
Tool.Ing

Inventive and knowledge based tooling in Europe

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Fraunhofer IPT, Aachen, Germany

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Wiesbaden, November 28th

Who we are

Aachen tool and die making – We know the branch

Fraunhofer
IPT

Process
technology

Production
machines

Measuring and
quality management

Technology
management

Aachen bundles the
competencies of several
institutes around tooling in one
platform



Prof. G. Schuh

Prof. R. Schmitt

Prof. C. Brecher

Prof. F. Klocke

WZL
RWTHAACHEN

Technology of
Manufacturing processes

Machine
tools

Quality
management

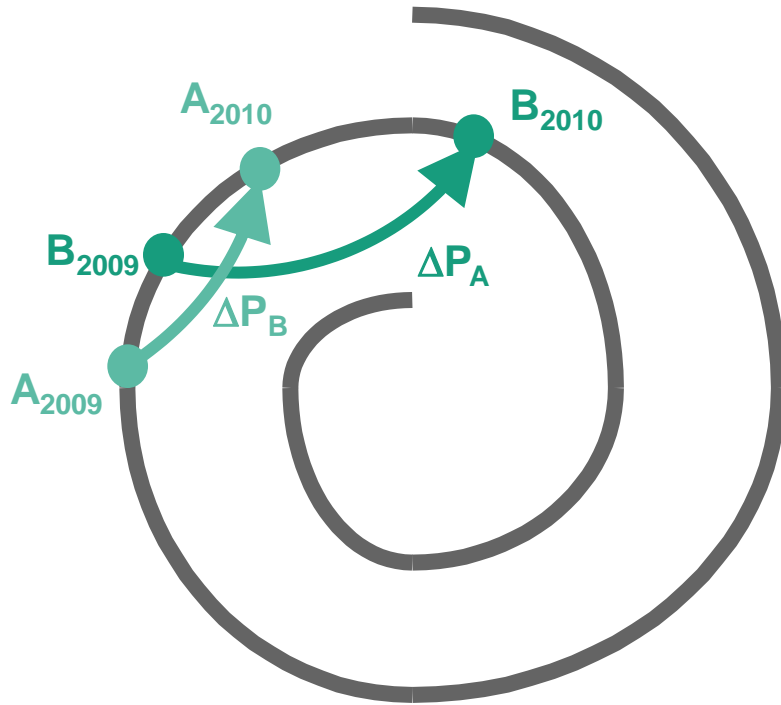
Production
engineering

Outline of the presentation

- 1 Production technology in Aachen
- 2 The today's status of the German Mould and Die making industry
- 3 Actual trends – how will the companies cope with the actual challenges?
- 4 Cooperation between companies – how joint developments can be pursued
- 5 Summary and Outlook

Prices for Tools and Dies

The Situation in 2009 got worse ...



$$\emptyset \Delta P_{2009} = 12.3 \%$$

$$\Delta P_{\min 2009} = 3 \%$$

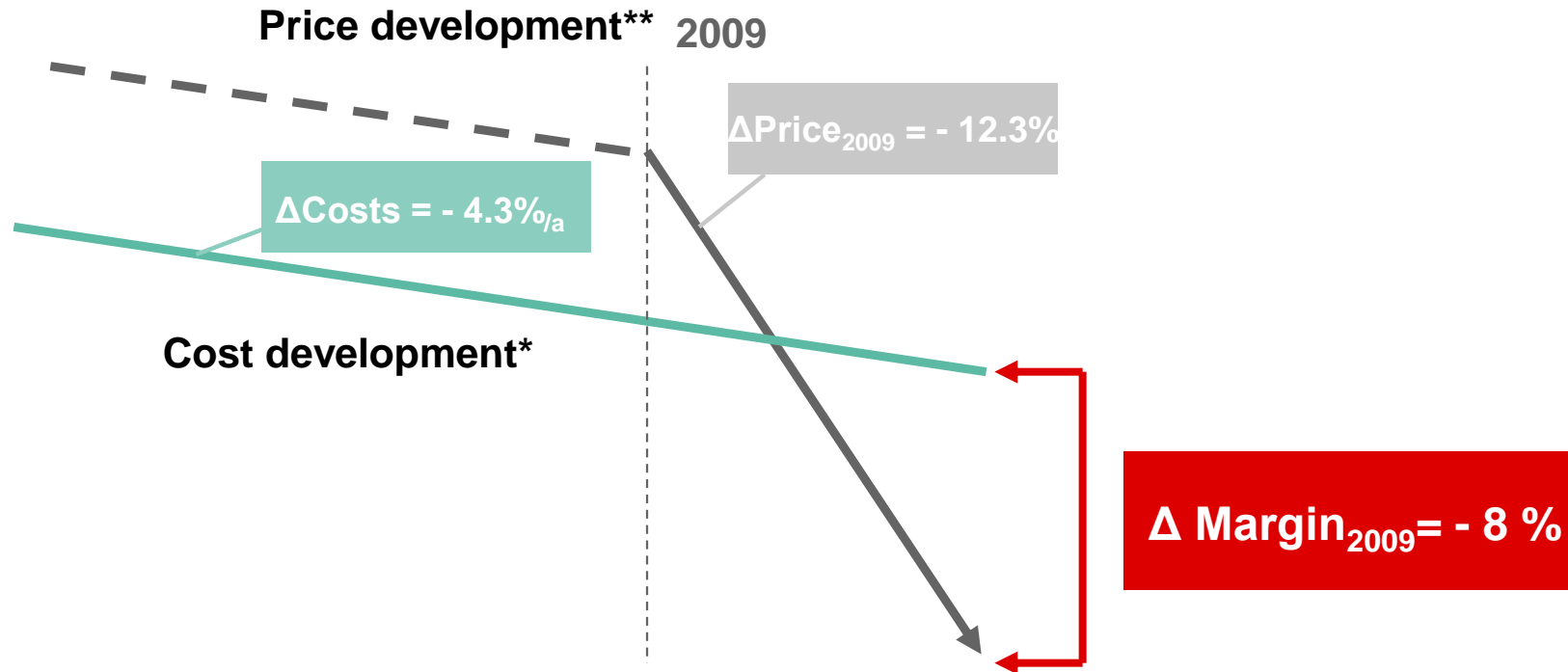
$$\Delta P_{\max 2009} = 42 \%$$

...a price war took place to ensure the utilisation of own capacities leading to eroding – and in some cases severely negative – profit margins

Source: Study "Operative Exzellenz im Werkzeugbau" 2010

Industry was unable to compensate a high fall in prices in short term Risking a long-term loss of margins

Why insolvencies in the sector increase despite full order books...

