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International Benchmarking Analysis of the Hong Kong Mold and Die Industry
香港模具行业国际标杆分析

Hong Kong / Digital | 1st March 2022

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International Benchmarking Analysis of the Hong Kong Mold and Die Industry: Agenda I 1st March 2022
香港模具行业的国际基准分析：议程 I 2022 年 3 月 1 日

1	Welcome 欢迎	13:00 – 13:05
2	Key findings benchmarking analysis HK mold and die industry 2019-2022 香港模具行业对标分析的主要发现2019-2022	13:05 – 13:20
3	Recap factory visits 2022 回顾工厂参观 2022	13:20 – 13:45
4	Fields of action for HK mold and die industry 香港模具行业的评估报告	13:45 – 14:45
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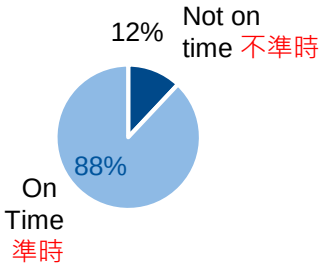
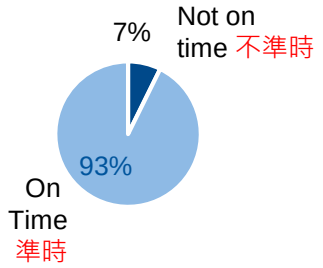
General overview of results: All in all Hong Kong mold and die industry reaches good results in terms of timeliness and budgeting

业绩概览：总体而言，香港模具行业在时效性和预算方面都取得了不错的成绩

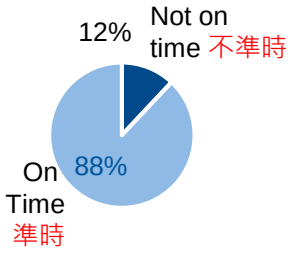
Timeliness 时效性



Hong Kong average, 2019
香港平均, 2019



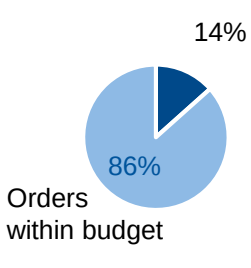
Hong Kong average, 2021
香港平均, 2021



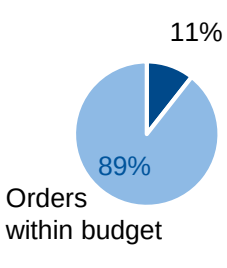
Top 10 German tooling companies, 2021
德國首10家頂尖的模具企業, 2021

Share of rush orders
加急訂單份額

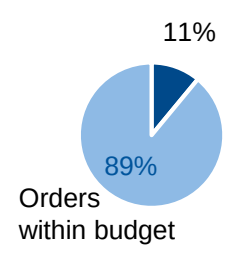
Budgeting 预算



Hong Kong average, 2019
香港平均, 2019

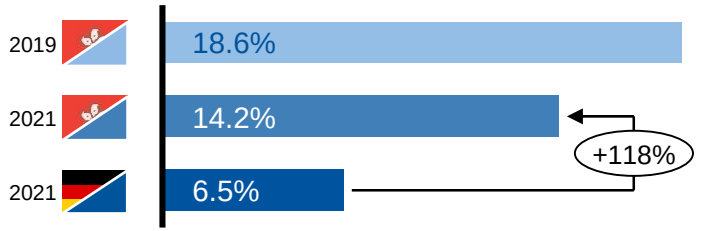


Hong Kong average, 2021
香港平均, 2021



Top 10 German tooling companies, 2021
德國首10家頂尖的模具企業, 2021

Share of customer complaints after 2nd inspection
第二次調研後的加急訂單份額



The Hong Kong mold and die industry was able to improve the timeliness drastically in the last two years – however in terms of quality and resulting customer complaints German tool shops are still more advanced
香港模具行业在过去两年中大幅提高了及时性——但在质量和由此产生的客户投诉方面，德国模具车间仍然更先进

Investments and machines: In the last two years the investment ratio of Hong Kong mold and die industry decreased rapidly resulting in an unchanged level of automation
投资与设备：近两年香港模具行业的投资比例迅速下降，导致自动化水平不变

Investments 投资

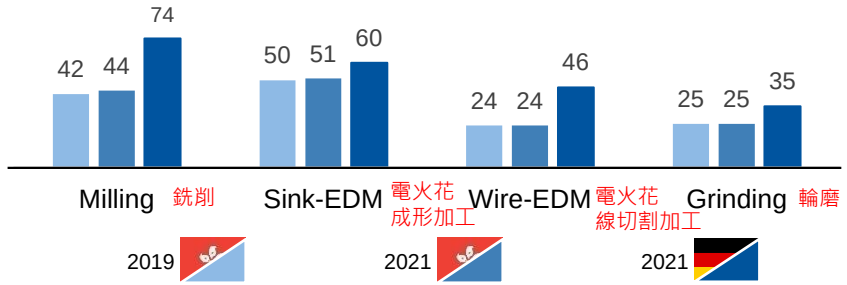
Investment II [%]

Hong Kong average, 2019
香港平均, 2019

Hong Kong average, 2021
香港平均, 2021

Top 10 German tooling companies, 2021
德國首10家頂尖的模具企業, 2021

Level of automation 自動化水平



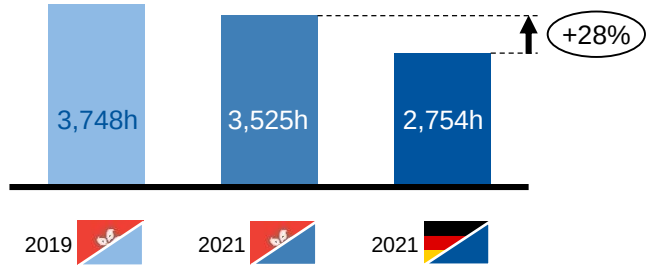
Machines 设备

Hong Kong average, 2019
香港平均, 2019

Hong Kong average, 2021
香港平均, 2021

Top 10 German tooling companies, 2021
德國首10家頂尖的模具企業, 2021

Yearly average machine runtime
機械運行時間的年平均值

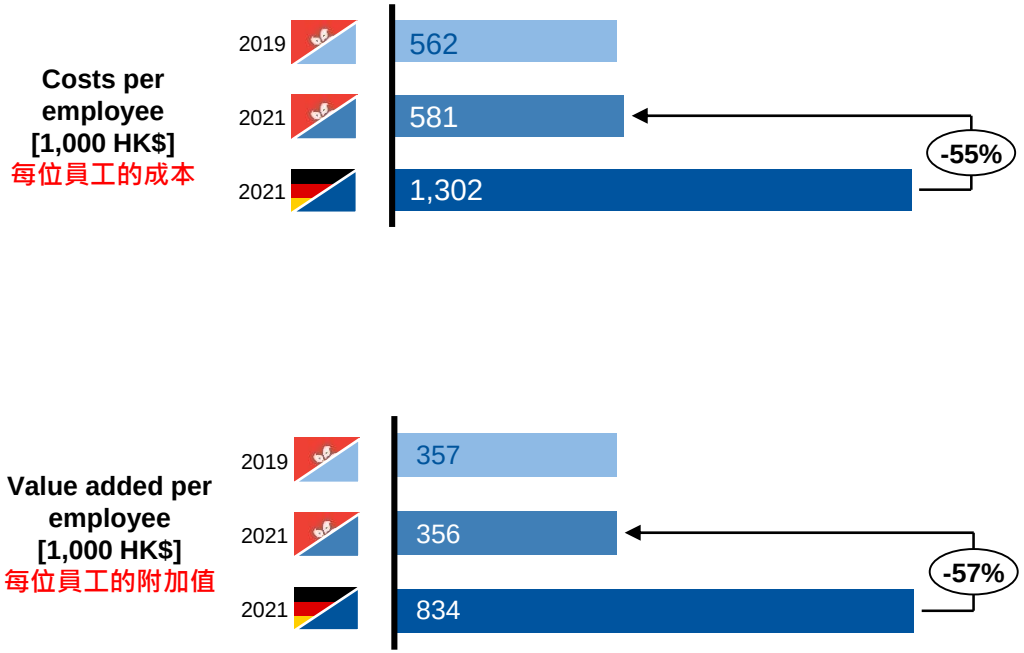


Compared to German tool shops the Hong Kong mold and die industry uses far less automation in production – automation could be a measure to increase the high machine runtime even more efficiently
与德国模具车间相比，香港模具行业在生产中使用的自动化程度要低得多——自动化可能是一种更有效地增加机器运行时间的措施

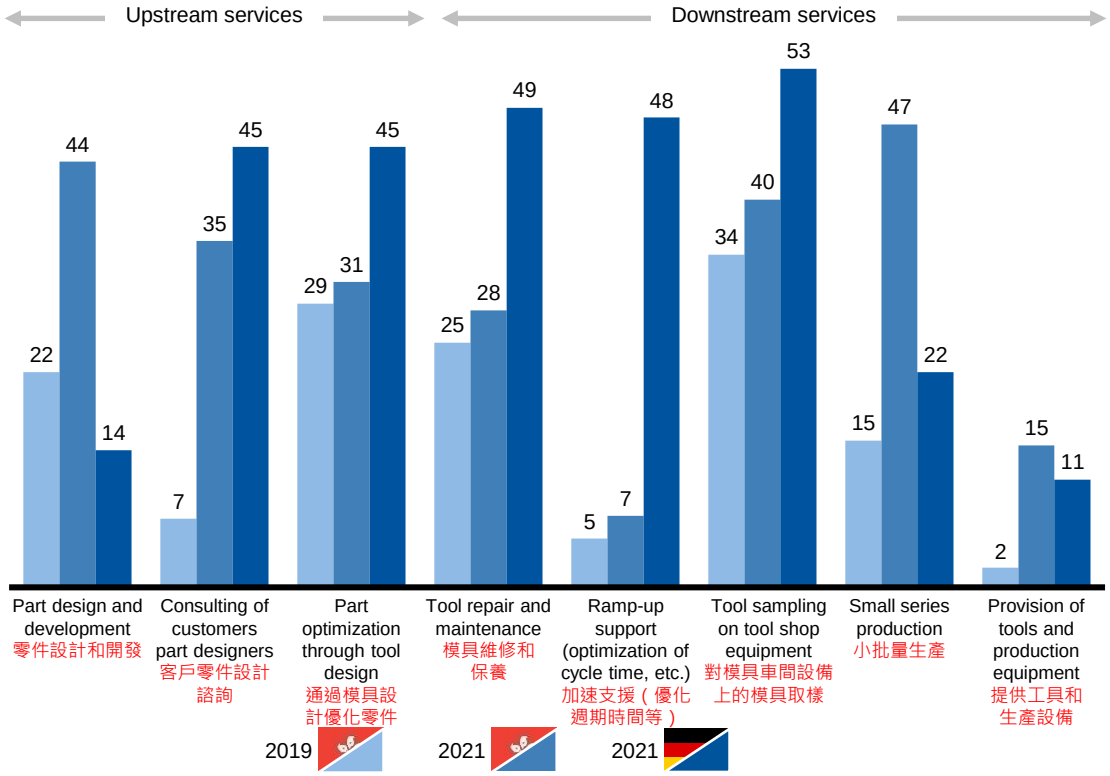
Investment ratio II: "Investments into fixed assets / turnover"

Performance of employees and services: While the performance per employee remained almost identical more additional services where offered to the customers
员工和服务的绩效：虽然每位员工的表现几乎保持不变，但向客户提供的额外服务更多

Performance per employee 每位员工的表现



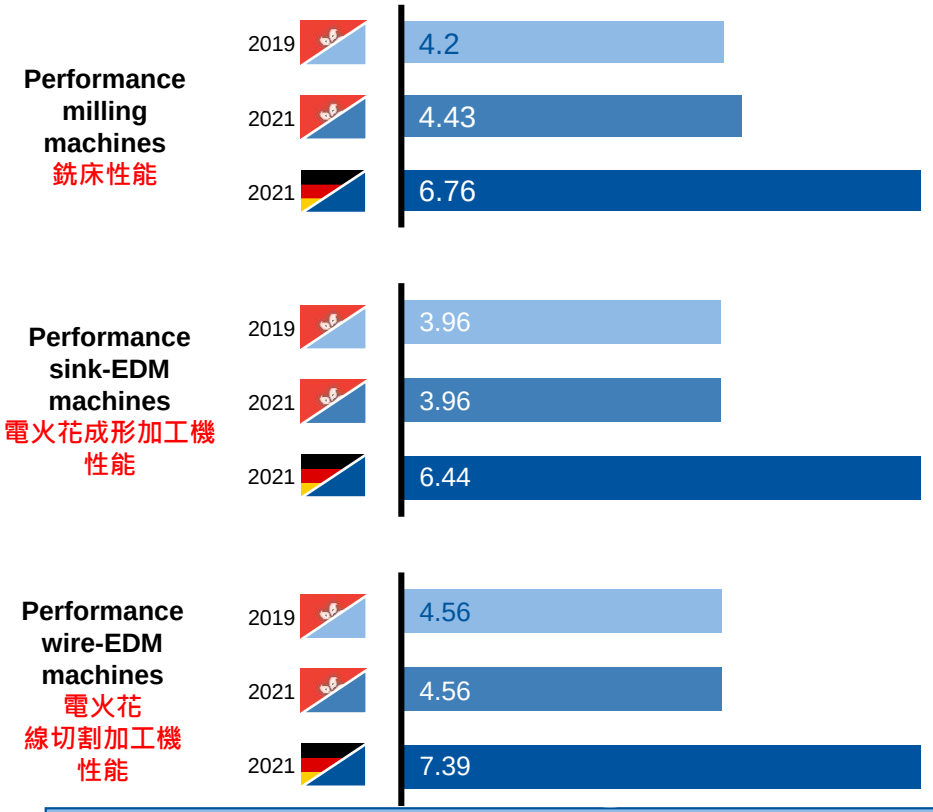
Offer of additional upstream and downstream services 提供额外的上游和下游服务



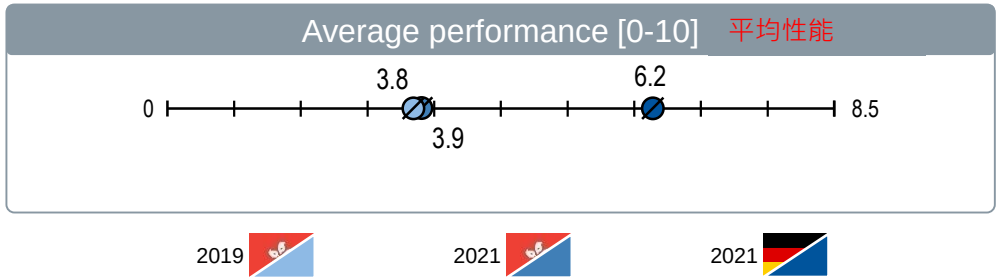
The performance per employee is still comparably low and reveals great potentials in terms of efficiency and added value – at the same time the potentials for offering more value to the customers through additional services was addressed successfully in the period under review
每位员工的绩效仍然相对较低，并在效率和附加值方面显示出较大的提升空间——同时，通过附加服务为客户提供更多价值的提升空间在标杆检测期间得到了成功解决

General overview of technological weaknesses: The Hong Kong mold and die industry has great potential to improve machine performance
技术弱点概述：香港模具行业在提高机器性能方面具有较大提升空间

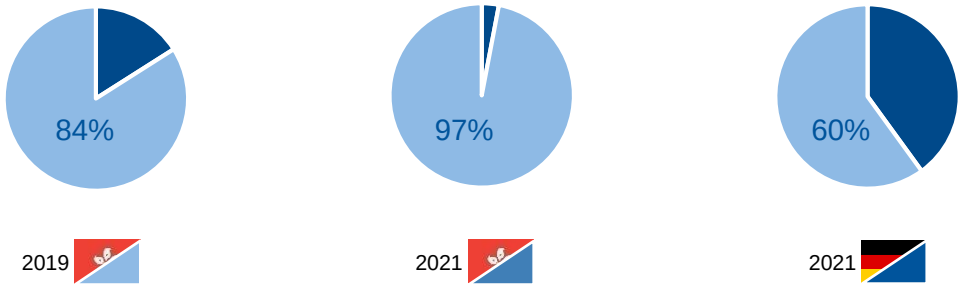
Machine performance in detail 设备性能详情



Average machine performance 平均设备性能



Percentage of CAM-programming in milling CAM 编程在铣削中的百分比



The Hong Kong mold and die industry reaches a relatively low machine performance – only significant improvements in CAM-programming were achieved in the period under review
香港模具行业的设备性能相对较低——标杆检测期内仅在 CAM 编程方面取得显着改善

The gap between effectiveness and efficiency in consideration of the current challenges of the Hong Kong mold and die industry
考虑到香港模具行业当前的挑战，效率与效能之间的差距

Current challenges of Hong Kong mold & die industry 香港模具行业目前的挑战

+118% **more customer complaints** indicate the need for in increase in quality and effectiveness 更多的客戶投訴顯示出需要提高質量和效用

