

HORIZON 2030
A GAP INNOVATION PROJECT

Research & Development

Innovation driver for the
industrial SME sector.



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GAP
Gesellschaft für angewandte Prozesslenkung

SCHUNACHER
PRECISION TOOLS SINCE 1918

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Research and development project **HORIZON 2030**

Target definition: Development of a cross-divisional, digital process control system as an innovative solution for a high increase in efficiency in the utilisation of all resources.

» in the development, manufacture and marketing of precision tools

Character of a medium-sized industrial company

- » strong customer orientation
- » small batch sizes with complex product definitions

The solutions for steering systems

- » Use of digital methods for process analysis in the product-defining departments process-related information provision
- » Web-based networking with the market
- » Technical value-added services that go beyond the primary product

These are the challenges in the **HORIZON 2030** project.



Initial industrial situation in SMEs

Digital transformation technology is playing a key role in corporate efficiency in all processes.

Research collaborations with various technical universities

RWTH AACHEN
UNIVERSITY

tu technische universität
dortmund



Universität Stuttgart

Complex processes:

- » Administration
- » Product definition and development / design
- » Production
- » Support for precision tools in the application
- » Provision of WEB-based value-added services

Conservation of central resources:

- » Operating resources
- » Energy
- » Raw materials
- » Human resources
- » Liquid funds

Holistic data integration in the new HORIZON 2030 **R&D project**, the developers are building on technology, steering and controlling modules that have been developed at **Schumacher Precision Tools** in more than 25 years of academic collaboration with **RWTH Aachen University, TU Dortmund University** and the **University of Stuttgart**.

The goal:

- » Controllable resource efficiency through data integration in industrial SMEs



IT framework conditions / challenges

The prerequisite for cross-divisional digital process control in industrial SMEs is a central, standardised data basis that maps the entire value chain.

Lack of integration capability of many commercially available standard IT modules **ERP, MES, CAD, FEM**, etc. for cross-departmental networking.

» Consistent, redundancy-free data management is at the centre of the development of **HORIZON 2030**.

To ensure the practical relevance of the development objectives, the market experience and infrastructure of precision tool manufacturer **Schumacher Precision Tools** is utilised as a laboratory and pilot user.

... redundancy-free, cross-divisional
data processing are the prerequisites
for a holistic „IT system“.