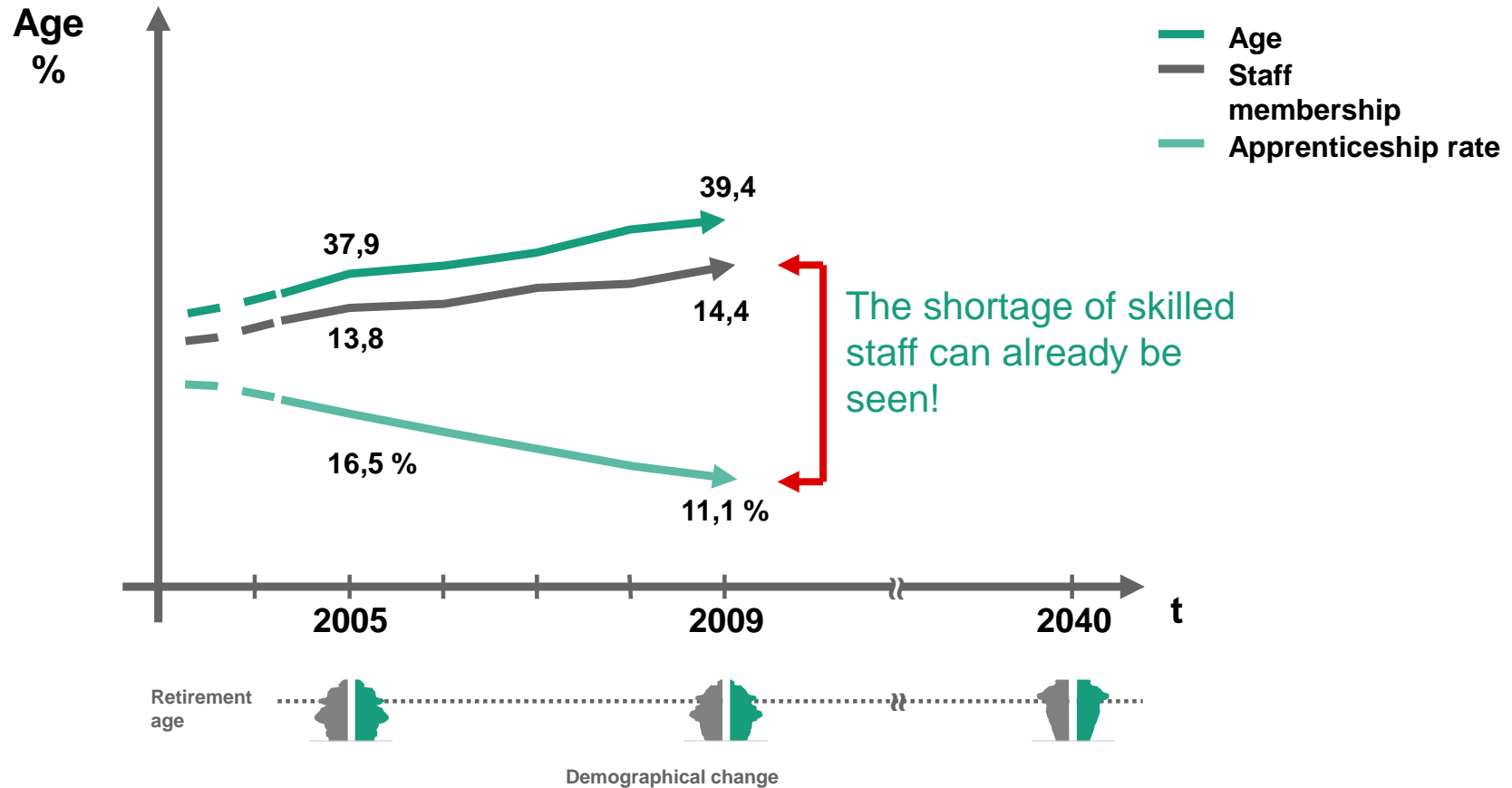


How can the sector close this gap in the long term by improving the risk / earnings relation?

Source: *Analysis of EIP 2004-2010; **Evaluation of the survey "Organisatorische Trends im Werkzeugbau", n=64, 2010

Where are we standing?

The know-how intensive Industry faces great Risk from Ageing



The perspectives for job starters need to be improved to gain the best ones: By offering further education as well as proper career and income prospects