+33% higher degree of **rush orders** compared to Germany's best tool shops resulting in a more difficult planning of orders
與德國最好的模具廠商相比，緊急訂單程度更高，導致訂單計劃更加困難

-57% below in **value added per employee**, although salaries are rapidly increasing in China 儘管中國的工資正快速增長，每位員工的附加值仍較低

-63% below the **average machine performance** in relation to the entire machine park 平均機械性能低於整個機器園區

Current situation and need for action 现状和需要采取的行动

High effectiveness & good preconditions
高效率和良好的前提条件

Improvable efficiency, transparency & quality
提高效率、透明度和质量

The Hong Kong mold and die industry has a high effectiveness and very good preconditions in terms of competing with the best tool shops – however there are huge potentials when it comes to efficiency and transparency, which can currently lead to comparably lower quality
香港模具行业在与最好的模具车间在竞争方面具有很高的效率和非常好的先决条件——但在效率和透明度方面有较大提升空间，目前可能导致质量不是什么理想

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January 2022:
On-site audits have been conducted in twelve companies
2022年1月：已对12家公司进行现场标杆审核

1. Hongrita
2. EVA®
3. 导新数控工程有限公司 DATAMATIC CNC ENGINEERING CO., LTD.
4. 奔达 SUPERBAND
5. VIGOR PRECISION LTD
6. LAP CHI MOULDING
7. 雅達模具 ULTRATECH
8. 富滔模具(东莞)有限公司 FULLMARKS METAL TECHNOLOGY COMPANY LIMITED
9. 泰興塑膠五金有限公司 TAI HING PLASTIC METAL LTD
10. 東江控股 TK HOLDINGS 香港主板上市 股份代號：2283
11. KENTA 健大企業有限公司 Kenta Enterprise Co.,Ltd
12. SH

The purpose of the audits was to review and validate answers given in the questionnaire as well as identify individually recommended action fields
标杆检查的目的是审查和验证问卷中给出的答案，并定制推荐改善方案

Industry benchmarking model WBA: Overview of the fields from on-site visits
行业标杆模型WBA：实地考察领域概览

- Strategic orientation 战略定位
- Shopfloor management & layout 车间管理和布局
- Calculation 报价成本计算
- Human resources & employees 人力资源和雇员
- Order processing 订单处理
- Error and knowledge management 错误和知识管理
- Design & work preparation 设计和工作规划
- Industry 4.0 工业4.0
- Manufacturing technologies 制造技术
- Sustainability 可持续性

The key findings which have been identified during the on-site-visits will be structured in nine fields
实地考察期间主要发现将分为九个领域

Overview of strengths and potentials from on-site visits: Strategic orientation
实地考察的优势和潜力概述：战略导向

Strengths …优点

- Extended range of service (e.g., small series production, pre-finish manufacturing, more consulting services)扩展服务范围（例如，小批量生产、成品制造、更多咨询服务）
- Change in strategy during the pandemic (e.g., to domestic market or medical products) 大流行期间的战略变化（例如，转向国内市场或医疗产品）
- Increase of sales in all markets as well as acquisition of new customers 增加所有市场的销售额以及获得新客户

Potentials to address…改善空间

- Quantification of strategic goals and development of tool shops-specific strategic roadmaps incl. measures 战略目标的量化和模具车间特定战略路线图，线路图和具体措施的开发。
- Identification of further potentials for additional services/products and general market positioning 确定额外服务/产品和一般市场定位的更多的潜力
- Further acquisition of clients from different sectors (e.g. medical sector) and increase of market share in emerging markets (e. g. e-mobility) 进一步获得不同行业（例如医疗行业）的客户并增加新兴市场（例如电动汽车）的市场份额

Overview of strengths and potentials from on-site visits: Calculation
实地考察的优势和潜力概述：报价成本计算

Strengths …优点

- Generally fast processes of cost calculation 通常快速的成本计算过程
- Partially usage of defined templates for tool price calculation with systematic foundation through the definition of different tool types and complexities 通过定义不同的模具类型和复杂性，部分使用定义的模板进行模具价格计算，具有系统基础
- Separated calculations for different markets to improve quotation precision 不同市场分开计算，提高报价精度

Potentials to address…改善空间

- Implementation of system support with historical data in order to improve experience-based cost calculation 通过历史数据实施系统支持，以改进基于经验的成本计算
- Improvement of post calculation methodologies in some of the visited tool shops in order to increase overall cost transparence and calculation reliability 改进一些完成的模具的成本计算方法，以提高整体成本透明度和计算可靠性
- Software support for the analysis of similarities of components and further expansion of the tool data bases 用于分析组件相似性和进一步扩展工具数据库的软件支持

Overview of strengths and potentials from on-site visits: Order processing
实地考察的优势和潜力概述：订单处理

Strengths …优点

- Usage of convenient software systems for planning and scheduling in most of the visited companies 在大多数访问的公司中使用方便的软件系统进行计划和调度
- Recording of production times through bar code scanning and other solutions in order to establish a sufficient data availability 通过条形码扫描和其他解决方案记录生产时间，以建立足够的可用的数据
- Partially consideration of required and available capacities in the planning of part production with focus on increasing efficiency 在零件生产规划中部分考虑所需和可用的能力，重点是提高效率

Potentials to address…改善空间

- Integration of more planning functions and systems into one leading system with focus on ensuring reliable data and reducing paper work 将更多计划功能和系统集成到一个先进的系统中，重点是确保可靠的数据和减少文书工作
- Increased focus on rough planning for capacity adjustments in order to enable better efficiency and avoiding over-capacities 更加关注产能调整的粗略规划，以提高效率并避免产能过剩
- Scheduling by visualization of relevant information instead of team leader steering in some of the visited tool shops 通过相关信息的可视化而不是团队领导在模具车间中进行任务分配

Overview of strengths and potentials from on-site visits: Design & work preparation
实地考察的优势和潜力概述：设计和工作规划

Strengths …优点

- Usage of simulation of tool paths for collision control 使用模拟刀具路径进行碰撞控制
- Implemented internal design guidelines 实施内部设计指南
- Usage of color codes for different tolerances in CAD model CAD模型中不同公差的颜色代码的使用

Potentials to address…改善空间

- Definition of standard part groups for higher standardization为更高的标准化定义标准零件组
- Update to newer UG version in CAD and CAM 在 CAD 和 CAM 中更新到最新的 UG 版本
- Implementation of PMI and color codes for manufacturing technologies 为制造技术实施 PMI 和颜色代码

Overview of strengths and potentials from on-site visits: Manufacturing technologies
实地考察的优势和潜力概述：制造技术

Strengths …优点

- Integration of process standards for the decision between different technologies (e.g., milling and wire cutting) 整合不同技术（例如铣削和线切割）之间决策的工艺标准
- Improvement of E-Man integration (e.g. EDM or CMM machines) 改进 E-Man 集成（例如 EDM 或 CMM 机器）
- Usage of additive manufacturing as innovative manufacturing technology 使用增材制造作为创新制造技术

Potentials to address…改善空间

- Integration of (further) automation solutions to improve machine run times 整合（进一步）自动化解决方案以提高机器运行时间
- Investments in new machines (e.g. 5-axis milling machine) 投资新机器（例如 5 轴铣床）
- Improvement of milling tool strategy (CAM-programming standards, central tool supply) 改进铣刀策略（CAM 编程标准、中央刀具管理）

Overview of strengths and potentials from on-site visits: Shopfloor management & layout
实地考察的优势和潜力概览：车间管理和布局

Strengths …优点

- Implementation of KPI tracking on the shop floor in progress for some of the visited tool shops 部分模具车间实施车间关键绩效指标跟踪
- Partially high degree of order and cleanliness as well as good structuring of the shopfloor in some of the visited tool shops 部分参观的模具车间的秩序和清洁度以及车间结构良好
- Partly integrated lean management guidelines in many of the visited tool shops 在许多参观的模具车间中整合了部分的精益管理

Potentials to address…改善空间

- Reduction of material on the shopfloor and increase of transparency 减少车间材料并增加透明度
- Improvement of visualization on the shop floor with relevant data 使用相关数据改进车间的可视化
- Further improvement of cleanliness, tidiness and lean guidelines in some of the visited tool shops 进一步改善模具车间的清洁、整洁和精益准则

Overview of strengths and potentials from on-site visits: Human resources & employees
实地考察的优势和潜力概述：人力资源和员工

Strengths …优点

- Modern office spaces in design, project management and CAM programming in some of the visited tool shops 在一些模具车间中设计、项目管理和 CAM 编程方面的先进的办公空间
- Partially bonus systems and other incentives for employees to motivate employees and reward fast and good work 为员工提供部分奖金制度和其他激励措施，以激励员工并奖励快速和良好的工作

Potentials to address…改善空间

- Implementation of measures to retain employees and their knowledge in the company 实施措施以留住员工及其在公司的经验
- Improvement of ergonomics at the workplace on the shop floor an in several of the visited tool shops 改善模具工作场所的工作环境以及访问多几家模具车间

Overview of strengths and potentials from on-site visits: Error and knowledge management
实地考察的优势和潜力概述：错误和知识管理

Strengths …优点

- Usage of E-Man and other solutions for error management 使用 E-Man 和其他解决方案进行错误管理
- Internal workshops for knowledge management 内部经验交流研讨会
- Quality checks during manufacturing processes 制造过程中的质量检查

Potentials to address…改善空间

- Implementation of more systematic software support for knowledge management 为知识管理实施更系统的软件支持
- Systematic application of lessons learned 从经验中系统性学习
- Creation of knowledge management action plans for key processes 为关键流程创建具体管理措施计划

Overview of strengths and potentials from on-site visits: Industry 4.0
实地考察的优势和潜力概览：工业 4.0

Strengths …优点

- Partially implemented data collection of important CNC machines 部分实施重要数控机床的数据采集
- Partially digital visualization of KPIs on the shopfloor 车间 KPI 的部分数字化可视化
- Implementation of different stand-alone Industry 4.0 solutions, e. g. augmented reality and AGVs 实施不同的独立工业 4.0 解决方案，例如增强现实和 AGV

Potentials to address…提升空间

- Further building of awareness and understanding for the potentials of Industry 4.0 进一步提高对工业 4.0 潜力的认识和理解
- Further development of the interlinking of systems to connect all subsystems and departments (Single Source of Information) 进一步发展系统互连以连接所有子系统和部门（单一信息源）
- Development of specific Industry 4.0 strategies in order to ensure a holistic implementation of smart solutions 制定特定的工业4.0战略，以确保智能解决方案的整体实施

Overview of strengths and potentials from on-site visits: Sustainability
实地考察的优势和潜力概述：可持续性

Strengths …优点

- Reduction of oil usage in milling 减少铣削中的油用量
- Usage of solar panels for power supply 使用太阳能电池板供电
- Implementation of new technologies for the overall reduction of energy consumption 实施新技术全面降低能耗

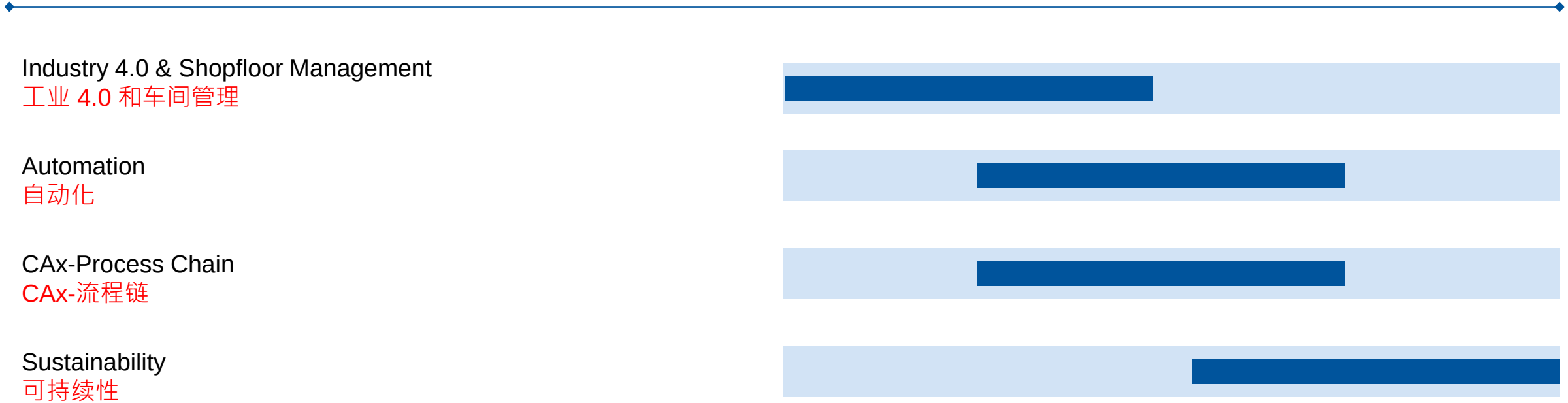
Potentials to address…提升空间

- Definition of a sustainability strategy 可持续发展战略的定义
- Implementation of energy management system with transparent energy consumption overview 能源管理系统的实施与透明的能源消耗概览
- Recording of CO2-emissions (e.g. per machine and order) 记录二氧化碳排放量（例如每台机器和订单）

International Benchmarking Analysis of the Hong Kong Mold and Die Industry: Agenda I 1st March 2022
香港模具行业的国际基准分析：议程 I 2022 年 3 月 1 日

1	Welcome 欢迎	13:00 – 13:05
2	Key findings benchmarking analysis HK mold and die industry 2019-2022 香港模具行业对标分析的主要发现2019-2022	13:05 – 13:20
3	Recap factory visits 2022 回顾工厂参观 2022	13:20 – 13:45
4	Fields of action for HK mold and die industry 香港模具行业的评估报告	13:45 – 14:45
5	Q&A and final discussion 问答和最后讨论	14:45 – 15:00

Roadmap for continuous improvement: After achieving progress in the last two years, four main fields of action can be identified for the Hong Kong mold and die industry
持续改进路线图：在过去两年取得进展后，香港模具行业可以确定四个主要行动领域



By addressing these fields of action, especially transparency and in the end efficiency and quality can be improved – through the realization of sustainable tool manufacturing the Hong Kong mold and die industry can respond early to one of the next global mega trends and the following customer requirements

通过解决这些行动措施，尤其是提高透明度，最终可以提高效率和质量 — 通过实现可持续的模具制造，香港模具行业可以及早响应下一个全球大趋势之一和跟进客户要求

Field of action 1:
Industry 4.0 & Shopfloor Management
行动领域 1：工业 4.0 和车间管理

Identified Potentials (extract):
改善空间（摘录）：

- Lack of transparency regarding current order progress for employees
  员工对当前订单进度缺乏透明度
- Lack of data visualization on the shopfloor
  车间缺乏数据可视化
- Only minor recording and analysis of shopfloor data
  仅对车间数据进行少量记录和分析
- Improvable usage of Industry 4.0 application
  工业 4.0 应用程序的改进使用

Benefits:
好处：

- ✓ Value creation by learning from data and identifying potentials for optimization
  通过从数据中学习和识别优化空间，并创造价值
- ✓ Increased transparency and responsiveness
  提高透明度和响应能力
- ✓ Reduced potential for errors resulting in an overall improved quality
  减少错误的可能性，从而提高整体质量

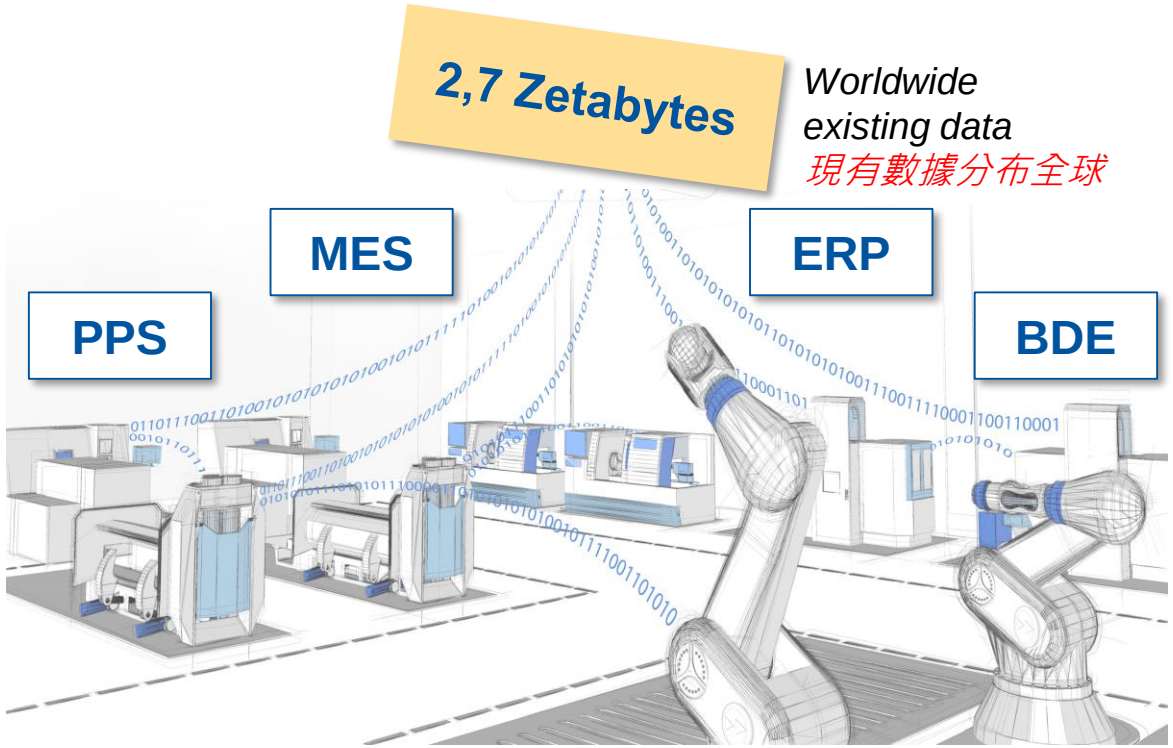
By addressing the field of action Industry 4.0 & Shopfloor Management, the overall transparency and productivity can be improved and tool shops are enabled to achieve higher qualities, process reliability and responsiveness
通过解决工业 4.0 和车间管理行动领域，可以提高整体透明度和生产力，并使模具车间能够实现更高的质量、流程可靠性和响应能力

