MANAGING KNOWLEDGE AND BEST PRACTICE IN THE TOOL AND DIE INDUSTRY

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ABSTRACT

Tool and die making occupies a key position in the value-added process chain. Therefore an effective and efficient tool and die shop is a critical success factor for an industrial enterprise. However, the tool and die shop operates in a highly complex, dynamic and competitive environment which leads to a high number of possible measures for enterprise engineering. Therefore enterprise engineering in the tool and die industry has to be done in a systematic way to find the measures with the highest impact on global competitiveness.
In this paper a model for enterprise engineering in the tool and die industry is presented. It consists of three roadmaps: In the Tool and Die Development Roadmap the process chain for developing and manufacturing a tool is represented. In the Tool and Die Enterprise Design Roadmap two basic directions of strategic development are described. The Benchmarking Masterplan contains a process to improve the position of the tool and die shop using a benchmarking procedure. The roadmaps have been implemented into EDEN and can be used to manage knowledge and best practice in the tool and die industry.

KEYWORDS: **Tool and Die Industry, Knowledge Management, Best Practice, Benchmarking**

INTRODUCTION

"He who stops being better stops being good."
Oliver Cromwell, British statesman and army commander

The questions "Who is the best?" and "How can I improve?" are maybe as old as mankind and adaptation is a fundamental principle in the evolution of man. Therefore it is not astonishing that from early in the industrial era clever businessmen have compared their company to others and have applied best practices from other companies or even industries to their own. Examples are the introduction of the assembly line by Henry Ford who applied the division of labour from slaughter-houses in Chicago to automotive

production or the introduction of the kanban-principle by Toyota who transferred the organisation of filling the shelves in American supermarkets to automotive production [8].

This unsystematic approach of comparing has later been developed into a formal method called benchmarking developed and first applied at the Rank Xerox Corporation in the 1970es. The foundation of institutions which dedicate their work to benchmarking followed in the 1990es. Examples are the International Benchmarking Clearinghouse (IBC) by the American Productivity and Quality Center (APQC), the European Benchmarking Center by the European Foundation for Quality Management and the Informationszentrum Benchmarking (IZB) by the Fraunhofer-Gesellschaft [8].

KNOWLEDGE AND BEST PRACTICE

There is no standardized definition for benchmarking in the literature. But when one looks at the different definitions in literature one can come up with the following description: Benchmarking is the comparison of certain objects of examination (e.g. products or processes) of an organisational unit or an organisation with those of other organisational units or organisations on the basis of qualitative measures which are called benchmarks. The aim of benchmarking is to determine the Best in Class and to realise Best Practice [8].

The search for the Best in Class answers the question "What is the best performance?" which in benchmarking is often substituted by the question "Who is the best in this sector?". Best Practice gives an answer to the question "What is the best solution?" containing not only the question "What is done?" but also "How is it done?". Finally the question "How can I use Best Practice to become Best in Class?" has to be dealt with.