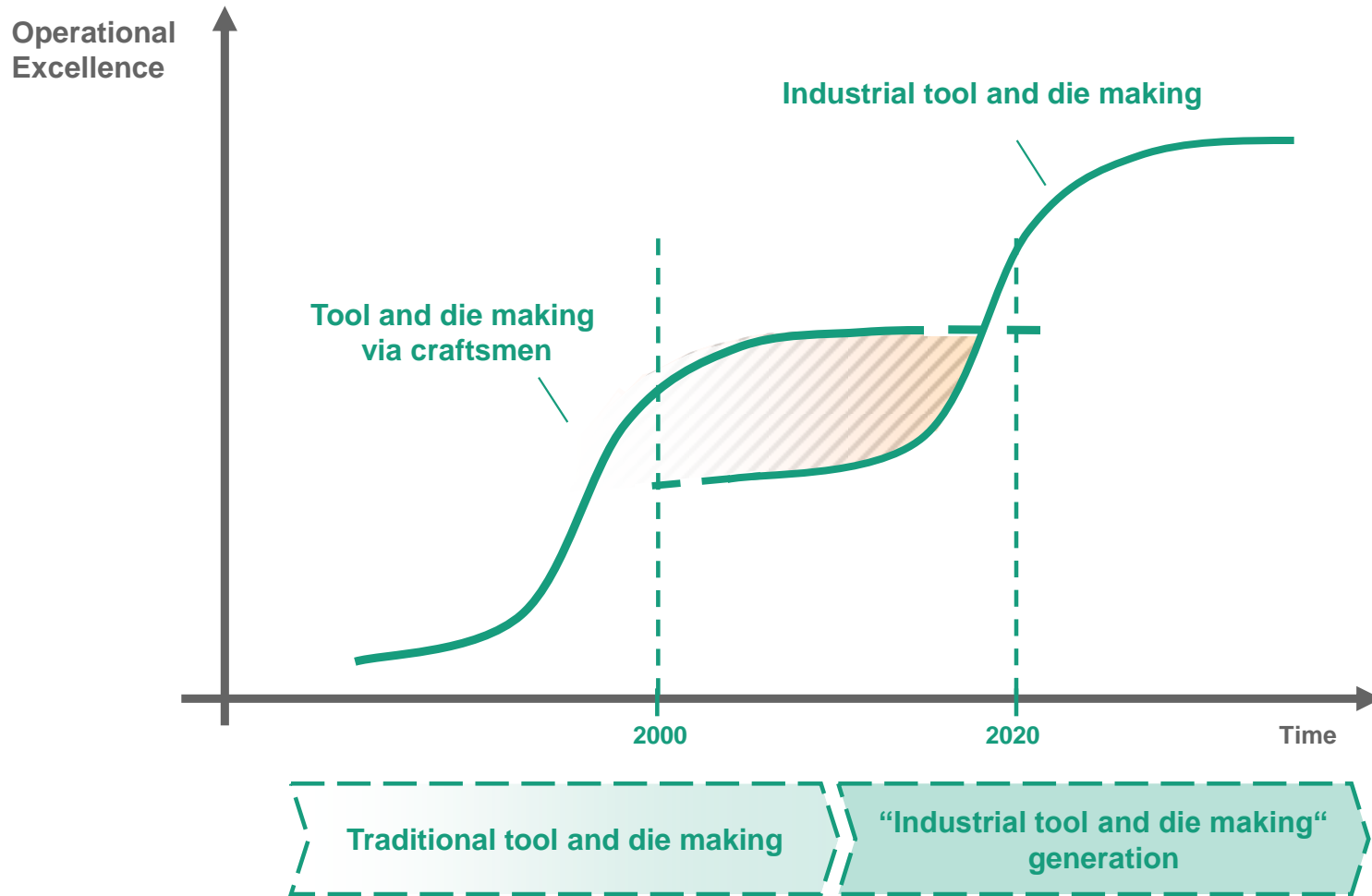
Source: Analyse EIP 2004-2010

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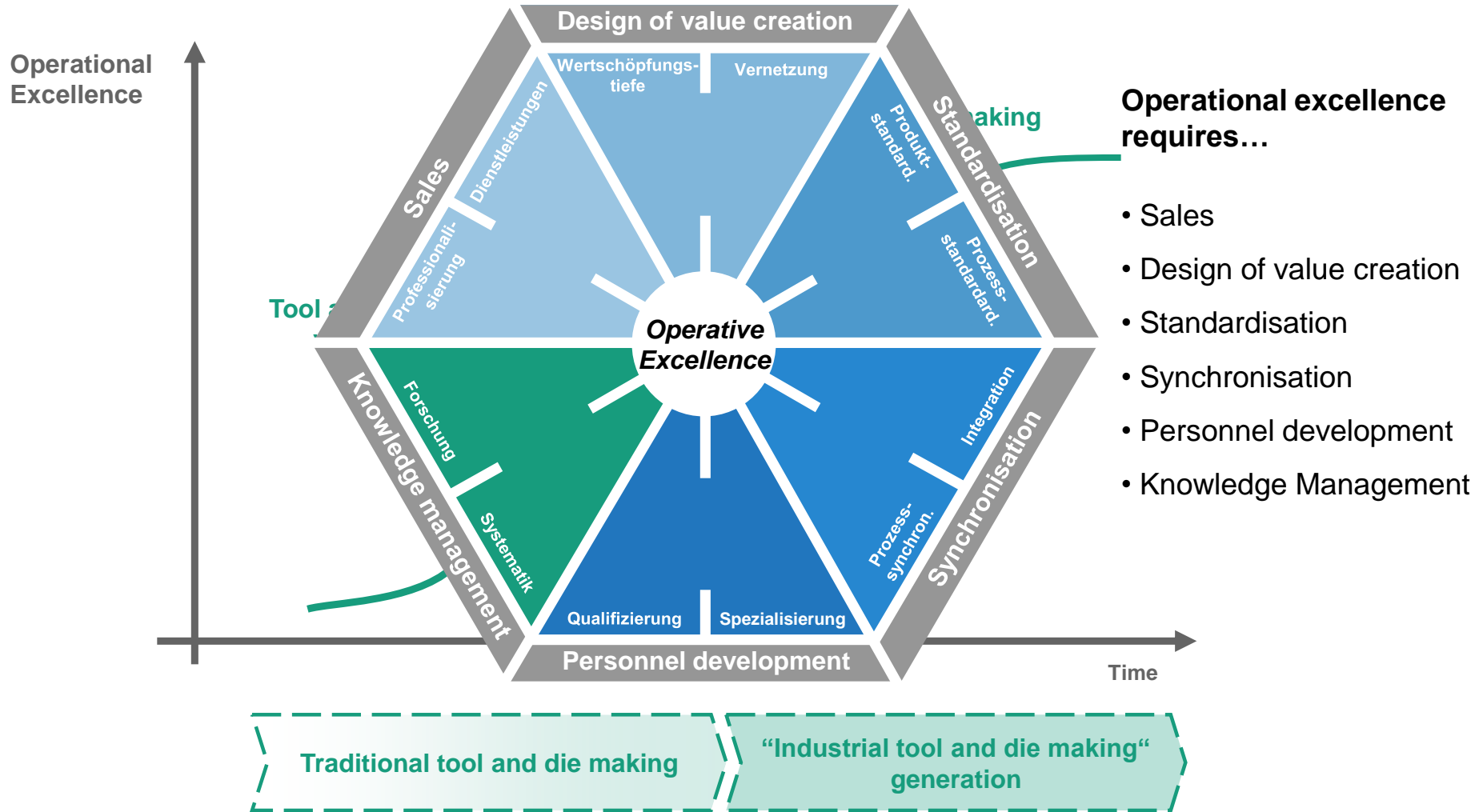
The Generation “Industrial tool and die making”