Industry 4.0 and the increasing availability of data from the production process offer huge potential to address both challenges

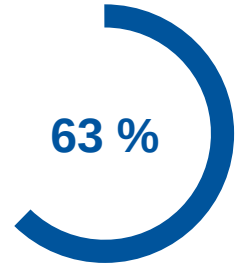
工业 4.0 和生产过程中数据可用性的增加为应对这两个挑战提供了巨大的潜在帮助

Definition 定义

*Real-time, intelligent, horizontal and vertical **networking** of **people**, **machines**, **objects** and **ICT** systems for **dynamic control** of **complex systems** 人、**機器**、**物件**和**ICT系統**的實時、智能、水平和垂直**網絡**，用於**復雜系統**的動態控制*



Quelle: IDC (2017)



… evaluate the potential of Industry 4.0 in production as very high

… 评估工业 4.0 在生产中的作用

… expect a reduction of mistakes

… 期望减少错误

… expect an increase in productivity

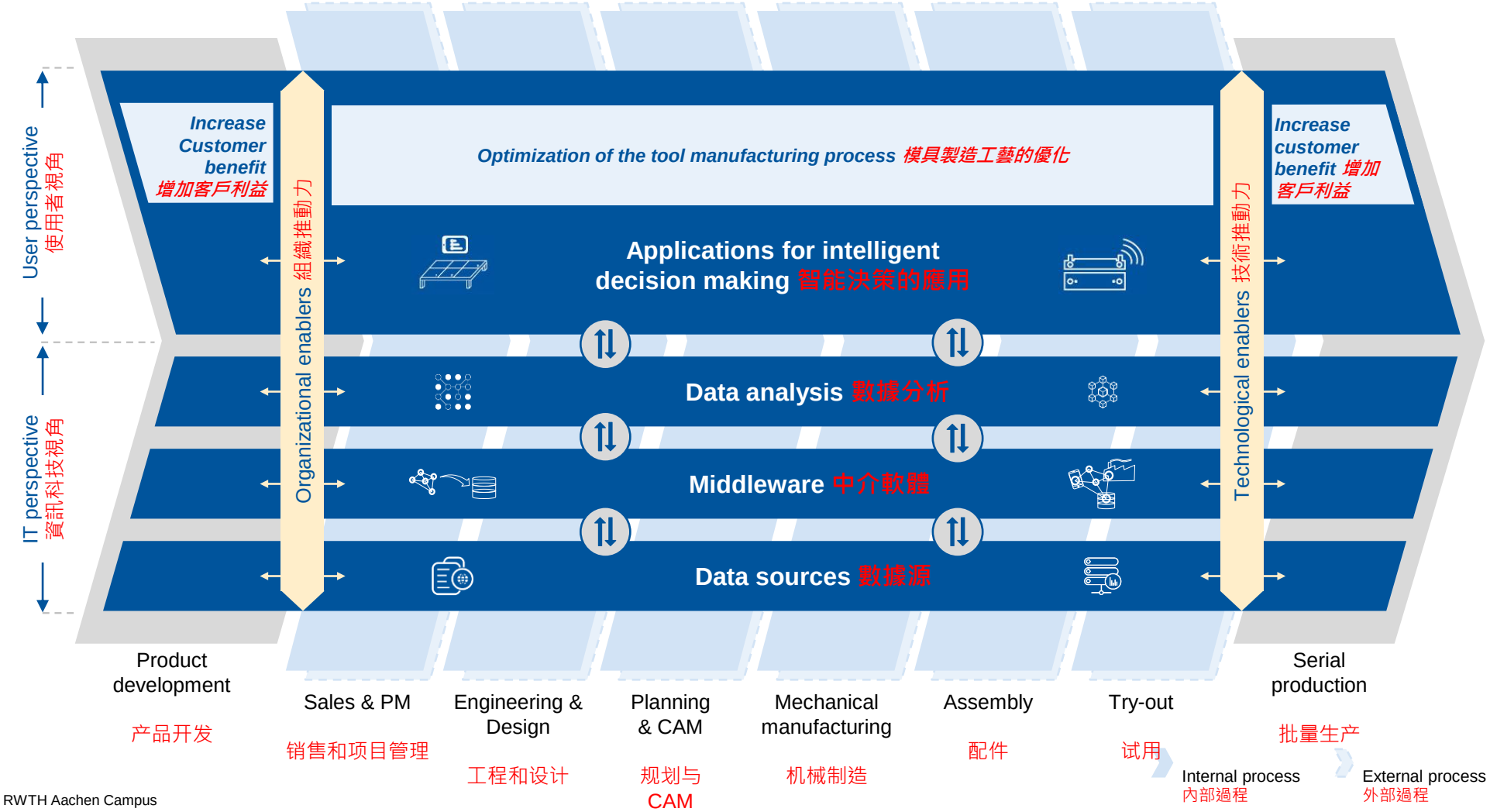
… 预计生产力会提高

… expect a reduction of lead times

… 预计交货时间会缩短

Tooling 4.0: Central elements for the holistic implementation of Industry 4.0 solutions in tool making

模具 4.0：在模具制造中整体实施工业 4.0 解决方案的核心要素



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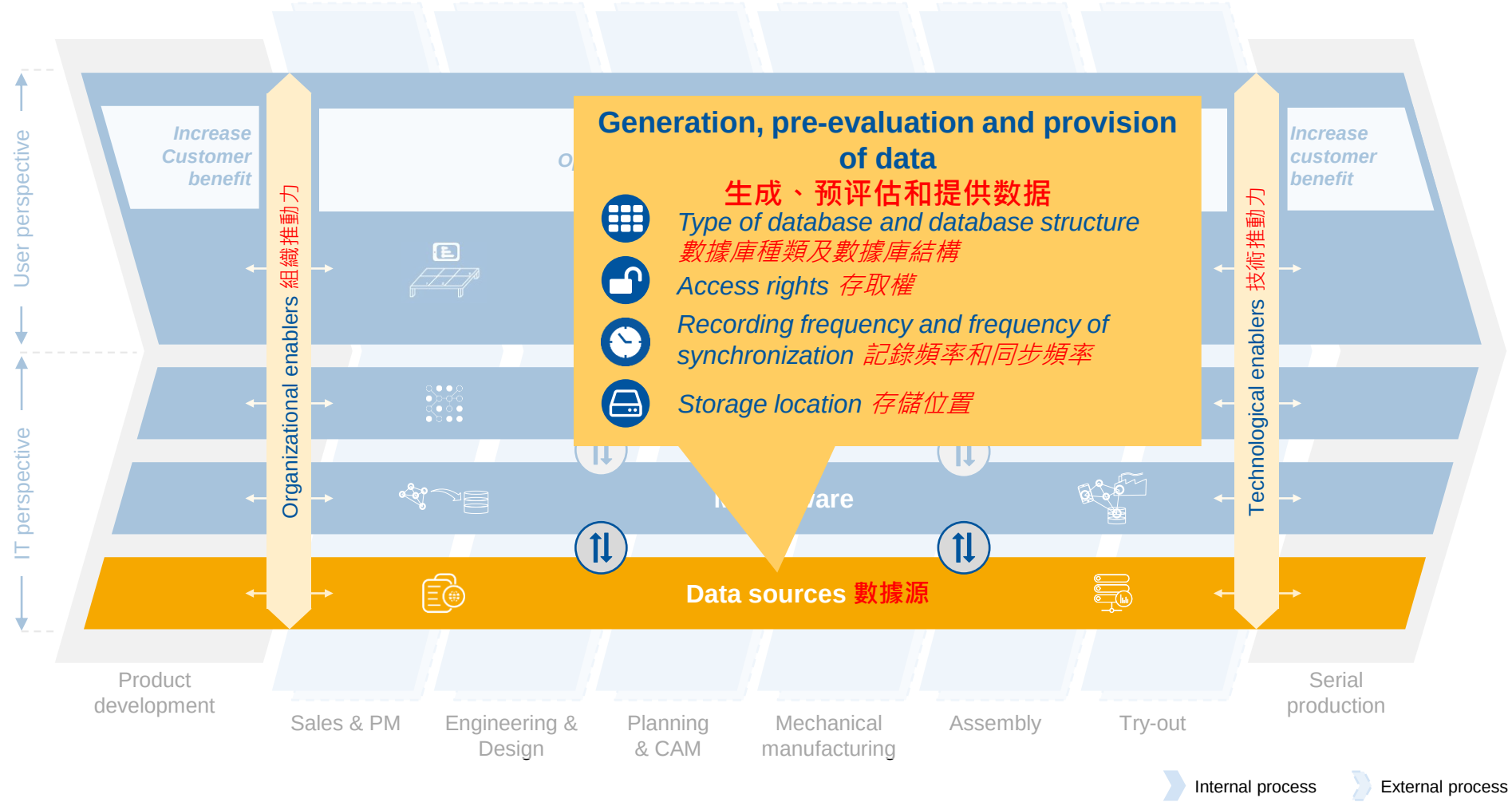

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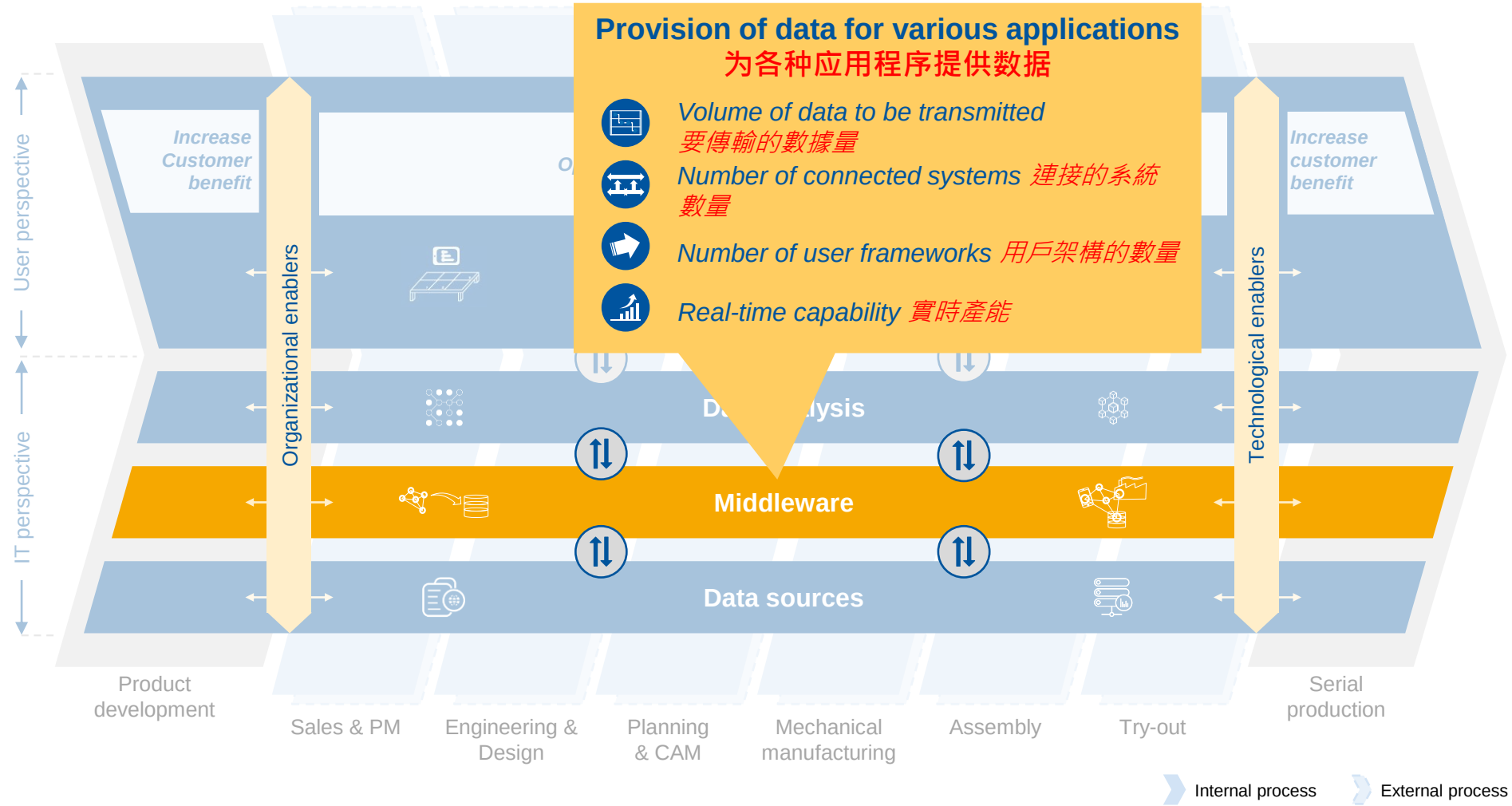