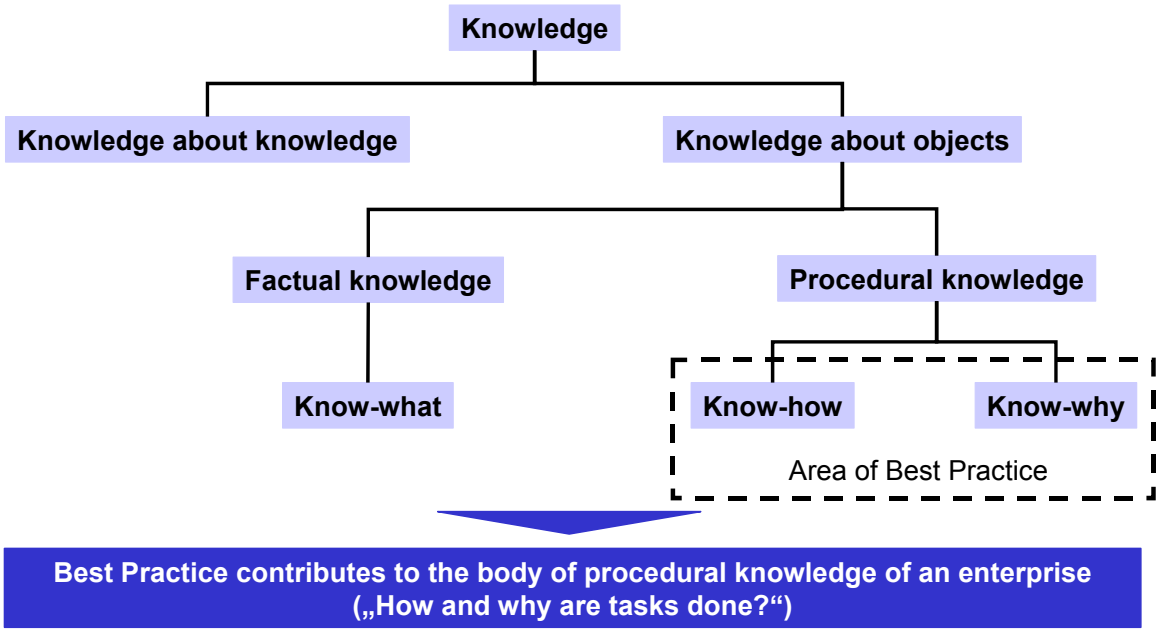


Fig. 1: Knowledge and Best Practice [1]

So Best Practice can be described as the best solution at present for a given problem. This comprises technical processes, methods, tools as well as ways of working which

show a particularly high productivity, quality and/or value-added [5]. In the body of knowledge of an organisation Best Practice belongs to the body of procedural knowledge. It contributes to the know-how and the know-why of an enterprise [1, 7] (fig.1).

BOUNDARY CONDITIONS OF THE TOOL AND DIE INDUSTRY

Tool and die making occupies a key position in the industrial value-added process chain. Therefore an effective and efficient tool and die shop is a critical success factor for an industrial enterprise. However, the tool and die shop operates in a highly complex, dynamic and competitive environment. On the other hand the tool and die manufacturing is in an area of conflict between external and internal boundary conditions. External boundary conditions are high pressure of time and cost as well as high quality standards caused by fierce competition, new technological developments and a lack of qualified personnel. Internal boundary conditions are a complex production of unique tools for a wide product spectrum which is disturbed by a high percentage of alteration orders, repair orders and rush orders [2] (fig. 2).

These conditions do not only lead to high turbulence in the work environment but also to a high number of possible measures for enterprise engineering. Strategies in tool manufacturing focus on the range of products and services, locations, process organisation and organisational structure as well as resources required. In this context it is important to strive for the overall optimum solution by applying successful strategies to the tool manufacture. Therefore enterprise engineering in the tool and die industry has to be done in a systematic way to find the measures with the highest impact on global competitiveness [4].