Operational Excellence helps to secure margins in the long term



The Generation “Industrial tool and die making”

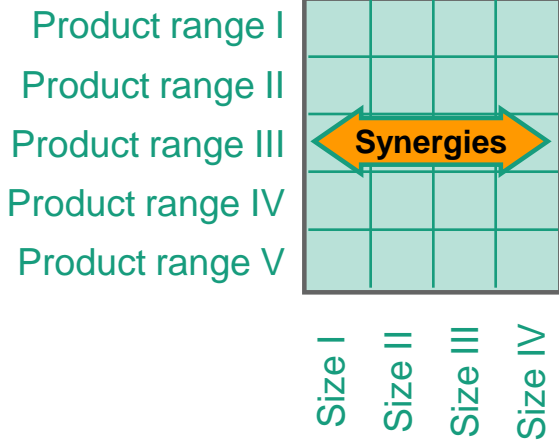
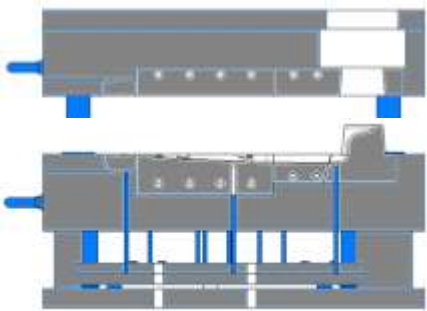
Operational Excellence helps to secure margins in the long term



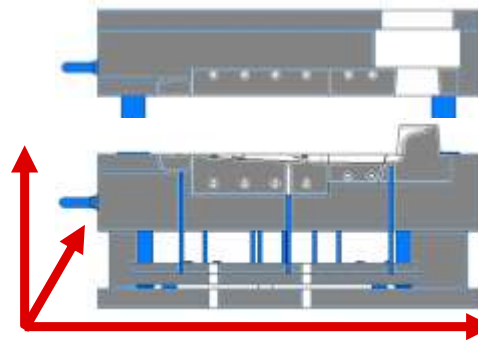
Standardisation

Holistic synergies are enabled by utilising modular design systems

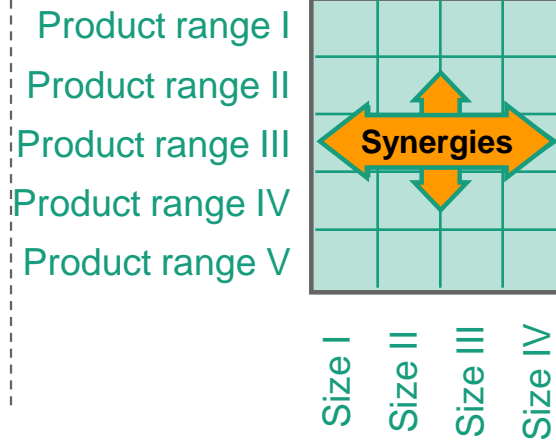
Yesterday
Norm parts



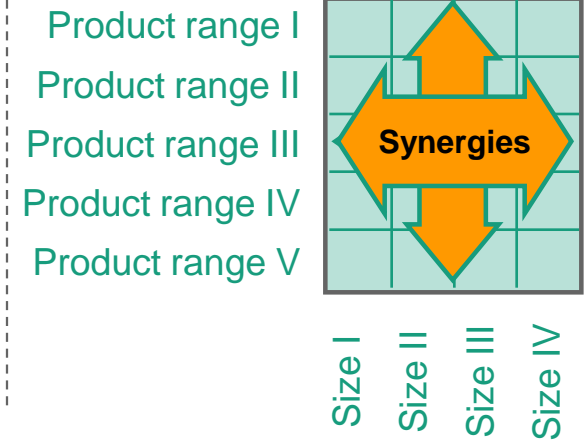
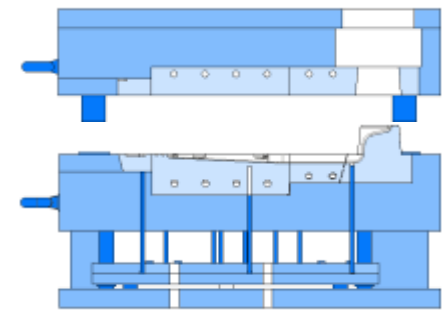
Today
Parameterised Standards