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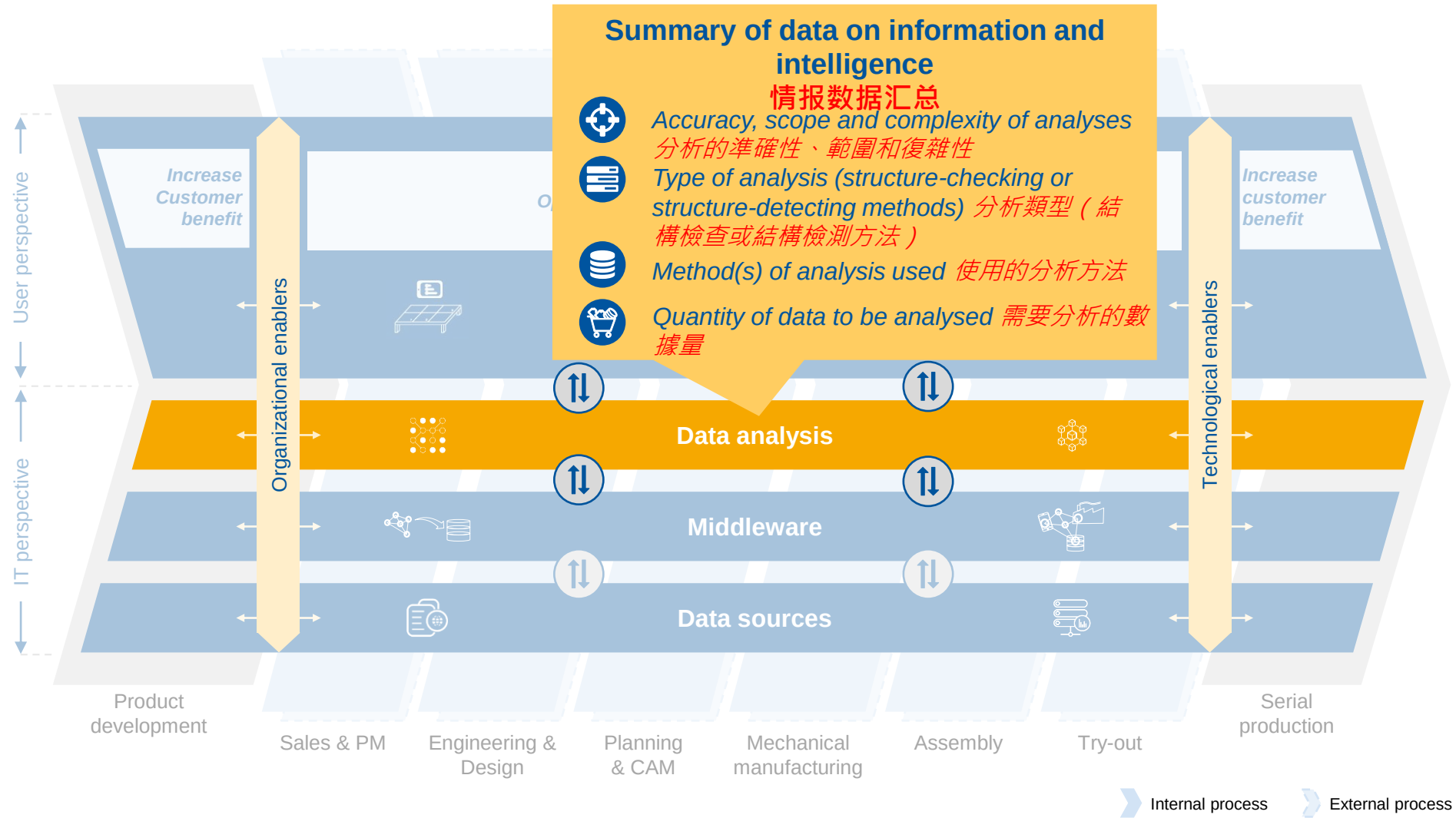
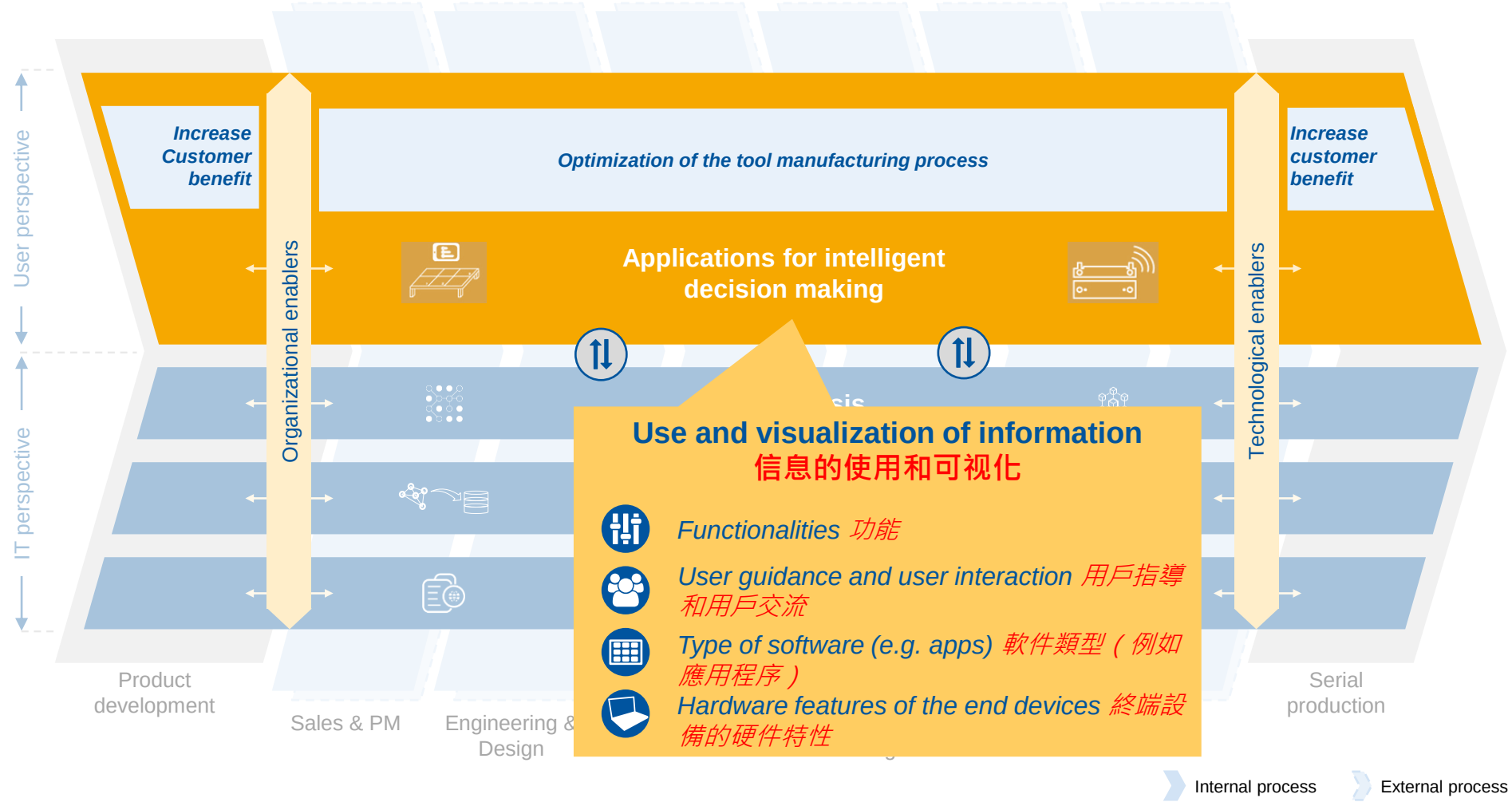


Tooling 4.0: Central elements for the holistic implementation of Industry 4.0 solutions in tool making

模具4.0：在模具制造中整体实施工业 4.0 解决方案的核心要素



Best Practice – Engineering:
Cost estimation based on a digital tool database
最佳实践 - 工程：基于数字化模具数据库的成本估算

Functional principle 功能原理

- Digital recording of tool projects within a central database
- 中央数据库中模具项目的数字记录
- Storing of component, tool and process data
- 存储组件、模具和过程数据
- Comparison of new customer components with components of previous tool projects based on similarity values of the component and the associated tool
- 基于组件和相关模具的相似性值，将新客户组件与先前模具项目的组件进行比较

Benefits 好处

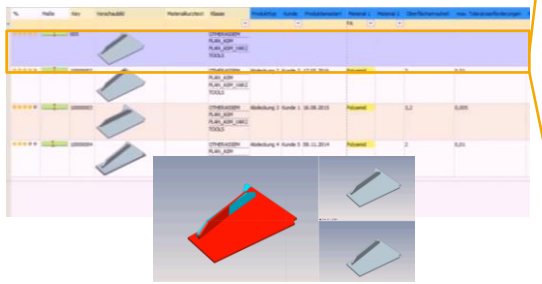
- ✓ Rapid identification of previous tool projects with similar tool concepts
- ✓ 快速识别具有相似模具概念的先前模具项目
- ✓ Rapid and robust costing based on actual costs of similar tool projects
- ✓ 基于类似模具项目的实际成本的快速而稳健的成本核算
- ✓ Recourse to existing tool concepts/designs and lessons learned
- ✓ 求助于积累现有的模具概念/设计和经验

simus systems

WBA WERKZEUGBAU AKADEMIE

Customer component 客戶組件

Comparison 比較



Product data 產品數據

- *product type 產品種類*
- *material 1, material 2, …材料1, 材料2*
- *surface roughness表面粗糙度*
- *max. tolerance specification 最大公差規格*
- *dimensions 尺寸*
- *…*

Corresponding tool data 相對的模具數據

- *tool type 模具種類*
- *material 材料*
- *Hardness 硬度*
- *Dimensions 尺寸*
- *number of cavities 腔的數目*
- *required hours, costs 所需時間、費用*
- *sensor technology 傳感器技術*
- *…*

Digital networking at the beginning of value creation process allows to improve the quality of cost accounting and development while reducing the required working hours

价值创造过程开始时的数字网络可以提高成本计算的质量和开发，同时减少所需的工作时间

Implementation costs Time savings

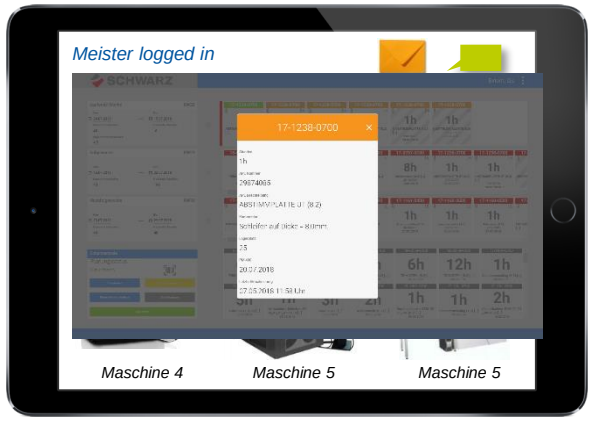
Best Practice – Planning and mechanical manufacturing: Digital prioritization board for sequence planning
最佳实践 - 规划和机械制造：用于序列规划的数字化优先级看板

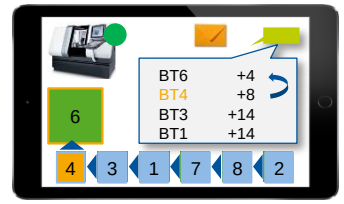
Functional principle 功能原理

- More transparent planning and control of orders 更透明的規劃及控制訂單
- Part placement on the interactive control table and loading into the ERP system by the machine operator 在交互式控制台上放置零件並由機器操作員加載到 ERP 系統中
- Overview of the machining sequences for the employee at his machine and for each machine for the central planner 概觀員工在其機器上的加工順序和中央規劃器的每台機器的加工順序
- Display of the effects of rescheduling and re-prioritization by the central planner 顯示中央計劃器重新安排和重新確定優先級的效果

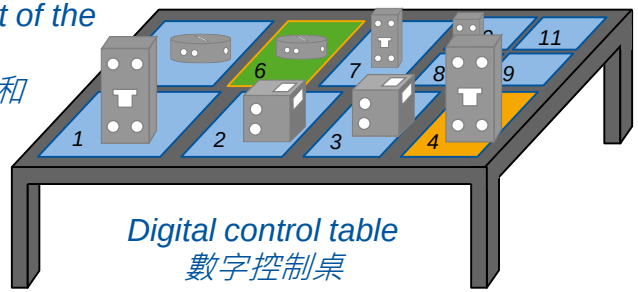
Benefits 好处

- ✓ More efficient interaction and communication between employees and managers to prioritize orders in real time
- ✓ 员工和经理之间更有效的互动和沟通，以实时确定订单的优先级





Planning & control tablet of the central planner
中央規劃器的規劃和平板電腦控制



Digital control table
數字控制桌

The simple and transparent display of order sequences and potential changes due to sequence shifts makes planning on the shop floor considerably more convenient.
订单顺序的简单透明显示以及顺序变化导致的潜在变化使车间规划更加方便。

Source: WBA

€ Implementation costs

Time savings

Best Practice – Digital Try-out process:
Digital support of the try-out process through mobile applications
最佳实践 – 数字化试模流程：通过移动应用程序为试模流程提供数字化支持

Digital support of the try-out process试模过程的数字化支持

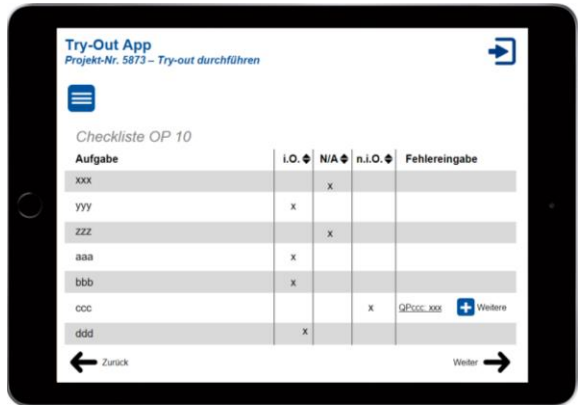
Engineering 工程 | Manufacturing 製造 | Assembly 裝配 | Try-out 試模

WBA WERKZEUGBAU AKADEMIE

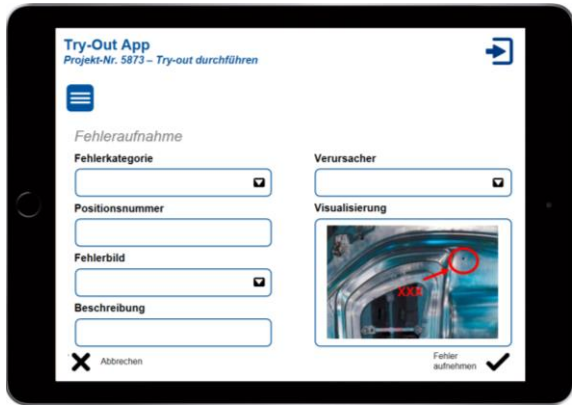
Open try-out project 開啟試模項目 → Add try-out iteration 添加反覆試模 → Go through checklist 檢查清單 → Document deviations 文件偏差 → Return knowledge 知識返回

Define measures 定義方法 → Track measures 追蹤方法

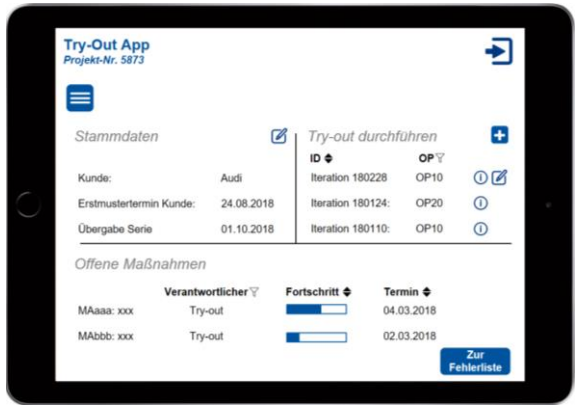
Go through checklist 浏览清单



Document deviations记录变化



Track measures 跟踪措施



In order to support the try-out process digitally, an app was developed together with a research consortium
为了以数字方式支持试用过程，与研究联盟共同开发了一款应用程序

Source: WBA

Field of action 2: Automation
改善措施 2：自动化

Identified Potentials (extract):
改善空间（摘要）

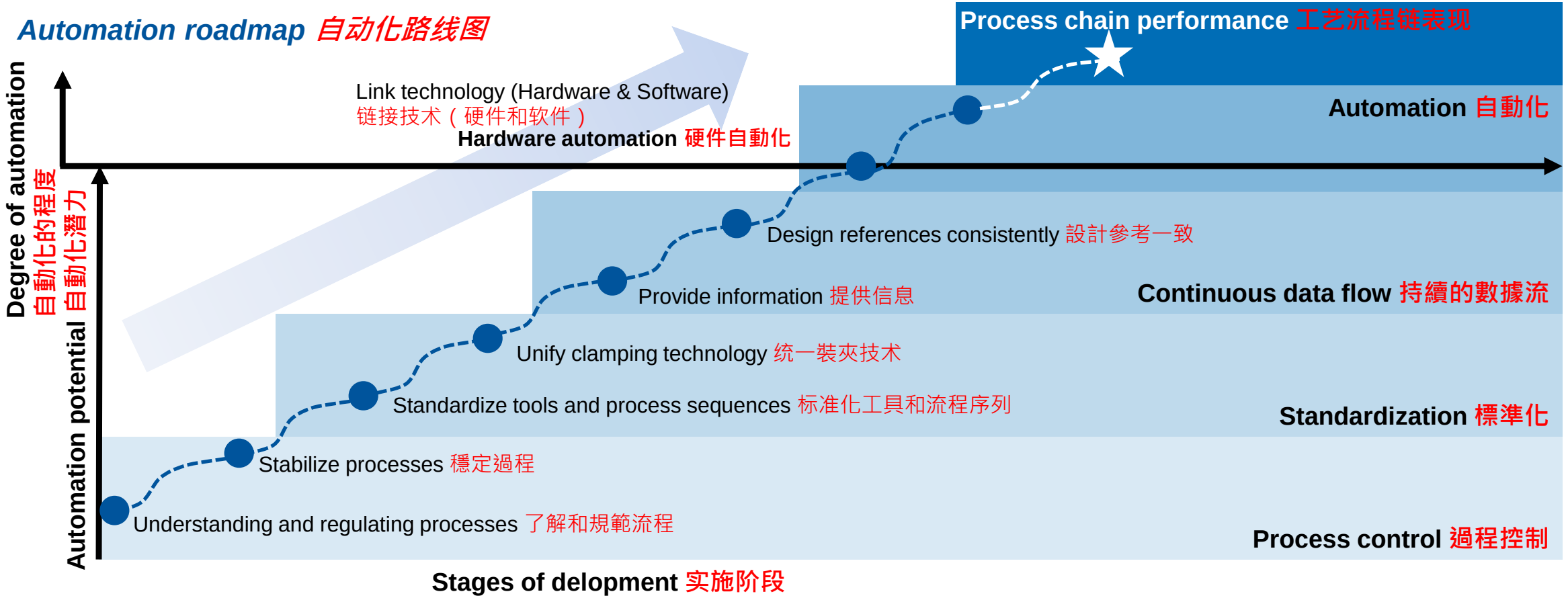
- High number of employees and working hours
  大量员工和工作时间
- Low level of automation in all technologies
  所有技术的自动化程度低
- No standardized and continuous workpiece clamping system
  无标准化连续工件装夹系统

Benefits:

- ✓ Usage of manless manufacturing times
  使用无人作业的制造时间
- ✓ Increase of machine runtimes
  机器运行时间增加
- ✓ Reducing set-up times and increasing productivity
  减少设置时间并提高生产力

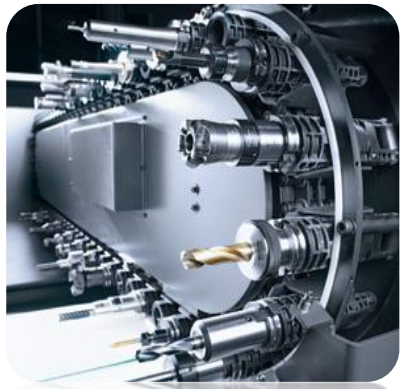
By addressing the field of action automation, cost savings can be achieved by reducing personal
通过解决行动自动化领域，减少人员来节省成本