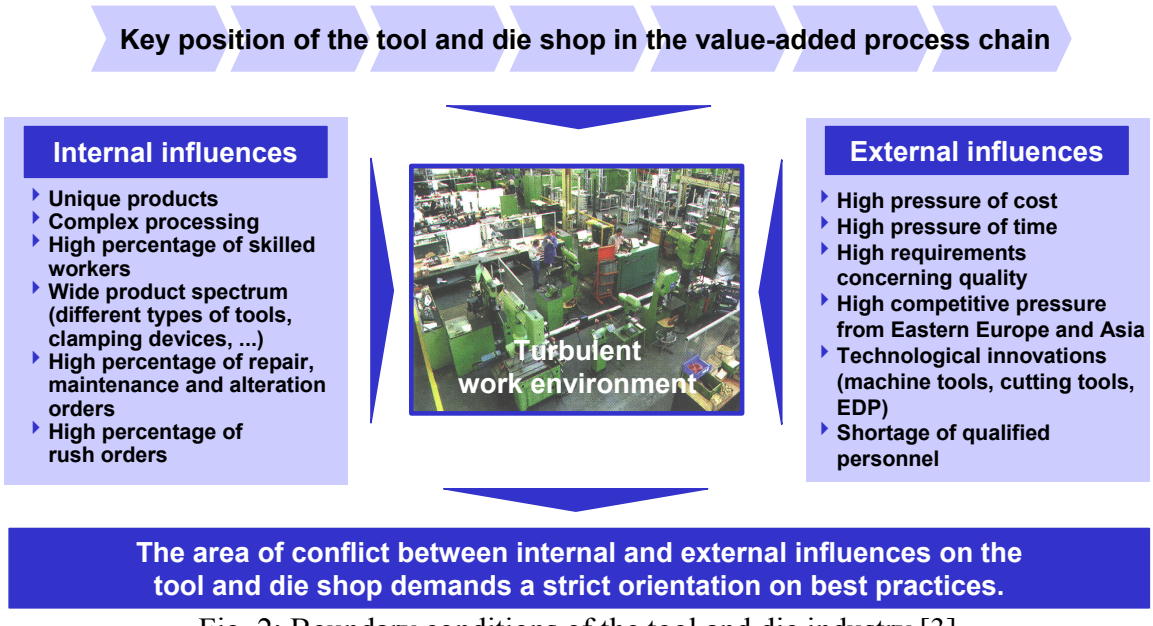


Fig. 2: Boundary conditions of the tool and die industry [3]

Statistical analyses of benchmarking data at the Laboratory for Machine Tools and Production Engineering (WZL) show that the success factors in the tool and die industry are:

- a high motivation of personnel,

- the concentration on core competences,
- high efforts in early phases of the development process,
- continuous investments and modern machinery, as well as
- adequate NC-programming strategies.

For each of these success factors benchmarks for best practice can be determined through statistical methods [3]. But these results still lack a model for enterprise engineering which enables the tool and die shop to manage the best practices in their context.

THREE MODELS FOR ENTERPRISE ENGINEERING IN THE TOOL AND DIE INDUSTRY

The model for enterprise engineering in the tool and die industry consists of three roadmaps: the Tool and Die Development Roadmap, the Tool and Die Enterprise Design Roadmap and the Benchmarking Masterplan.

Tool and Die Development Roadmap

In the Tool and Die Development Roadmap the process chain for developing and manufacturing a tool is represented. It comprises not only the core processes of tool development and tool production which are the traditional gameboard of a tool and die shop. But it also includes the adjacent processes of product development and tool usage which offer an extended gameboard for the tool and die shop (fig. 3). The four phases have been broken down into process chains and sub-processes with descriptions as well as examples and templates.

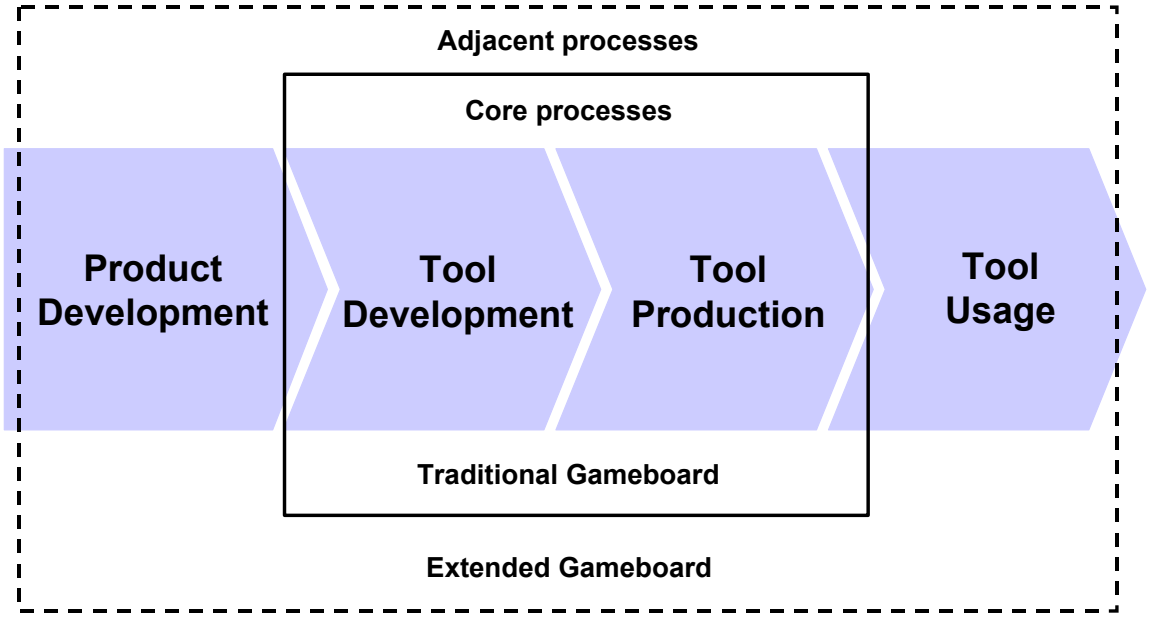


Fig. 3: Phases of the Tool and Die Development Roadmap

Tool and Die Enterprise Design Roadmap

In the Tool and Die Enterprise Design Roadmap two basic directions of strategic development are described. These strategic directions comprise the extended gameboard of the tool and die shop. Following a survey in the machine tool industry by McKinsey and the Laboratory for Machine Tools and Production Engineering

(WZL) [6] a contribution to application as well as a contribution to availability and productivity are distinguished.