Size classes 400, 900, 1300mm

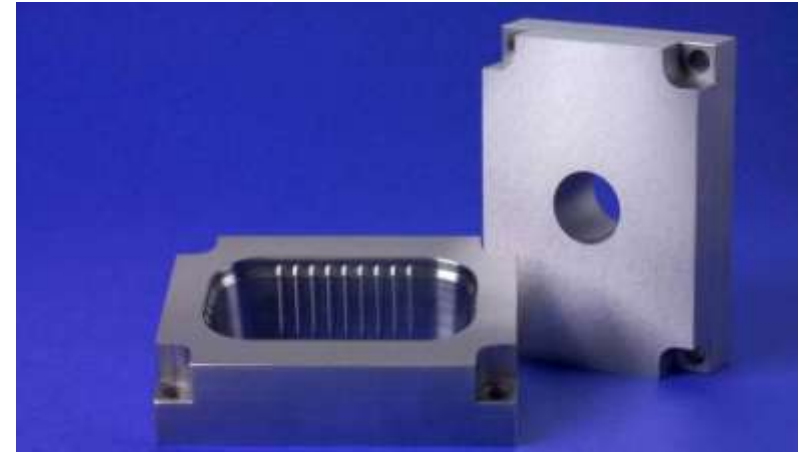
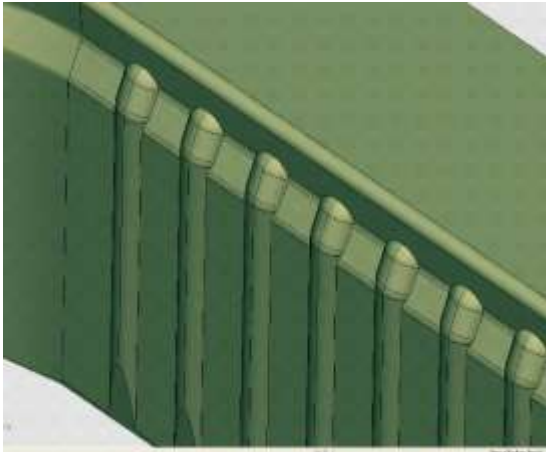


Tomorrow
Holistic, normed tooling concepts

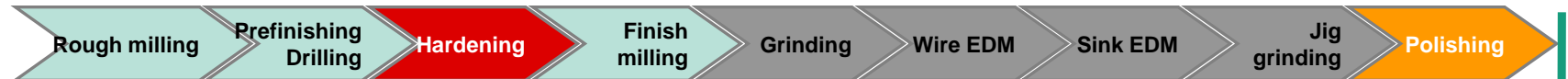


Modifications in the process chain design

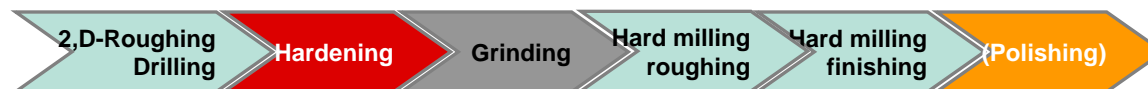
Similar operation time, drastically reduced idle times



Conventional process chain:



Complete hard machining:

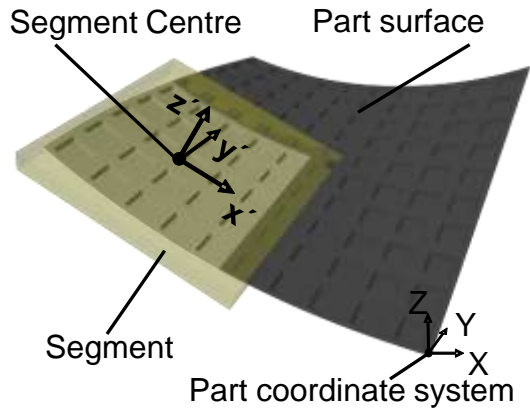
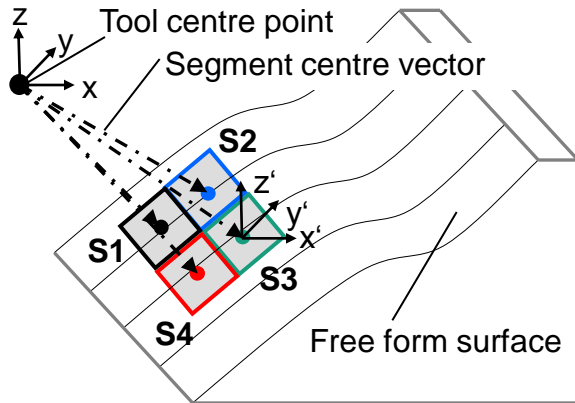


- Operation time reduction »only« ca. 15%
- »However«: Reduction of throughput time ca. 40%!