Automation in toolmaking:
A holistic view
模具制造中的自动化：整体观点



Targeted measures can systematically increase the automation potential to achieve process chain performance!
有针对性的措施可以系统地提高自动化能力，以实现流程链绩效！

Automation:
Different level of automation
自动化：不同程度的自动化



Tool Changer
刀具更换器

Zero point clamping system
零点夹紧系统

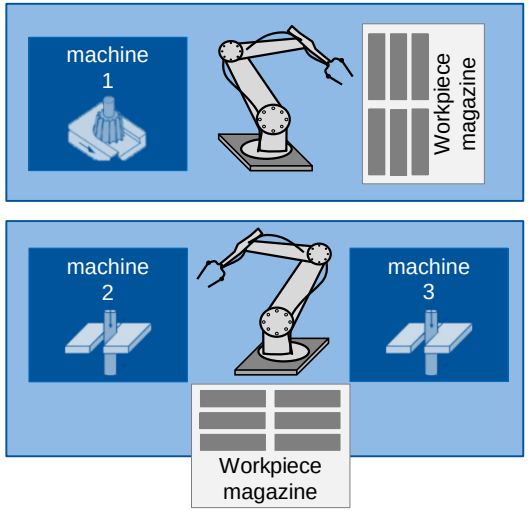
Work Piece Changing system
工件更换系统

Handling Systems
处理系统

Sources: Kuka; system3R; zerspanungstechnik.at; maschinewerkzeug.de

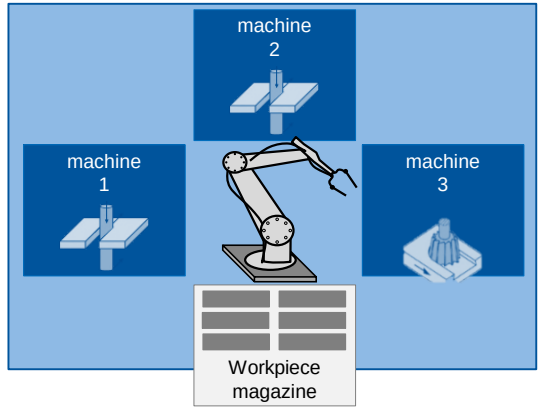
Interlinking types: System overview
互连类型：系统概述

One/two machine automation
一/二台设备自动化



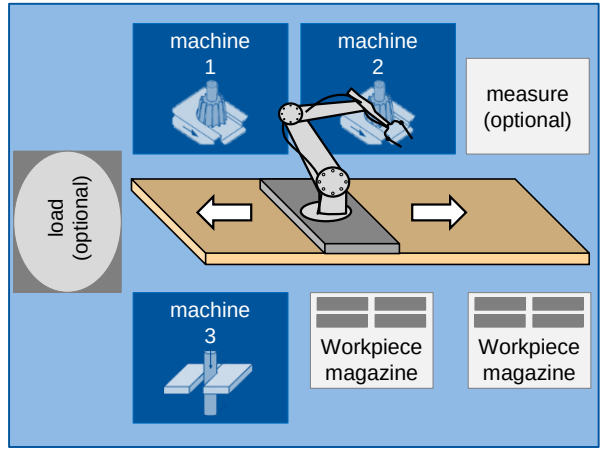
- Low investment volume 低投資額
- Entry-level solution for automation 入門級自動化解決方案
- Low degree of automation 自動化的程度低
- Measurement still manual 仍使用手動測量

Flexible manufacturing cells
柔性制造单元



- Extensibility is given 給予可擴充性
- High productivity 生產力高
- Risk of complete failure due to strong coupling 因為強耦合導致完全失效的風險
- Continue measuring manually 繼續手動測量

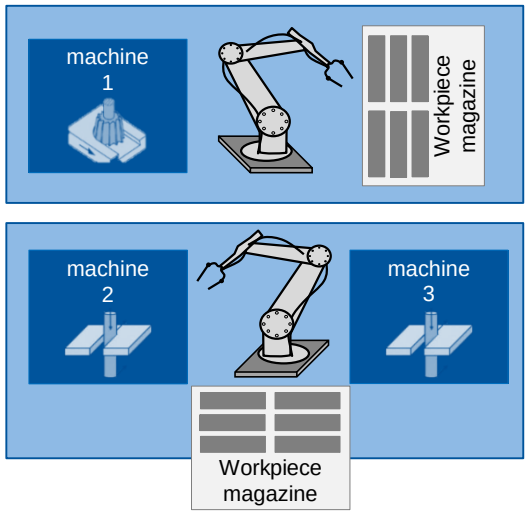
Linear handling system
直线搬运系统



- High degree of automation 自動化程度高
- Very high productivity 生產力非常高
- Very high investment volume 投資額非常高
- High space requirement 空間要求高

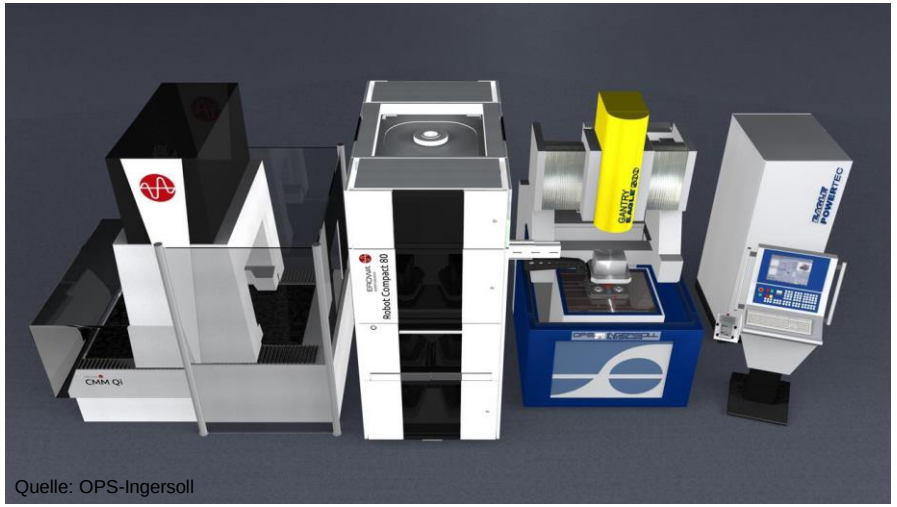
Interlinking types: one/two machine automatics
互连类型：一/二台设备自动

One/two machine automation
一/二台设备自动化



- Low investment volume 低投資額
- Entry-level solution for automation 入門級自動化解決方案
- Low degree of automation 自動化程度低
- Measurement still manual 測量仍然是手動的


Quelle: EROWA

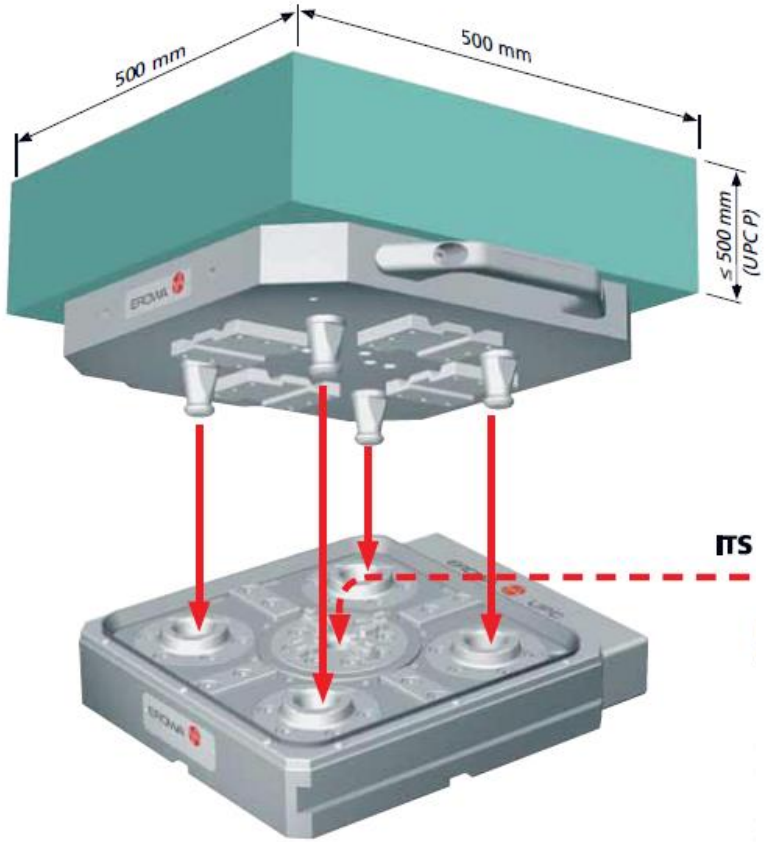

Quelle: OPS-Ingersoll

Automation potential by standardization: Work piece palettizing
标准化带来的自动化提升潜力：工件码垛

Erowa UPC

Performance data 性能数据

Palett size [mm]< 码垛尺寸 [毫米]	320 / 320 / 40
System height (chuck and pallett) [mm] 系統高度 (卡盤和码垛) [毫米]	105
Clamping chuck dimensions [mm] 夾頭/盤尺寸 [毫米]	280 / 280
Maximium work piece size [mm] 最大工件尺寸 [毫米]	500 / 500 / 350
Repreating accuracy for centering [µm] 對中精度的折射準確度 [微米]	2
Required air pressure [bar] 所需氣壓 [巴]	min 6
Pallett type 码垛種類	4 x 90°
Identification 識別	Chip



EROWA® system solutions

Source: EROWA System Technologien GmbH

Best practice - automation cell:
Continuous and process-mixed automation cell
最佳实践 - 自动化单元：连续和过程混合的自动化单元

Targets 目标

- Analysis of the order fulfillment process, the status quo analysis of the automation requirements.订单履行流程分析，自动化需求现状分析。
- Enabling the machine for autonomous production 使机器实现自动生产
- Reduction of idle time and individual process steps 减少空闲时间和单个流程步骤
- Increasing the responsiveness of the production 提高生产的响应能力
- Increase of the ergonomics of the employee 提高员工的工作环境
- Generation, provision and use of relevant knowledge 相关知识的产生、提供和使用
- Machine and peripheral components:机器及周边部件

- 1x vertical eroding machine 1x 垂直燒蝕機
- 1x 3-axis HSC milling machine 1x 3軸HSC銑床
- 1x 5-axis milling machine 1x 5軸銑床
- 1x measuring machine 1x 測量儀
- 1x electrode washing machine 1x 電極清洗機
- 1x cleaning cell 1x 清洗單元
- 1x loading station for UPC pallets 1x UPC托盤裝載站
- 1x magazine loading identification system 1x 倉庫加載識別
- 3x tool magazines 3x 模具倉庫

Linked process steps:关联流程步骤：

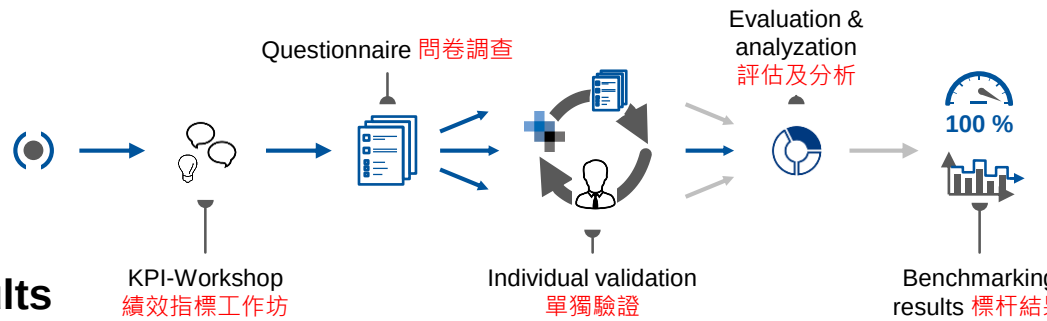
- Milling 铣削
- Electrode milling 电极铣削
- Die sinking 模具下沉
- Cleaning 打扫
- Measuring 测量

Quelle: Phoenix Contact

WBA Consortium Project: Best of Benchmark - Automation and Machine Interlinking in Toolmaking
WBA 联盟项目：最佳基准 – 模具制造中的自动化和机器互连

Approach 方法

- Workshop for the development of key figures and evaluation criteria制定開發關鍵數字和評估準則的工場
- Systematic documentation of the characteristics and specifications of the automation solution 系統化紀錄自動化方案的特性和規格
- Modular evaluation of the categories processes, resources, network模組化評估類別的流程、資源、網路等
- Identification of company-specific development potentials 識別公司特定的開發潛力
- Evaluation and creation of the benchmarking report 評估和創建標杆報告



Scope 范围

8 *Analyzed automation approaches 分析自動化方法*

Evaluation levels:
- Resources 資源
- Process 過程
- Network 網絡

Interlinking types 互连类型

5 Single machine automation 單一機械自動化

2 Interlinked manu-facturing systems 互聯製造系統

1 Detailed automation concept 詳細自動化概念

System components 系统元素

12 *Machining centers 加工中心*

4 *Handling systems 抓取系統*

4 *Manufacturing technologies 製造技術*

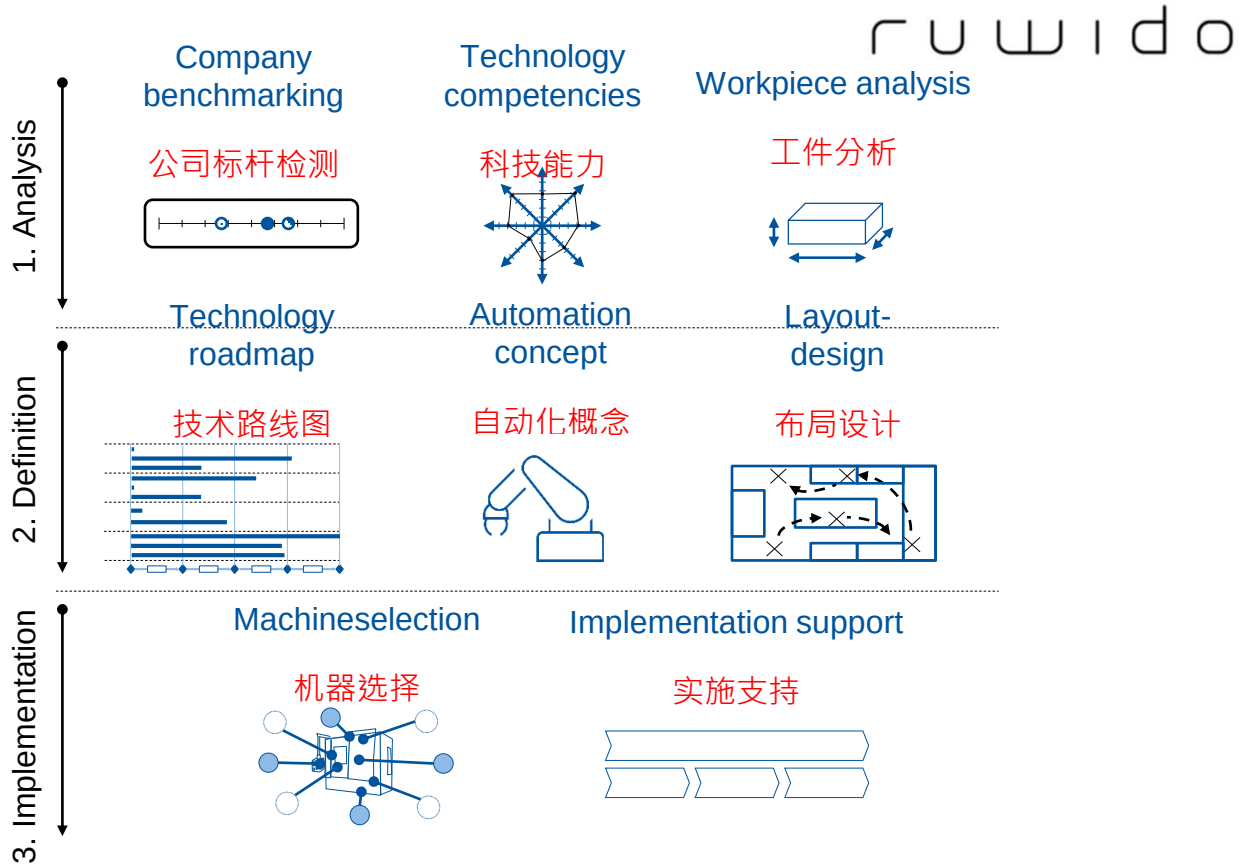
Results

- ► **Comparability of automation solutions through evaluation of the individual system components 通过评估各个系统组件实现自动化解决方案的可比性**
- ► **Derivation of individual need for action for further technological development 推导个人对进一步技术发展的行动需求**

Automation and layout design for the implementation of modern manufacturing at ruwido austria gmbh
ruwido austria gmbh 公司实施现代制造的自动化和布局设计