Revolution in der Prozesslenkung

Supporting Digital Production

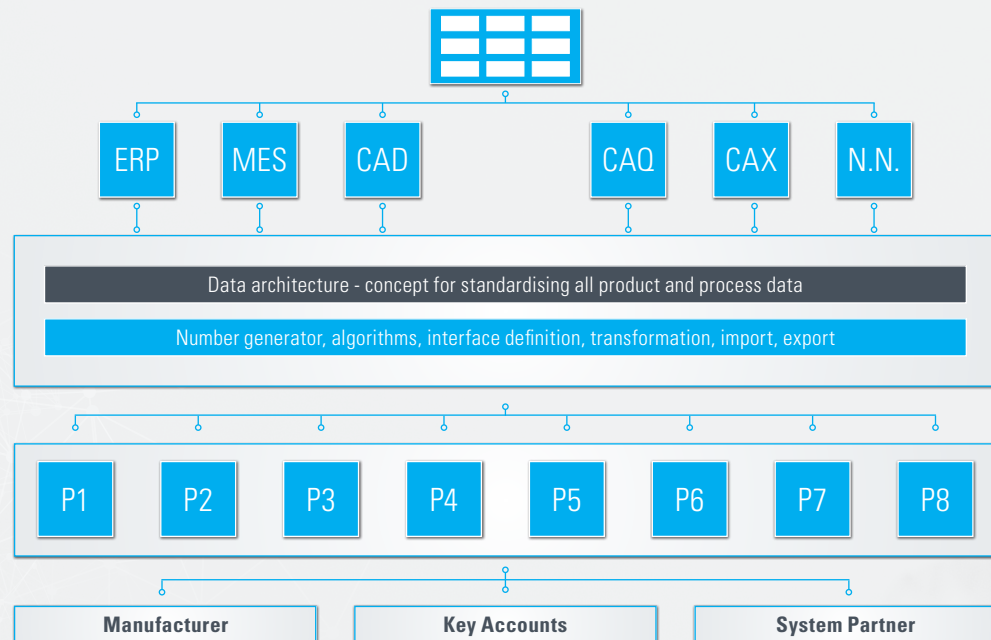
GAP - ToolProduction

1. integrated
user interface
GAP / SPT

2. IT modules

3. Standardised
data platform

4. 8-platform strategy



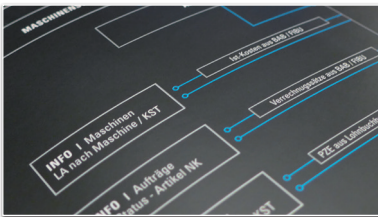
Practical solution approach for industrial SMEs

Due to the political and economic framework conditions, **resource conservation** in all its facets is becoming increasingly important.



» **The introduction** of cross-divisional digital process control is an obvious choice due to its high efficiency and holistic nature for conserving all resources in industrial processes.

» **To increase this efficiency**, the use of artificial intelligence can achieve additional positive effects. For such a development in the SME class of companies considered here, however, the prerequisites for the realisation of digital process control must be planned with targeted solution approaches.



» **The integration of different IT modules for a control system is a major challenge in this class of company.** Data integration is also a key success factor in order to ensure comprehensive process flows between the necessary standard IT modules - not least for AI applications. If this integration is not successful across all areas, redundancies arise which, in the view of the experts, would thwart all the prerequisites for successful digitalisation.

System implementation

Description of the GAP implementation of the digital process control system **Tool-Production** for resource management using the example of the ,pilot manufacturer' **Schumacher Precision Tools** - Remscheid

For **ToolProduction (TP)**, **GAP** defines and digitally maps all of the precision tool manufacturer's processes with the expertise and support of its academic partners. The basic prerequisite for such a project is detailed knowledge of all relevant process and product descriptions, which must be available in analogue form without redundancy before the start. These details are prepared by the pilot manufacturer with the specifications of the **GAP**.

ToolProduction 
by Schumacher

In this case, **TP** is the target system, which was preceded by various **R&D** activities already mentioned for the development of the required components of the new **TP system** in the field of SME process control. The centre-pieces of the **TP** control system in the digital implementation are various standard IT modules:

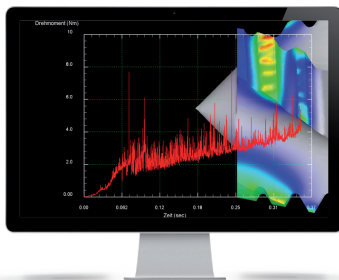
- » ERP
- » MES
- » CAD

In addition, engineering components developed through the **GAP** founder's earlier **R&D** activities:

- » **CAD 3D modelling** with graphical programming language (variant design)
- » **FEM simulation** of the 3D tool models before production

Engineering serves the goal of optimising tool life and thus reducing the use of raw materials and energy. All processes for industrial **SMEs** are thus digitally mapped in **TP** with the redundancy-free data architecture of the:

- | | |
|--|---------------------------------|
| » Marketing | » Incoming orders |
| » Industrial accounting with product controlling | » Solid state simulation FEM |
| » Modelling with internal cooling systems for the use of flow simulations (Computational Fluid Dynamics CFD) | » Work plan creation |
| » Labelling and packaging preparation | » Production process control |
| » Support of the product in use at the customer | » 3D Quality control management |
| | » Shipping |