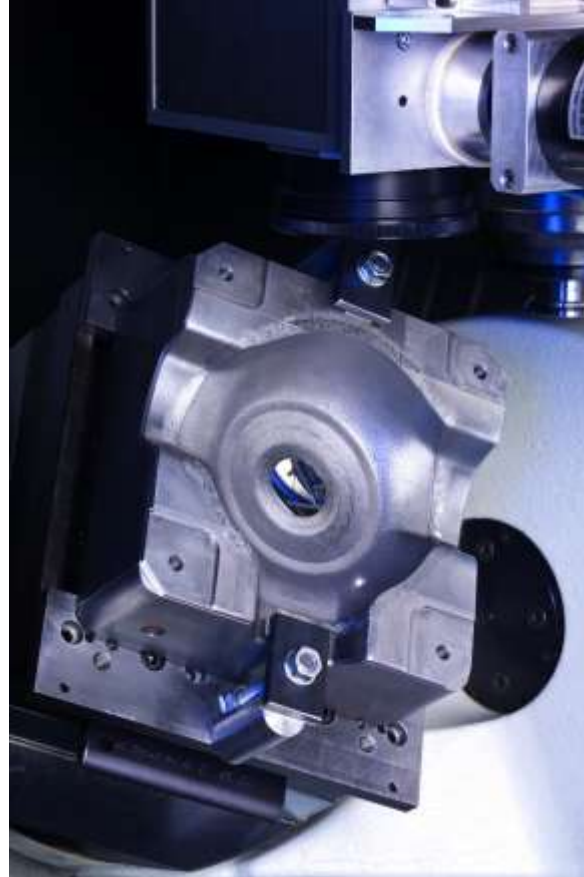
Laser beam structuring

Design structures for the mold manufacturing

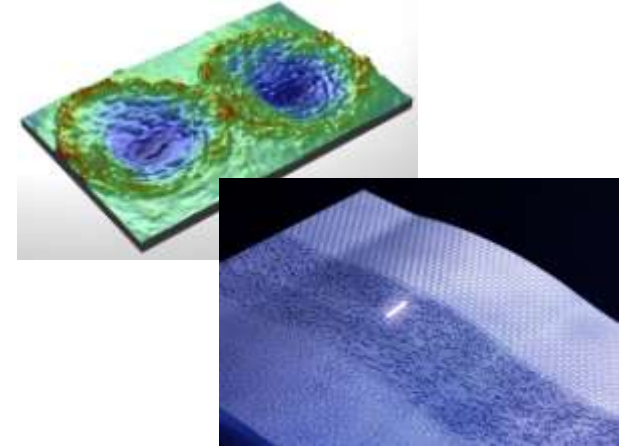
Segmentation and toolpath planning



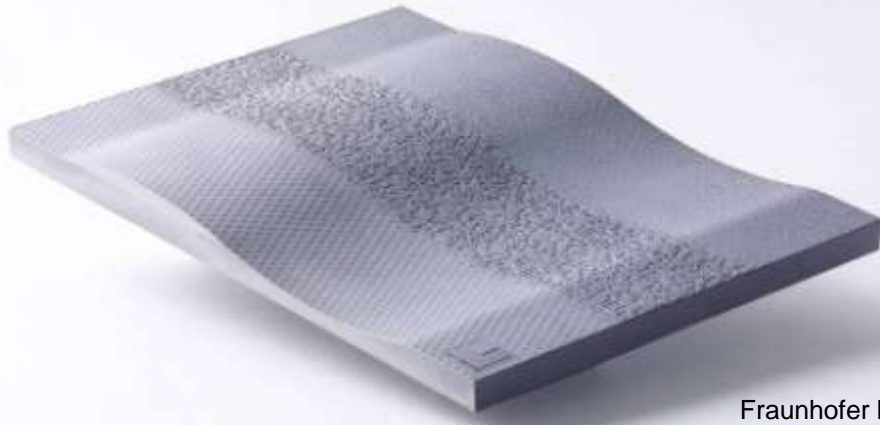
Implementation



Process technology



- Use of pulsed laser beam sources
- Amount of melt on surface can be influenced
- Choice and cost optimisation of beam guidance components

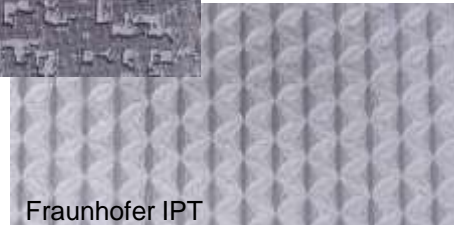
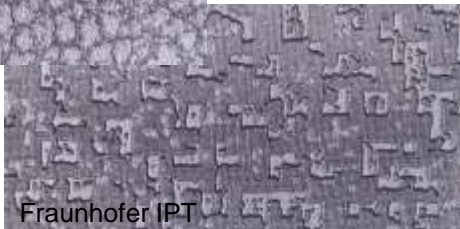
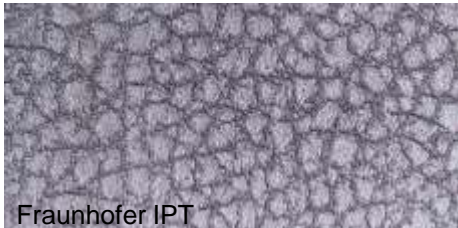


Work piece specification

- Injection mold
- Basis material 1.2343 (X38CrMoV5-1)
- Quenched and tempered to 50 +2 HRC
- Laser structured area:
196 mm x 152 mm

Result

- Large-scale and seamless surface structuring
 - Leather-grain K3A of the Volkswagen Golf VI
 - Hybrid-structure with micro- and macro structures
 - Geometrically defined pyramid structures

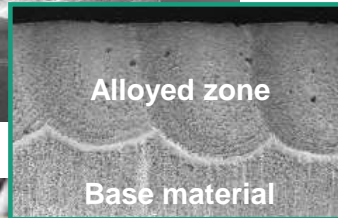
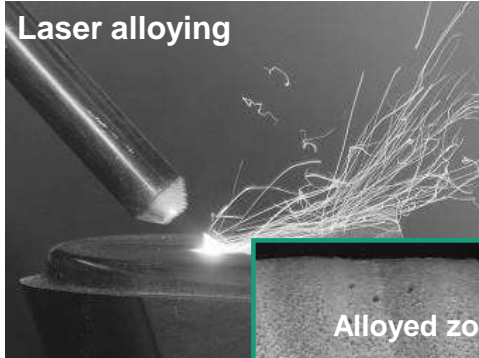


Laser surface treatment

Local wear protection – the Laser as a flexible mean of production

Process technology

Laser alloying



- Laser based surface modification with and without additional material

Wear protection

Forging



Die casting



Injection moulding

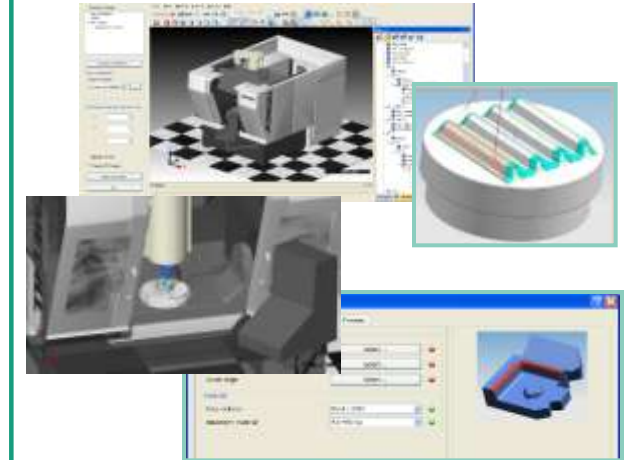


Deep drawing



- Reduction of
 - Abrasive wear on surfaces and edges
 - Local heat fracture
 - Adhesive wear in combination with nitriding
- Enhanced tool lifetime by up to 50%
- Integration in conventional process chains

CAM-based toolpaths



- Complete CAM integrated Toolpath planning and process parameters
- Simulation, analysis and optimization of toolpaths and material addition
- Simulation of machine kinematics to avoid collisions

Laser surface treatment

Example of laser alloying: “Aluminum die casting tool”