Procedure 流程

- Identification of the current technological performance of the tool shop through benchmarking and workpiece analysis 通過標杆
檢測和工件分析確定模具車間的當前技術性能
- Derivation of requirements from the corporate strategy for the manufacturing technology of the internal tool shop 從內部模具車間製造技術的企業戰略中得出需求
- Definition and elaboration of three recommendations for action: 定義及擬定三項建議的行動：
  - Technology roadmap 技術路線圖
  - Automation concept 自動化概念
  - Layout design (in a new building) 布局設計 (在新大樓內)
- Support of the operational implementation 業務執行支援



Result 结果

- **Technology roadmap and automation concept based on the product range and strategic goals**
- **基于产品范围和战略目标的技术路线图和自动化概念**
- **Layout concept for new production building and support in machine selection 新生产大楼的布局概念和为选择机器支持**

Field of action 3:
CAx-Process Chain
改进措施3：CAx-工艺流程链

Identified Potentials (extract):
提升空间（摘要）

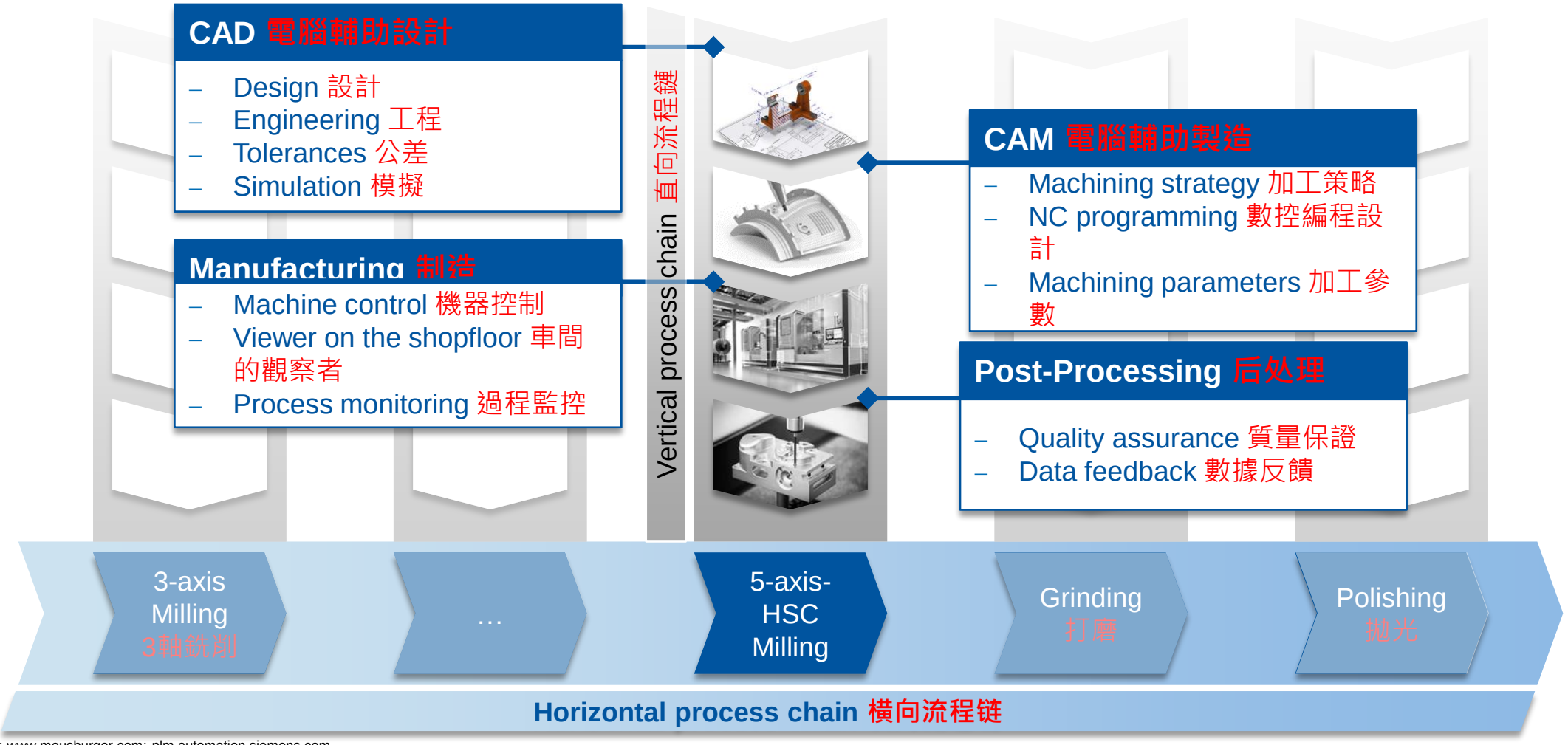
- Improvable design of the CAx process chain as basis for automation
  作为自动化基础的 CAx 流程链的改进设计
- Low percentage of standards used such as color codes for tolerances and manufacturing technologies
  使用的标准比例低，例如公差和制造技术的颜色代码
- No optimal programming strategy on the whole shopfloor
  整个车间没有最优的编程策略

Benefits:

- ✓ increase productivity in design and CAM programming
  提高设计和 CAM 编程的生产力
- ✓ Reduction of rework due to quality losses
  减少因质量损失而导致的返工
- ✓ Implementation of paperless manufacturing
  实施无纸化制造

By addressing the field of action Cax-process chain, cost savings can be achieved by increasing productivity and quality
通过改进措施Cax 流程链，可以通过提高生产力和质量来节省成本

Horizontal and vertical process chain:
CAx process steps provide the prerequisite for machining
水平和垂直工艺流程链：CAx 工艺步骤为加工提供了先决条件

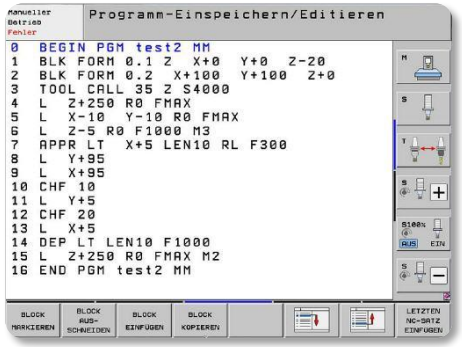


Sources: www.meusburger.com; plm.automation.siemens.com

Theory: 理论：
Overview of programming strategies 编程策略概述

Online programming on stationary/running machine 停止/运行上的在线编程

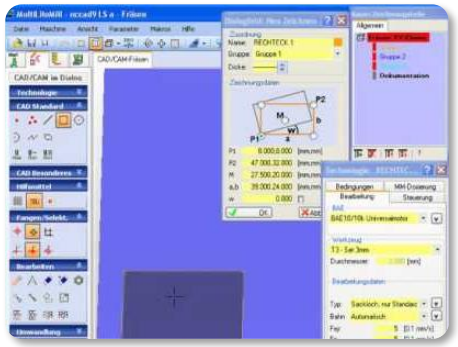
+ Low investment volume 低投資額
– High downtimes during programming on a standstill machine 在停止機器上進行設計編程期間的停機時間長
– Extensive knowledge of NC programming required 需要廣大的數控編程設計知識
– Very time-consuming due to the individual definition of tool movements 由於需單獨定義刀具的運行，非常耗時



Productivity 生产效率:

Shopfloor-oriented programming (SOP) 车间为主的编程 (SOP)

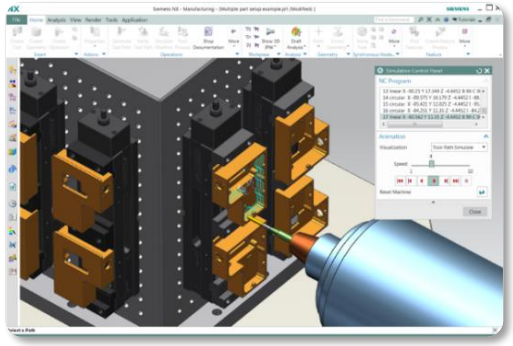
+ Robust against erroneous entries due to parameter queries during programming 對因為編程期間的參數詢問引致的錯誤輸入很耐用
+ Little programming knowledge required due to graphical user interface 由於有些圖像化的用戶介面，需要一些編程知識
– Less customizable due to predefined masks and fixed parameters 因為有些預定義的掩碼和固定參數，可自定義性較低



Productivity 生产效率:

Central CAM programming 中央 CAM 编程

+ High degree of automation possible 可實現高度自動化
+ No loss of time when transferring the NC code to the machine 將NC代碼傳輸到機器時沒有損失時間
– Extensive CAx environment required 需要廣泛的 CAx 環境

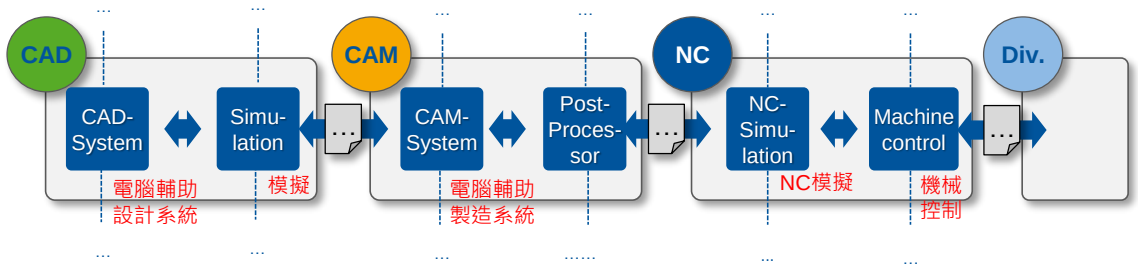


Productivity 生产效率:

Analysis phase: 分析阶段：
Recording the CAx process chain 记录 CAx 流程链

Status quo analysis 现状分析

- Workshop: Recording of the used individual programming strategies and processes during NC programming
- 车间：在数控编程过程中使用的记录单个编程策略和过程
- Recording of the weak points of the CAx process chain with regard to NC programming
- 记录 CAx 过程链在数控编程方面的薄弱环节



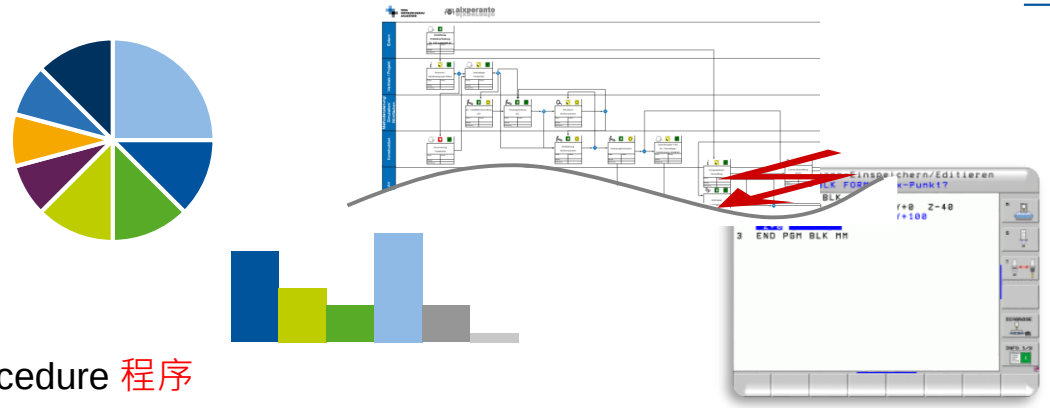
Control type ***Active surface construction***
Tolerances *in the process chain* ***Planning systems***
Information loss
Component tracking *Data availability* *Data conversion*
Post-processor deviation
System breaks *Standardization* ***Responsibilities***
Manufacturing Systems *Manufacturing networking*
Data handling ***Deviations*** *uniform interfaces*

During a kick-off, the status quo is comprehensively recorded and serves as a basis for the further design of the programming strategy
在开始的时候，现状被全面记录，并作为进一步设计编程策略的基础

Design phase: 設計階段
Generation of possible programming strategies 產生可行的編程設計策略

Generation 產生

- Presentation of possible variants for changing the NC programming and a uniform programming strategy 介紹用於更改 NC 編程設計的可行變量和統一的編程設計策略
- Benefit and cost analysis of the alternatives 替代方案的收益和成本分析
- Workshop: Definition of a programming strategy tailored to Conventos Ferramentaria 工作坊：為Conventos Ferramentaria定製的程式設計策略定義



Procedure 程序

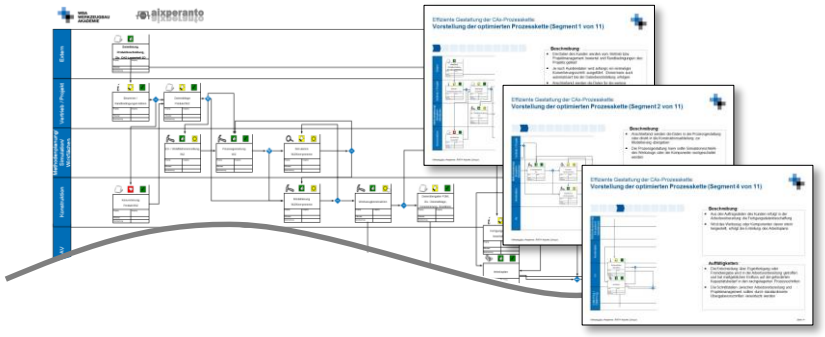
- Recording of NC programming strategies 記錄 NC 編程設計策略
- Analysis of weak points in CAx process chain concerning NC programming strategies 在CAx 工藝鏈中分析關於數控程式設計策略的弱點
- Development of alternative programming strategies for critical machines 為關鍵機器開發替代編程設計策略
- Discussion of the alternative programming strategies 討論備選編程戰略

Development and design of new programming strategies taking into account company-specific constraints 開發和設計新的程式設計策略，同時考慮到公司特定的限制

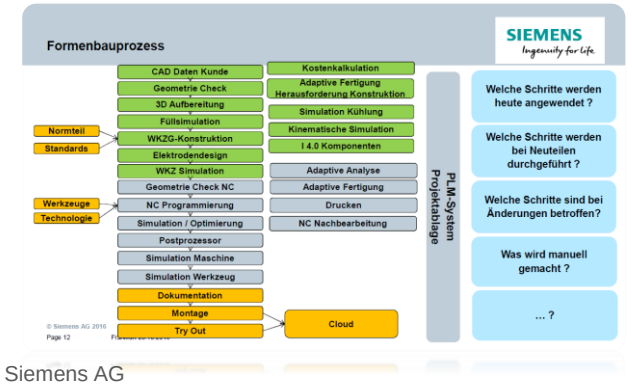
WBA Project "Efficient Design of the CAx Process Chain at WZB": Result Highlights - Ideal CAx Process Chain

WBA项目“WZB CAx流程链的高效设计”：成果亮点——理想的CAx流程链

Development Ideal CAx process chain
开发理想 CAx 流程链



Viewpoint of a CAx system provider
CAx 系统提供商的观点



Quelle: Siemens AG

Key Facts: Optimization result
关键事实：优化结果

8	5	15
Eliminated iteration cycles 消除反覆運算週期	Eliminated conversion steps消除了轉換步驟	Optimized operations 優化了操作

Key Facts: Discussion with system provider
關鍵事實：與系統供應商的討論

- **Software interfaces** currently represent one of the biggest problems along the process chain
  軟體介面目前是流程鏈中最大的問題之一
- **Cross-vendor interface** optimization is not the focus of the system providers‘ developments **跨廠商介面優化**不是系統廠商發展的重點
- **Clear responsibilities** are the basis for successful processes and process chains **明確的責任**是成功流程和流程鏈的基礎

The generic efficient Ideal CAx process chain developed in the consortium makes improvement potentials visible and serves as a guideline for company-specific process chain optimization.