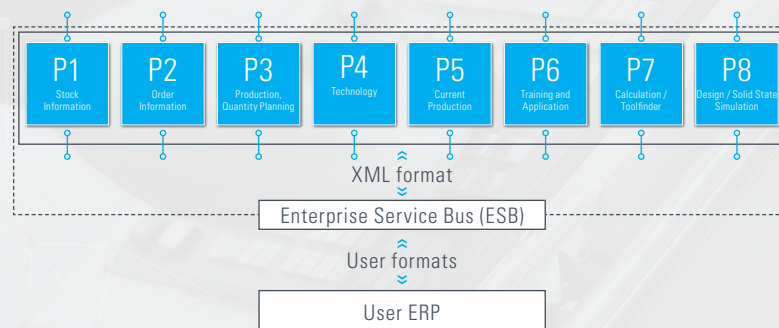


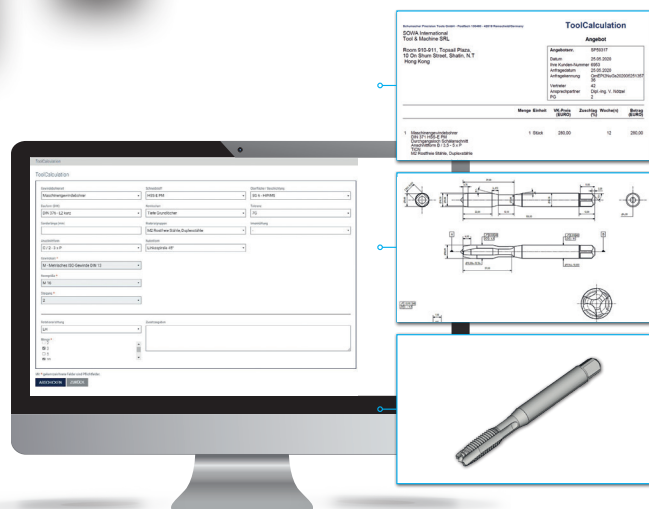
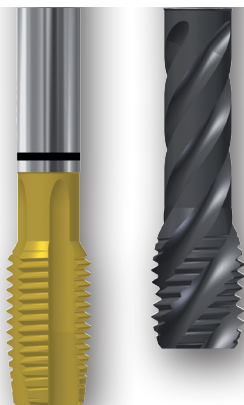
Digital value-added services for the primary product

Utilising the data structures of the TP steering system, **GAP** is developing a **WEB-based 8-platform strategy** for this application support.

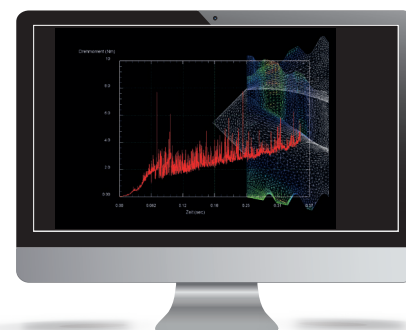
These **8 platforms** enable the tool manufacturer to network with its markets and offer product users in all relevant disciplines **„digital transformation“** with value-added services that go beyond the primary product.

Mirosoft Dynamics – Navision





WEB-based quotation system

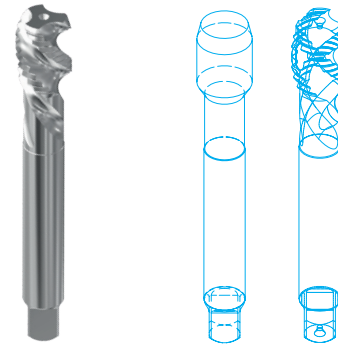


Solid state simulation FEM

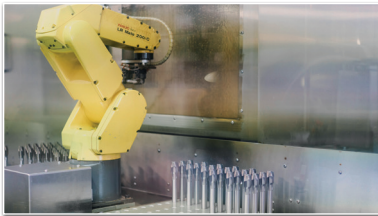
Decentralised 3D printing of precision tools using the **'Additive Manufacturing AM process'** with internal cooling variants has already been successfully tested by **TP** at the customer's premises.

At **TP**, retrofit solutions ensure the continuity of the control of operating resources that are not 100% digital-capable.