Surface which has to be treated



Laser surface treatment



Embedded insert of an Aluminum die casting tool

Specifications of the die

- Treatment of Aluminum die casing inserts
- Base material 1.2343 (X38CrMoV5-1)
- Max. dimensions: 55 mm
- Conventional: gas nitriding
- Innovative process chain:
Laser alloying and nitriding

Result

- Conventional:
Lifetime 5 000 parts
- Laser surface treated:
Lifetime circa 10 000 parts

Increase in lifetime of about 100 %

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The Tool Manufacturing Academy offers research, consulting and qualification with leading tool manufacturing companies

Aachen Tool Makers Academy

Research and Development

- Processing key aspects based on a development- and research- roadmap
- Acquisition of public research funds
- Accomplishment of contract research

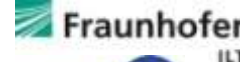
Industrial Consulting

- Bilateral projects concerning technical and organizational issues
- Concept development and project realization

Qualification

- Modular qualification proposals for non-graduates and graduates
- Top-class orators from industry and science

Sample tool manufacturing with a whole process chain and the support of the institutes



LEHRSTUHL WIRTSCHAFTSWISSENSCHAFTEN FÜR INGENIEURE UND NATURWISSENSCHAFTLER (WIN) - PROF. DR. BREITEL



Continuous collaboration on future issues in the tool manufacturing industry

Source: Summerer, Siebenwurst, Rathgeber

Industrial partners of the „Aachen Tool Makers Academy“

Premium Partner

Mercedes-Benz
Audi Werkzeugbau
PHENIX CONTACT
INSPIRING INNOVATIONS
RATH
WIR FORMEN IHRE IDEEN
MEISSNER
Return on Investment
GIRA
rathgeber tyrol
BMW

Business Partner

PWO
GERRESHEIMER
Hirschvogel Automotive Group
GEDIA
KIRCHHOFF
AUTOMOTIVE
ZF
Weidmüller

Partner

HILTI
MERIMA
PRÄZISIONSWERKZEUGBAU
BECKERT
formen modelle
HARTING
Huf Tools
LEIBER GROUP
KRÄMER+GREBE
Modell- und Werkzeugbau
sona
Driving Tomorrow
sauger & sohn
formentechnik
KEIPER
B/S/H/
Pushing Performance
ThysenKrupp
weber
ideen formen
HELLA
WIRO
PRÄZISIONS-Werkzeugbau
SIEBENWURST
MODELLBAU & FORMENBAU
SWA
GIEBELER

Cooperation Partner

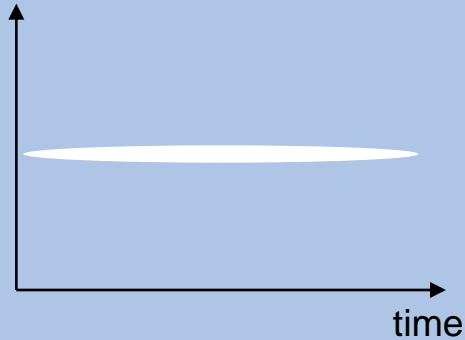
RWTH INTERNATIONAL ACADEMY
AACHEN UNIVERSITY
AUTOFORM
Forming Reality
SGL GROUP
THE CARBON COMPANY
ELB
HERMLE
Hoffmann Group
BÖHLER
Stahl für die Besten der Welt
HEIDENHAIN
DMG
OPS
INGERSOLL
Go for performance
+GF+
AgieCharmilles
Listemann AG
Werkzeug- und Wärmeverbindungsgeräte
frais
VDMA
WZL Forum
RWTH AACHEN

The Vision: RWTH Aachen Campus as catalyst for research und trigger for innovation

Research yesterday

- Long development times
- Narrow scope for solutions

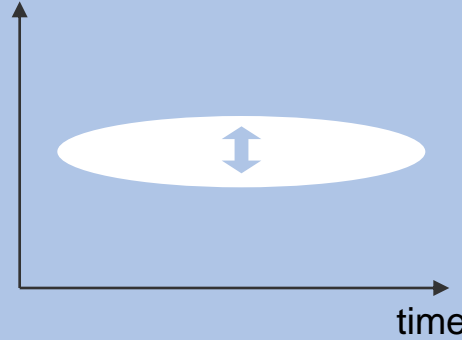
Solution Space



Research today

- Long development times
- Narrow scope for solution

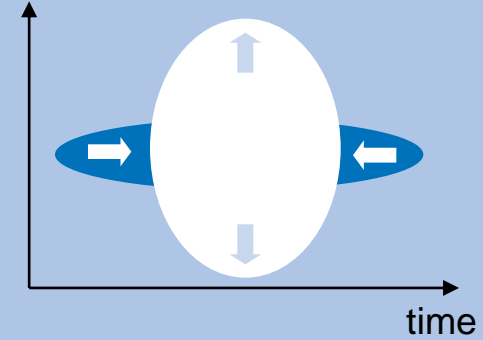
Solution Space



Research tomorrow

- Shortened development times
- Ample room for solutions

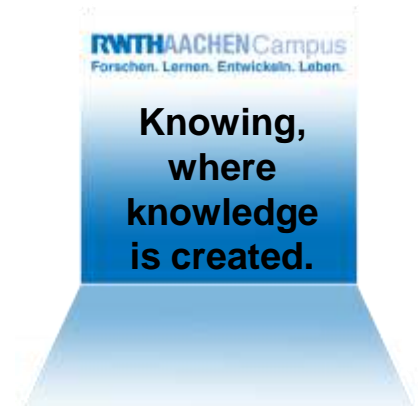
Solution Space



**Knowing,
where it
is written.**



**Knowing,
who knows
what.**



Outline of the presentation

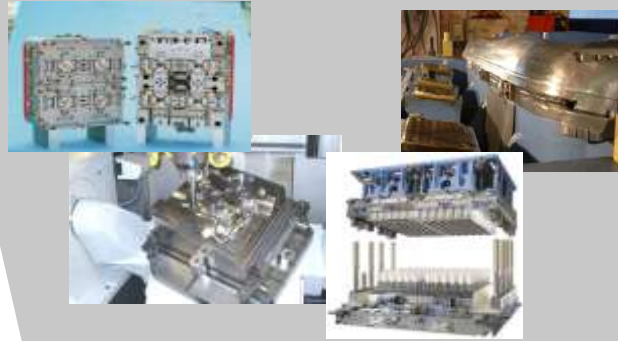
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Tool maker's influence on production efficiency

Defining the costs

- Initial cost:
appr. 15% of total invest related to tools and dies¹
- Life cycle cost:
appr. 30% of production costs related to tooling costs²
- Productivity:
Cycle time, tool wear, reliability

Tools:
Sheet metal, injection moulding, die casting, etc...