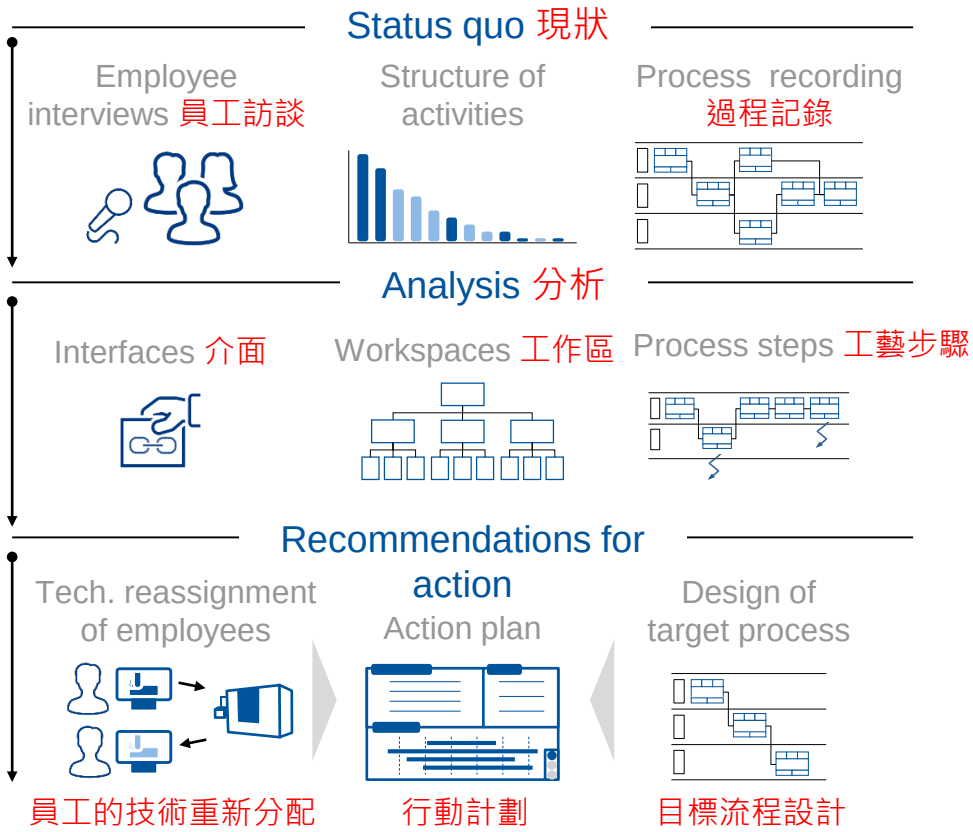
该联盟开发的通用高效 Ideal CAx 流程链使发现潜在改善空间，并可作为公司特定流程链优化的指南。

Reference project – CAx process chain:
CAx process and interface optimization in mechanical manufacturing
参考项目——CAx 工艺流程链：加工制造中的 CAx 流程和界面优化

SIEBENWURST
MODELLBAU & FORMENBAU

Approach 方法

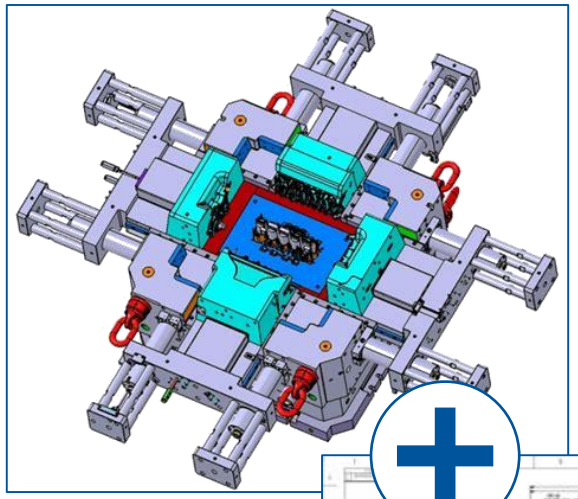
- Detailed analysis of the status quo with qualitative and quantitative methods: 使用定性和定量方法對現狀進行詳細分析：
  - Process recording with modeling language "aixperanto" 使用建模語言「aixperanto」進行過程記錄
  - Interviews to collect individual employee perspectives with a focus on CAx system usage 進行訪談以收集員工的個人觀點，重點關注CAx 系統的使用
  - Recording of the activity structure in a defined period of time 在定義的時間段內記錄活動結構
- Identification of improvement potentials based on technical requirements in individual process steps and at department interfaces 根據各個流程步驟和部門介面中的技術要求確定潛力改進
- Derivation of recommendations for action for example: 推導行動的建議示例：
  - Technical reassignment of employees 員工的技術重新分配
  - Derivation of a target process chain 衍生目標流程鏈
  - Defined and detailled action plan 明確和詳細的行動計劃
- Documentation in a roadmap to define responsibilities and scheduling 路線圖中的文檔，用於定義職責和排程安排

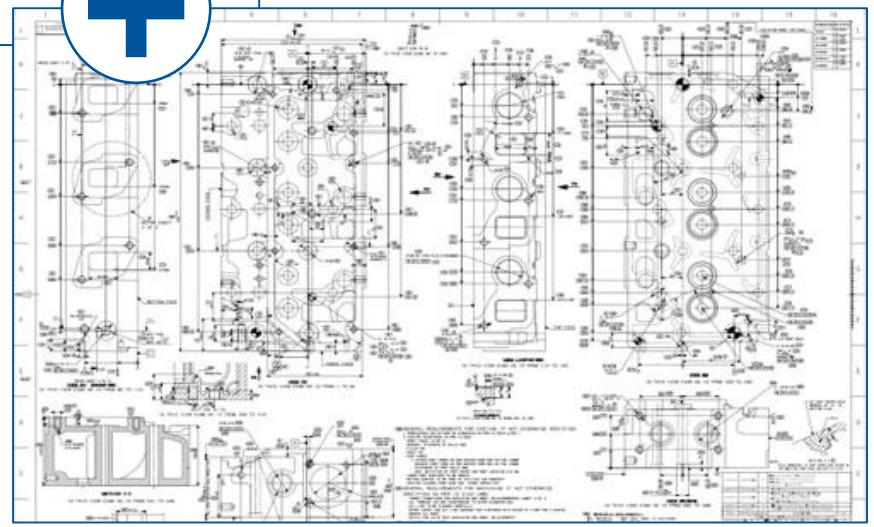


Results 结果

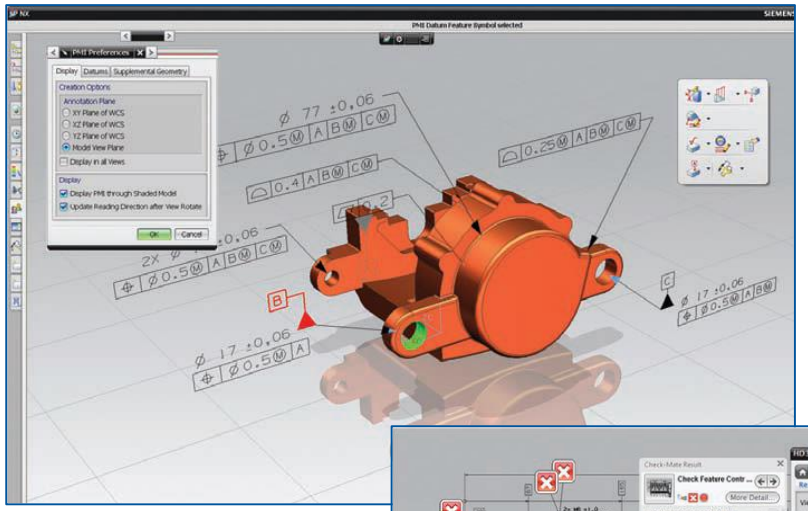
- ► **Recommendations for action to improve processes and interfaces in mechanical manufacturing** 改进机械制造过程和界面的行动建议
- ► **Roadmap with recommendations for action and assigned responsibilities and scheduling** 路线图，包含行动建议、分配的职责和时间安排

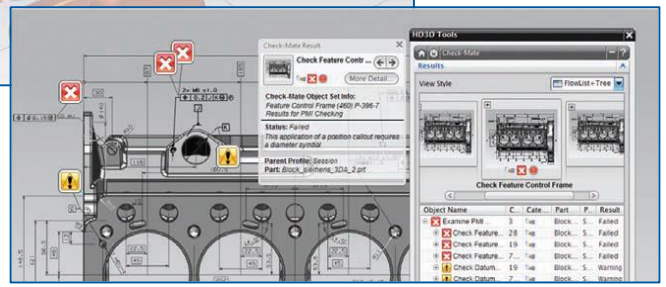
Best practice: Product manufacturing information
Metainformation for cross-process use
最佳实践：产品制造信息 元信息用于跨流程使用





- Dimensions 尺寸
- Dimensional tolerance 尺寸公差
- Shape and position tolerances 形狀和位置公差
- Surface details 表面細節
- Inspection gauges 檢測儀錶
- Machining zone 加工區





Design 設計 | Work Preparation 製備工作 | Manufacturing 製造

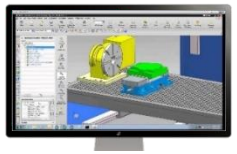
Simulation 模擬 | CAM 電腦輔助製造 | MRO

Quelle: Siemens Industry Software, Gießereilexikon; MRO: Maintainance, Repair, Overhaul

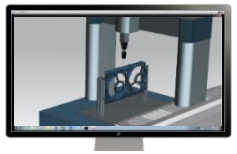
Product Manufacturing Information (PMI)
„Single Source of Truth“
产品制造信息 (PMI) “单一数据源”

Manufacturing 制造

Automated NC code generation & scrap reduction
自動NC代碼生成和廢料減少



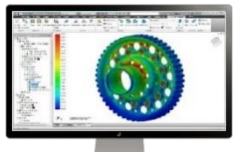
Quality 质量

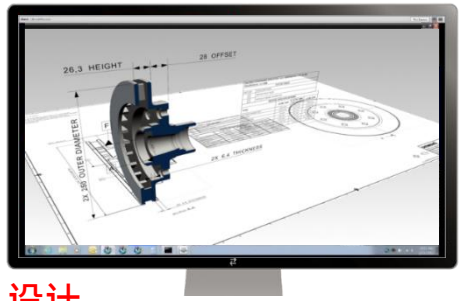


Automated CMM process through identification of features & tolerances **通過識別特徵和公差實現自動化 CMM 流程**

Analysis 分析

Verification of design, manufacturing and economic properties
驗證設計、製造和經濟特性



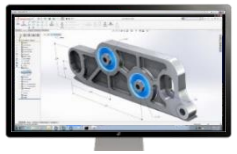


Technical Drawing 技术画图

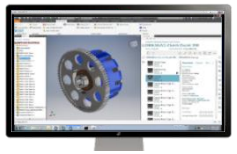
Automatic creation of 2D drawings from 3D PMI model
從 3D PMI 模型自動創建 2D 工程圖

Design 设计

Faster and more efficient design process and lower error rate
更快、更高效的設計流程和更低的錯誤率



Communication 交流



Simplified collaboration with internal and external suppliers
簡化與內部和外部供應商的協作

Digitally stored information (PMI) enables easy data access in numerous downstream processes and thus reuse throughout the entire product life cycle.

数字存储信息 (PMI) 可在众多下游流程中轻松访问数据，从而在整个产品生命周期中重复使用。

Quelle: Siemens, Engineers Rule

Field of action 4: Sustainability
改善空间 4：可持续性

Identified Potentials (extract):
改善空间（摘要）：

- Missing recording of CO_2-emissions per machine and order
  缺少每台机器和订单的二氧化碳排放记录
- Lack of transparency regarding overall energy consumption
  整体能源消耗缺乏透明度
- Lack of use of sustainability factors as a differentiating factor with customers
  缺乏将可持续性因素用作与客户的差异化因素

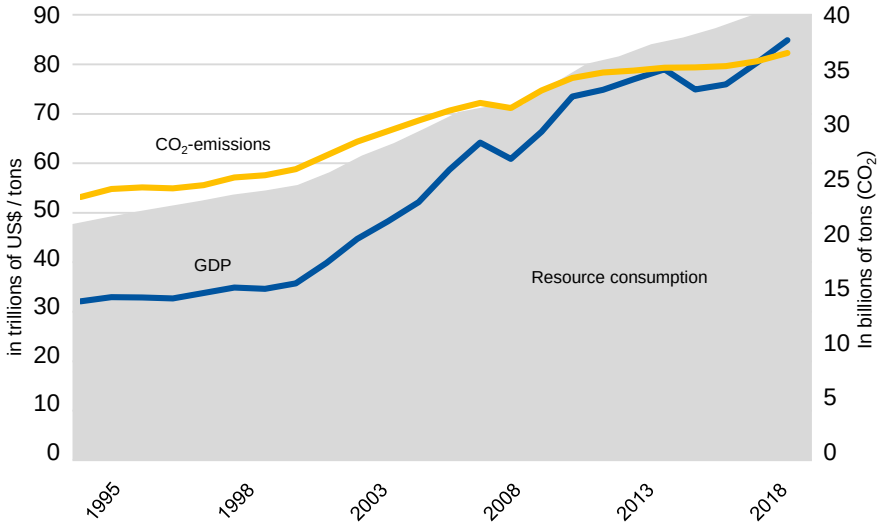
Benefits:

- ✓ Realization of cost-saving potential through more sustainable use of energy and resources
  通过更可持续地利用能源和资源实现成本节约潜力
- ✓ Realization of competitive advantages through “green” tool manufacturing
  通过“绿色”模具制造实现竞争优势
- ✓ Early response and alignment to one of the next global megatrends
  对下一个全球大趋势之一的早期响应和调整

By addressing the field of Sustainability, Hong Kong mold and die industry can respond early to the upcoming customer requirements in terms of sustainable tool manufacturing and realize both competitive advantages as well as cost saving potentials
通过解决可持续发展领域，香港模具行业可以及早响应客户在可持续模具制造方面的需求，并实现竞争优势和成本节约潜力

A global production turnaround is inevitable: The fundamental paradigm of production will change in the future resulting in higher
全球生产转型是不可避免的：未来生产的基本规则将发生变化

Economically sensible overproduction 经济上明显的生产过剩



Global comparison of GDP, CO_2 emissions and resource consumption
GDP、CO2排放量和資源消耗的全球比較

+40%

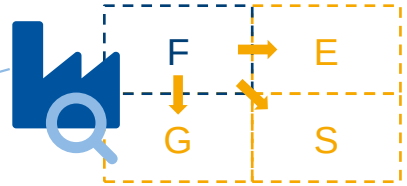
Material and energy requirements in the next 20 years
(referring to 2010)
未來20年的材料和能源需求
（指2010年）

Improvement by pursuing **cost optimization, time savings** and **quality enhancement**[3]
通过追求成本优化、节省时间和提高质量来改进

Fundamental change in the framework conditions 框架条件的根本的变化

Changing capital market and customer requirements

Society, Politics 社會，政治
Capital Market & Customers 資本市場與客戶



Changing capital market requirements and customer demands make the added value of sustainability measurable **不斷變化的資本市場要求和客戶需求使可持續性的附加值可量度**

Definition FESG

Finance 金融: *Productivity as the ratio of financial result to financial expense* ***使用生產率作為財務結果與財務費用的比率***

Environment 環境: *Use of natural resources, energy efficiency and emissions* ***自然資源的使用、能源效率和排放***

Social 社會: *Respect for human rights, promotion of diversity and social responsibility for own products* ***尊重人權，促進多樣性和對自身產品的社會責任***

Governance 管理方法: *Regulatory structures, management systems, transparency, regulations and barriers to innovation* ***監管結構、管理體系、透明度、法規和創新的障礙***

Sales revenue
銷售收入

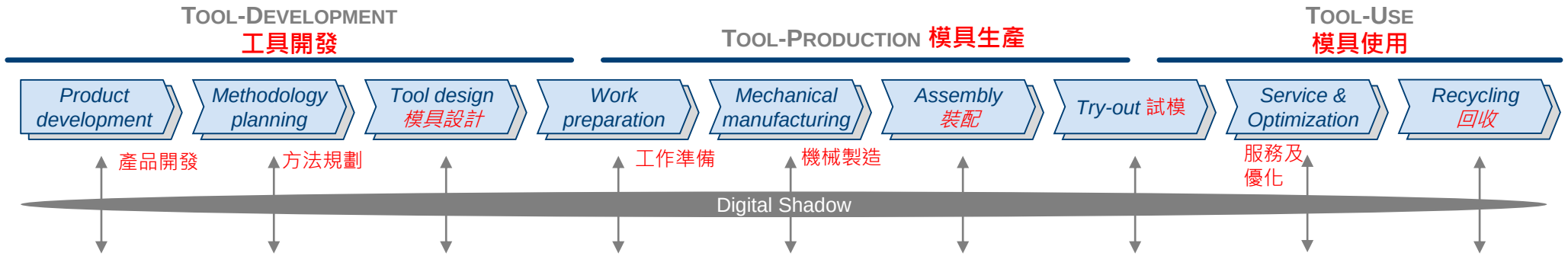
Emission load
排放負荷

Gender equity
性別平等

Innovation capability
創新能力

The regulatory framework “Sustainable Tool Production” describes the differentiation factors in the production turnaround for tool making