Use of industrial artificial intelligence



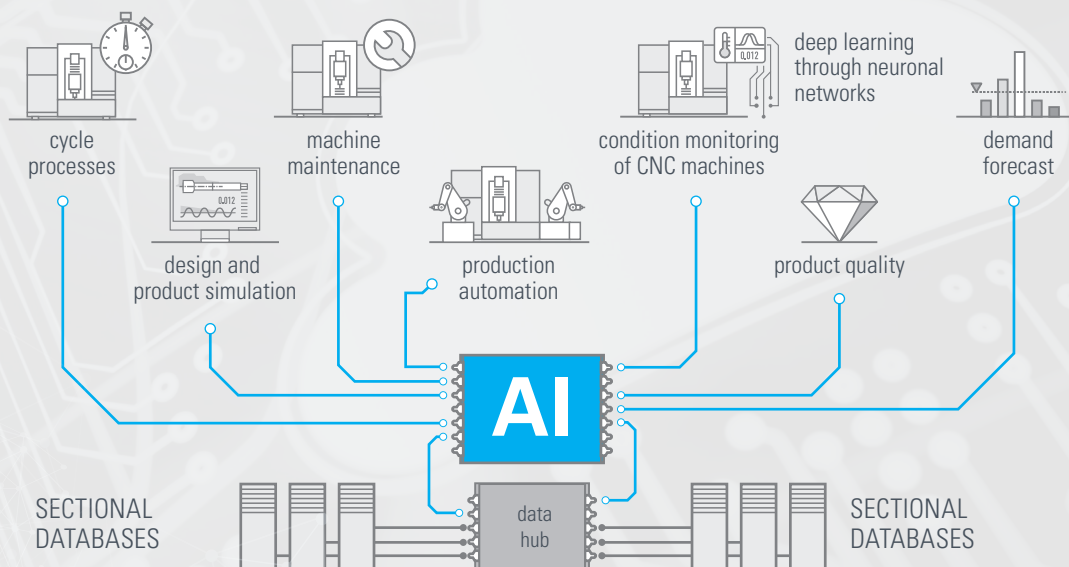
Various, separately created databases of the **IT modules** used in **TP** are merged into a central data hub. The data hub is implemented in a relational database and fully integrated into the process chains of all of the manufacturer's divisions.

This creates the basis for cross-divisional digital process control and subsequently for structured data collection from all processes for the use of artificial intelligence.

For example, **„deep learning“** is realised with neural networks for CNC production machines in **TP**. In total, the use of industrial artificial intelligence for sustainable production at the manufacturer can be divided into seven core areas using digital process control:

- » Cycle processes
- » Machine maintenance
- » Design and product simulation
- » Condition monitoring of CNC machines with neural networks - „Deep Learning“
- » Product quality
- » Production automation
- » Demand forecast

Seven core areas for the use of industrial artificial intelligence



Effects on efficiency in SMEs through digital process control

With the help of algorithms and mathematical analyses of the process data of these AI core areas structured in **TP**, the digital process control of **TP** leads to a significant reduction of:

- » incorrect capacity planning
- » high waiting and downtimes
- » incorrect staffing
- » coordination errors
- » redundancies in the process chains



In corporate controlling, this is referred to as complexity costs, which can amount to up to 40% of the total load on the resources provided, depending on the batch size, if sophisticated processes are controlled in an analogue manner. With the **TP** implementation example described above, this avoidable consumption of resources can be reduced down to 10%. This effect is confirmed by an industry survey conducted by the Fraunhofer Institute.



The digital **GAP process control system TP** is regarded as groundbreaking for changing demands in mechanical engineering thanks to all the innovations developed and implemented in the project for **SMEs** - also confirmed by the mechanical engineering association **VDMA** / Frankfurt.

Through the combination between positive, technological effects towards the product and the production area with yet unknown, value added services for the customers, **TP** provides the manufacturer with unique selling points and differentiation in **precision tool industry**. These features in turn guarantee the long-term survival of the manufacturer with significant social components for all employees involved.



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