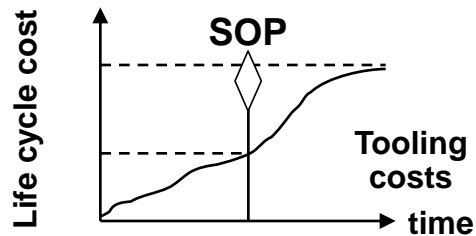
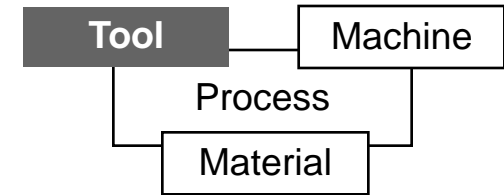


Defining the quality

- Process reliability
(reproducibility etc.)
- Product quality (Tolerances, surfaces, haptics etc.)

Defining the time

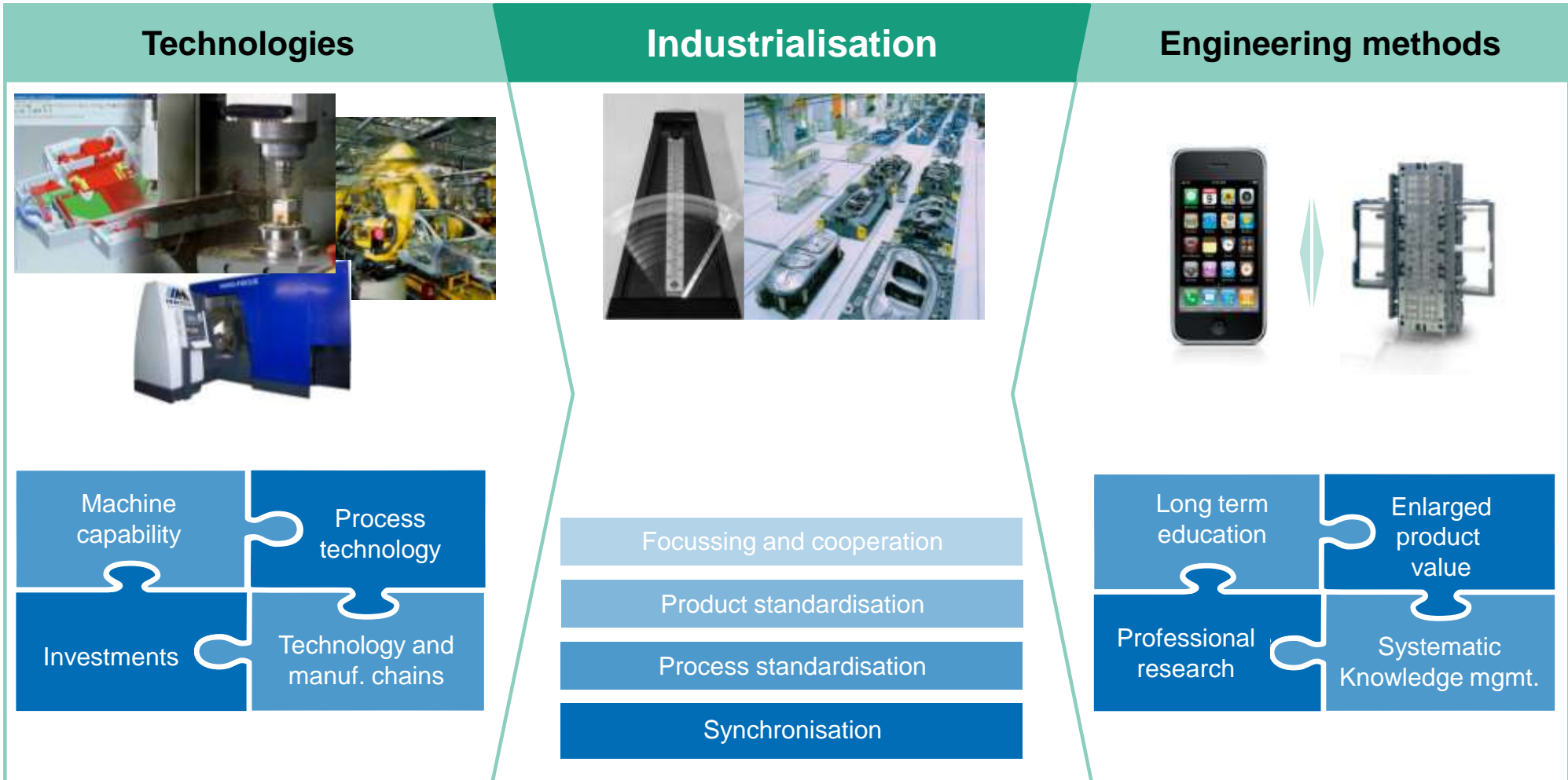
- Time to Market:
Tools are always on the critical path
- Time to Customer:
Availability and reliability



PD: Product development
T: Tooling

Source: ¹VDA, ²Eversheim; Bilder: Audi, Marbach, Philips

The idea of Tool.Ing incorporates technological and systematical knowledge to industrialize the tool making



Images: Audi AG; Deckel Maho Gildemeister; t-mobile;

Thank you very much for your attention!

Your contact to Fraunhofer IPT



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