plastics Processing

The Plastics Innovation Center 4.0 Is under Construction at the Campus Melaten in Aachen, Germany

Because it has not yet been possible to exploit the full potential of digitization in plastics processing, the Institute for Plastics Processing at RWTH Aachen University is building a new application-oriented research infrastructure along the lines of a Smart Factory. ***Kunststoffe*** is accompanying the building of the Plastics Innovation Center 4.0 with a series of publications. Part 1 describes the concept and the initial demands on the physical infrastructure.



Visionary overall picture of the expanded IKV in future, supplemented by the Plastics Innovation Center 4.0 © aig+ Architekten

Digitization is now making inroads into industrial production worldwide in all sectors. Despite the many opportunities promised by the implementation of innovative Industry 4.0 technologies, the benefits for the plastics industry characterized by SMEs have been minimal. Recognizing the potential of Industry 4.0 and actually implementing it in a company will often require extensive investment as well as a relationship of trust and confidence in a system partner who is familiar with the production operation and able to extend it with useful system modules.

When implemented in industrial production, insular solutions frequently fall short due to a lack of scalability or user proximity. For this reason, holistic approaches are needed. Buzzwords such as Smart Factory, Smart Manufacturing or Smart Production are therefore increasingly becoming the subject of research projects. Whereas the number of publications in the Google Scholar search engine for these terms shows that research in the field of Smart Factory is generally developing into a focus topic, a clear reference to plastics is almost completely lacking (**Fig. 1**).

Holistic Approach of Consistent Digitization in the PIC 4.0

With its Plastics Innovation Center 4.0 (PIC 4.0), the Institute for Plastics Pro- »

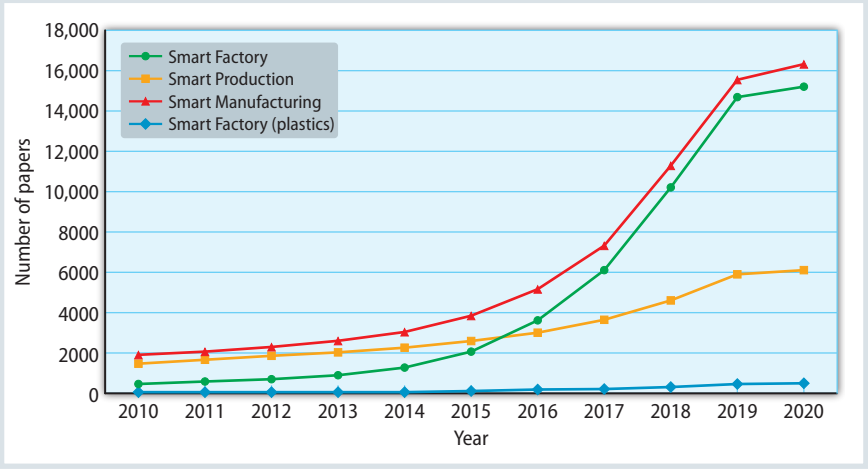


Fig. 1. Number of publications in the Google Scholar search engine (as at 2020–03–31) on various buzzwords, listed by year Source: IKV, graphic: © Hanser

cessing (IKV) at RWTH Aachen University aims to enable research in the field of digitized plastics processing by adopting a holistic approach. For this, existing research projects focused on digitization will be seamlessly integrated into the new research infrastructure, and new projects will be initiated in three topic areas:

- Digital Engineering,
- Value Chain, and
- Global Connectivity.

In **Digital Engineering**, during the physical construction phase, it is a question of combining methods of part and process development with the real processes in the PIC 4.0 technology center. For this purpose, continuous simulation chains and virtual process models are needed that enable a transfer of simulation models between conventional systems of component and process design without any loss of information and in an easy-to-use procedure. In addition to this, a routine is being developed to autonomously compare the predicted part quality with the attained part quality, and thus draw conclusions about the simulation quality.