“可持续模具生产”监管框架描述了模具制造生产周转的差异化因素

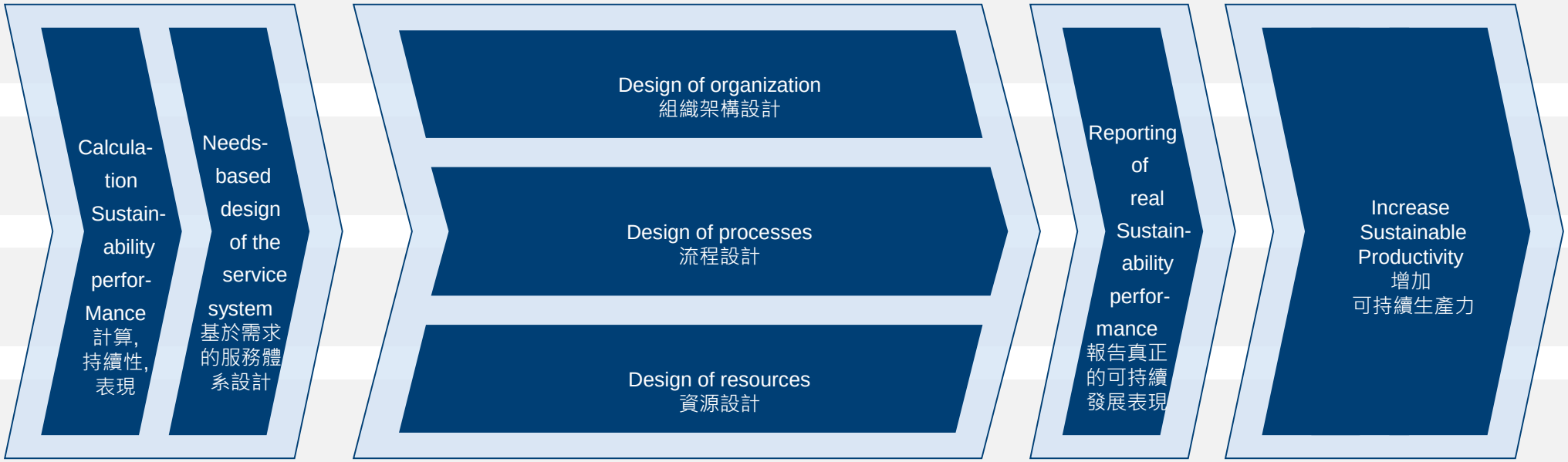


FINANCE
商業

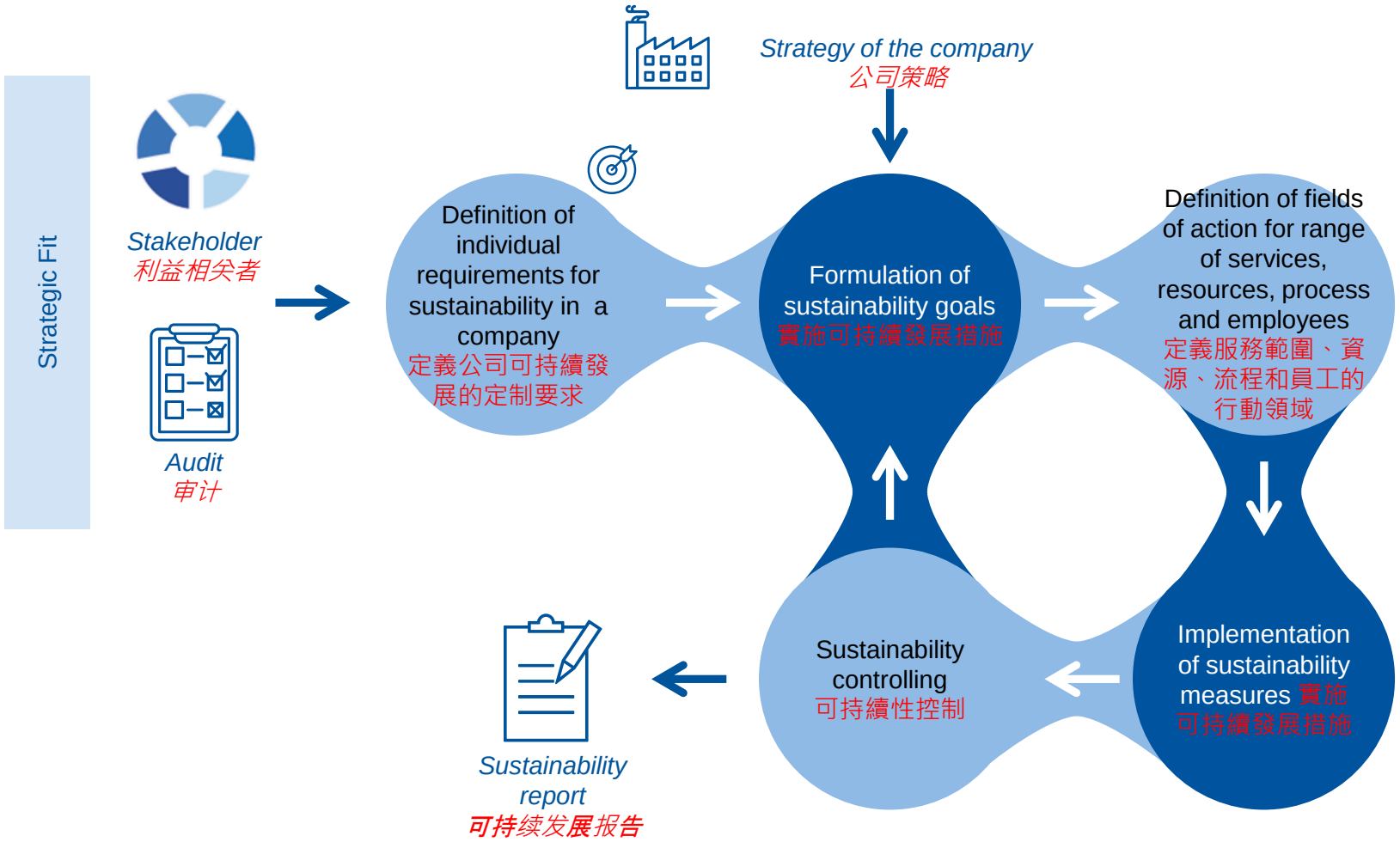
ENVIRONMENTAL
環保

SOCIAL
社會

GOVERNANCE
管理方法



Successful implementation requires a systematic process for the development and controlling of Sustainable Productivity
成功实施需要一个系统性的开发过程和可控制的持续生产力



Tasks of the sustainability officer
可持续发展员工的任务

Financially oriented 以財務為導向

Development of business cases for sustainability
開發可持續發展的商業案例

Market-oriented 市場導向

Identification of sustainability requirements and preparation of sustainability reports 確定可持續性要求並準備可持續性報告

Process-oriented 以流程為導向

Carrying out sustainability audits 進行可持續發展調研審計

Knowledge- and learning-oriented 以知識和學習為導向

Supporting training, motivation and knowledge of all stakeholders 支援所有利益相關者的培訓、鼓勵和知識

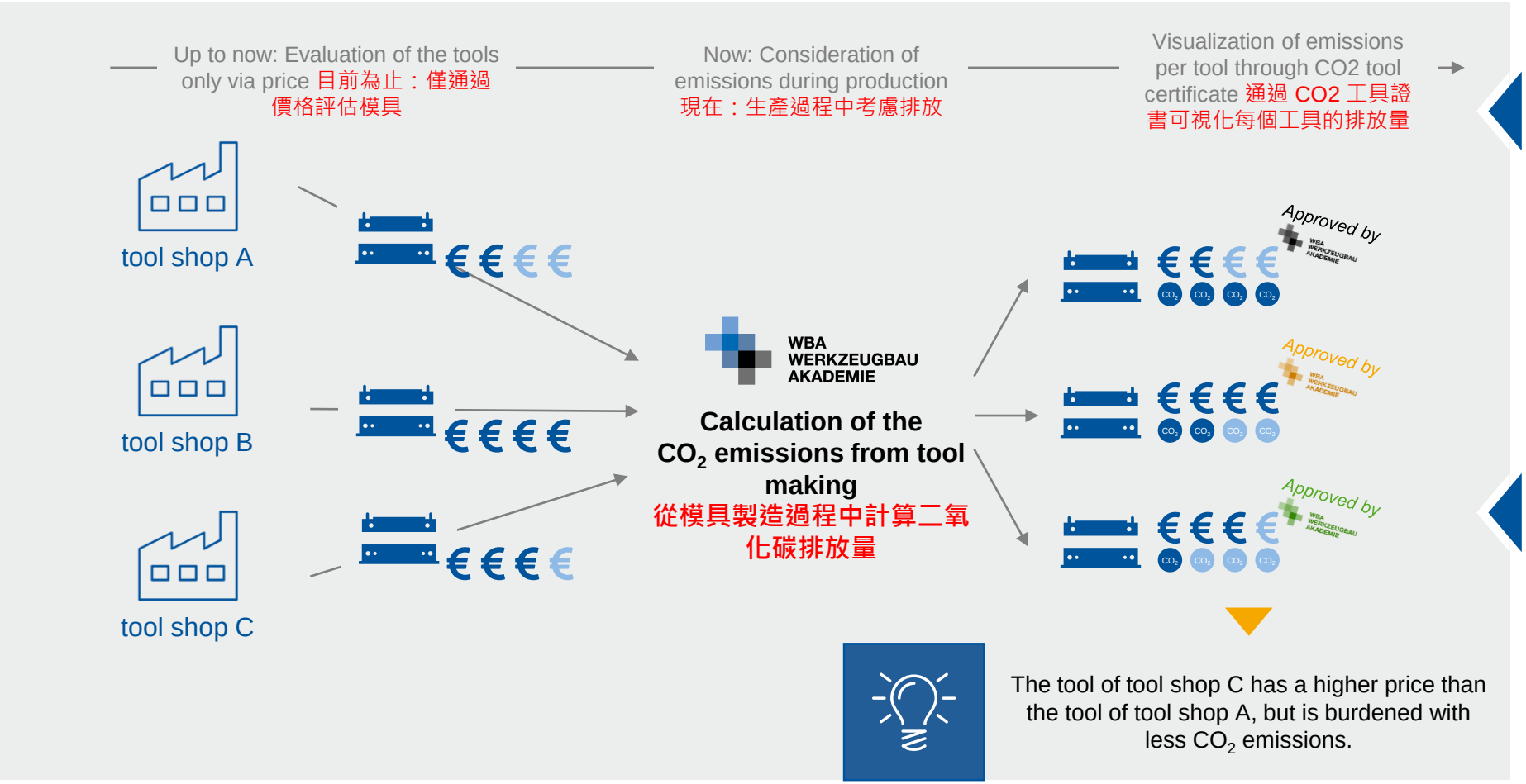
Out-of-market oriented 非市場導向

Securing legitimacy and reputation as well as social anchoring 確保合法性和聲譽以及社交

Sources: WBA Study – Competitive Factor Sustainability: A Differentiating Feature for Toolmaking (2020)

The CO_2 tool certificate of the WBA makes the higher sustainability of a tool shop comparatively visible for the series producer

WBA 的 CO_2 模具认证使模具车间相对于产品生产商而言，具有更高的可持续性



Series producers/customers.. 产品生产商/客户....

- ...are currently focusing on their own sustainability
- ...want to add as few emissions as possible to their balance sheet envelope from external sources
- ...will in future make their decision to buy a tool dependent not only on the price but also on its sustainability performance.

Capital providers... 资本提供商

- ...are looking for secure long-term investments
- ...see sustainable action as an increasingly important aspect of long-term security

Tracking of CO_2 emissions in toolmaking offers new potentials both for the tool shop and the customer

跟踪模具制造中的二氧化碳排放为模具车间和客户提供了新的提升空间

Potentials of sustainable tool making
可持续模具制造的潜力

Differentiation that is difficult to imitate by international competitors **國際競爭對手難以模仿的差異化**

Ensuring future consideration for customer enquiries **確保將來客戶查詢的考慮**

Easier access to capital providers **更容易接觸到資本**

Opportunities for new services **新服務的機會**

Medium-term cost savings in the area of energy and materials **能源和材料領域的中期節約成本**

Increased attractiveness for employees **提高對員工的吸引力**

Steps towards sustainable toolmaking
迈向可持续模具制造的步骤

1. Drawing up a CO_2 balance for companies and tools over the entire life cycle **在整個生命週期內為公司和模具制定CO2平衡**
2. Identification of fields of action to increase sustainability in value creation **確定行動領域，以提高價值創造的可持續性**
3. Implementation of reporting of the emitted CO_2 emissions from tool making **推行報告模具製造過程中排放的CO2排放量**
4. Identifying services to increase the customer‘s sustainability **確定服務以提高客戶的可持續性**
5. Complete consideration of all ESG dimensions along the entire product life cycle **全面考慮整個產品生命週期中的所有ESG維度**

Best Practice – Holistic life cycle approach: Establishing sustainability goals in the corporate strategy
最佳實踐——整體生命週期方法：在企業戰略中確立可持續發展目標

Description 描述

- **Linking** own **sustainability goals** with the **corporate strategy** as well as implementation of a monitoring system 將企業戰略和可持續發展目標連結起來，實施一個監察系統
- **Obligation to document** the commitment for sustainable management **記錄可持續管理承諾的義務**
- **Evaluation** and **controlling of** sustainability measures by an **internal sustainability team** **由內部可持續發展團隊評估和控制可持續發展措施**
- Annual participation in the **German Sustainability Award** **每年也參與德國可持續發展獎**

Improvements achieved 取得的进步

- ✓ Products consist of **50% bio-based raw materials** **產品由50%的生物基原料組成**
- ✓ Reduction of **raw material utilization** by **10%** **原材料利用率減低10%**
- ✓ Increasing **product innovation** with a focus on sustainability **增加產品創新，注重可持續發展**
- ✓ Elected **"Germany's most sustainable company"** **當選「德國最具可持續性的公司"**

With a holistic sustainable corporate strategy and consistent controlling Fischerwerke GmbH & Co. Kg is driving forward sustainable development in Germany

Fischerwerke GmbH & Co. Kg 凭借全面的可持续性的企业战略和持续的控制力推动德国的可持续发展

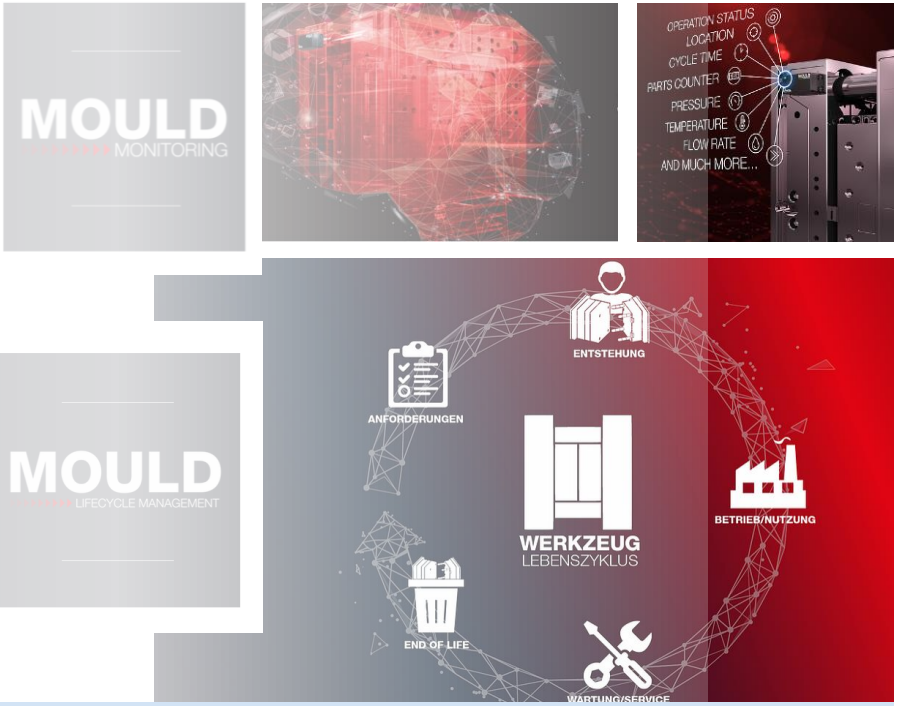
Sources: German Sustainability Award – Fischerwerke GmbH & Co. Kg (2020)

Best Practice – Sustainable Governance:
Realizing sustainability potentials through collaborative innovation
最佳實踐——可持續性管理方法：通過協作創新實現可持續性發展潛力

Description 描述

- Establishment of a **joint venture** as equal partners **成立合資企業作為合作夥伴**
- **Cooperative development** and **distribution of** intelligent digitization solutions for injection molds **合作開發與分銷注塑模具的數字化解決方案**
- Changes in **product design** and **weight optimization** to **reduce energy use** **優化改變產品設計和重量，以減少能源消耗**
- Implementation of **life cycle management** and use of an **energy management system** **實施生命週期管理和使用能源管理系統**

HAIDLMAIR GROUP
HOFMANN IHR IMPULSGEBER
M DIGITAL MOULDS



Improvements achieved 取得的进步

- ✓ Increased **transparency** over the entire **product life cycle** **提高整個產品生命週期的透明度**
- ✓ Addressing **economic** and **ecological aspects with** all partners **與所有合作夥伴一起解決經濟和生態問題**
- ✓ Increased implementation of **innovative product ideas** **加強創新產品理念的實施**

Intelligent monitoring of molds and cloud-based software solutions can systematically optimize the life cycle of injection molds with regard to sustainability goals
智慧監控模具和基於雲的軟體解決方案可以系統地優化注塑模具的生命週期，以實現可持續發展目標

International Benchmarking Analysis of the Hong Kong Mold and Die Industry: Agenda I 1st March 2022
香港模具行业的国际基准分析：议程 I 2022 年 3 月 1 日

1	Welcome 欢迎	13:00 – 13:05
2	Key findings benchmarking analysis HK mold and die industry 2019-2022 香港模具行业对标分析的主要发现2019-2022	13:05 – 13:20
3	Recap factory visits 2022 回顾工厂参观 2022	13:20 – 13:45
4	Fields of action for HK mold and die industry 香港模具行业的评估报告	13:45 – 14:45
5	Q&A and final discussion 问答和最后讨论	14:45 – 15:00

Q&A and final discussion:
问答和最后讨论：

Time for your questions

提问时间

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