To be able to compare the simulation results with the subsequently documented component and process quality, it is important to link the processing processes closely with each other in the PIC 4.0 technology center. A heterogeneous machinery equipment, on the other hand, frequently makes it difficult to transfer the developed solutions into industrial practice. In addition to complex interactions along the value chain – from preparation of the material through the processing process right the way through to quality assurance – an analysis of the age and functional scope of heterogeneous machines in the **Complex Value Chain** is of particular interest. It involves not only matters of digital retrofitting but also of data collection/processing and the meaningful utilization of these data.

Finally, focusing on consistent data collection and the information infrastructure needed for this is performed in the area of **Global Connectivity**. This involves above all collecting the available data in a uniform manner, and specifically analyzing this data for the data-driven optimization of the processes and systems in which it was collected. For companies in plastics processing, the possibility should also be created to analyze not only their own processes but also to make their production data available without risk to an independent research partner to find out what benefits can be generated from this.

In addition to the three described topic areas, work will also be carried out on digital teaching and learning possibilities both in the skilled crafts and in university teaching in order to qualify the experts of tomorrow in matters of digitization.

The Physical Infrastructure of the PIC 4.0

The gross total surface area of the infrastructure under construction is more than 4200 m^2 and includes, in addition to

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The Series Continues

In the following article, the authors report on examples of real applications of digitization. The article will probably appear in Edition 9/2020.

PIC 4.0

The concept of the PIC 4.0 expressly pursues the aim of data-networking various production technologies along a complex value-added chain, and of optimizing them under application conditions. The focus here is above all on the necessary information architecture and technology transfer to industrial practice.

↘ www.ikv-aachen.de/forschung/efre-pic-40/

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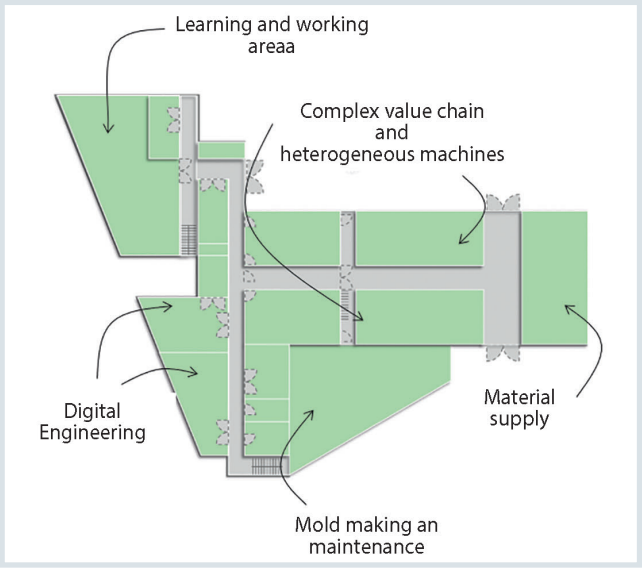

Fig. 2. Planned room allocation on the ground floor of the PIC 4.0 © IKV

the nearly 1000 m² technology center, a workshop with an area of around 570 m² for maintenance and service and for building testing molds (**Fig. 2**). Mold-making is thus integrated directly into the information/value chain to achieve cross-domain collaboration without information loss.

In the technology center itself, space will be allocated to various testbeds, for example, "complex value chain", "heterogeneous machinery equipment", and "material processing". Here, it is important at the planning and building phase to provide the necessary data connection, taking account of the expected network traffic and the bandwidth potentially needed in future applications – in addition to the usual infrastructure such as power lines, water pipelines and compressed air.

Apart from that, provision will initially be made for traditional Ethernet connections, although the basis will also be laid for future integration and testing of 5G technologies. The adaptability of the Smart Factory which needs to be ensured for this will be required for the later, long-term research work, because test rigs and production cells must, depending on the focus of analysis, be set up and combined for the complex cross-process interactions.

Communication not only between Machines and Equipment

All learning and working activities will be located in the building complex. The planned "open space offices" will not only enable communication between machines and equipment to be at the focus of the PIC 4.0, but will also facilitate open and flexible cooperation between scientific staff and students. Ideally, this exchange will create innovative research approaches.

To be able to carry out demanding tasks in digital engineering and in the data analysis of comprehensive real datasets from the ongoing processes, high-performance servers will be installed. The PIC 4.0 will thus offer, for all matters of digitized plastics processing, a contact point for partners from science and industry. ■