The first direction extends the tasks of the tool and die shop from the mere tool production over the tool development into the product development thus increasing the contribution of the application its tools have for its customers. It focuses on special features of the tool which add value to the end-product of the customer (fig. 4).

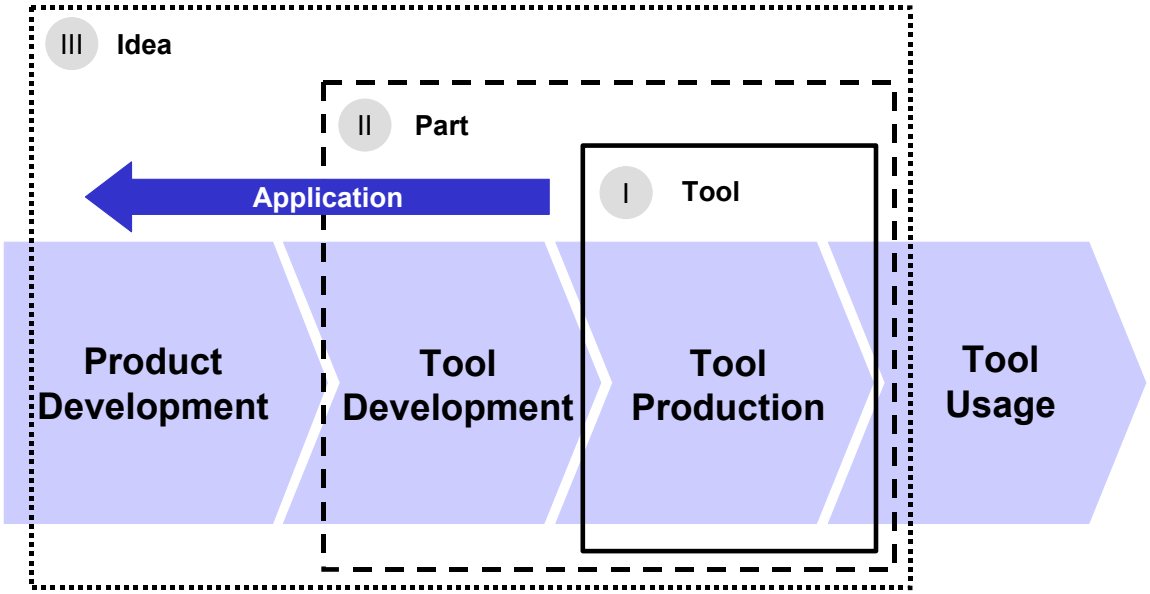


Fig. 4: Extended gameboard through contribution to application

The contribution to application comprises three horizons of development. The three horizons go from a reactive and periodic to a proactive and continuous approach. In the first horizon the tool and die shop provides solutions for a defined tool, i.e. that the customers develop the product and the tool and the tool and die shop merely manufactures the tool. In this case the tool and die shop has to build up operational excellence in manufacturing and assembly and can improve by focussing on core competences and generating effective process chains as well as implementing process planning and scheduling.

In the second horizon the tool and die shop provides solutions for a given part, i.e. that the customer develops the product and the tool and die shop develops and manufactures the tool. In this horizon the tool and die shop has to build up operational excellence in die concept and design, increase process orientation and reduce interfaces between development and manufacturing as well as increase the level of automation and process planning and scheduling.

In the third and last horizon the tool and die shop proactively provides solutions for the customers´ ideas, i.e. that the tool and die shop takes part in the product development process of its customers. In this horizon the tool and die shop can integrate into the process chain of the customers´ product development (e.g. through part optimisation and project management) as well as increase the customers´ loyalty through customer-specific bundling of outputs (e.g. development and manufacturing of whole tool systems for a product) (fig. 5).

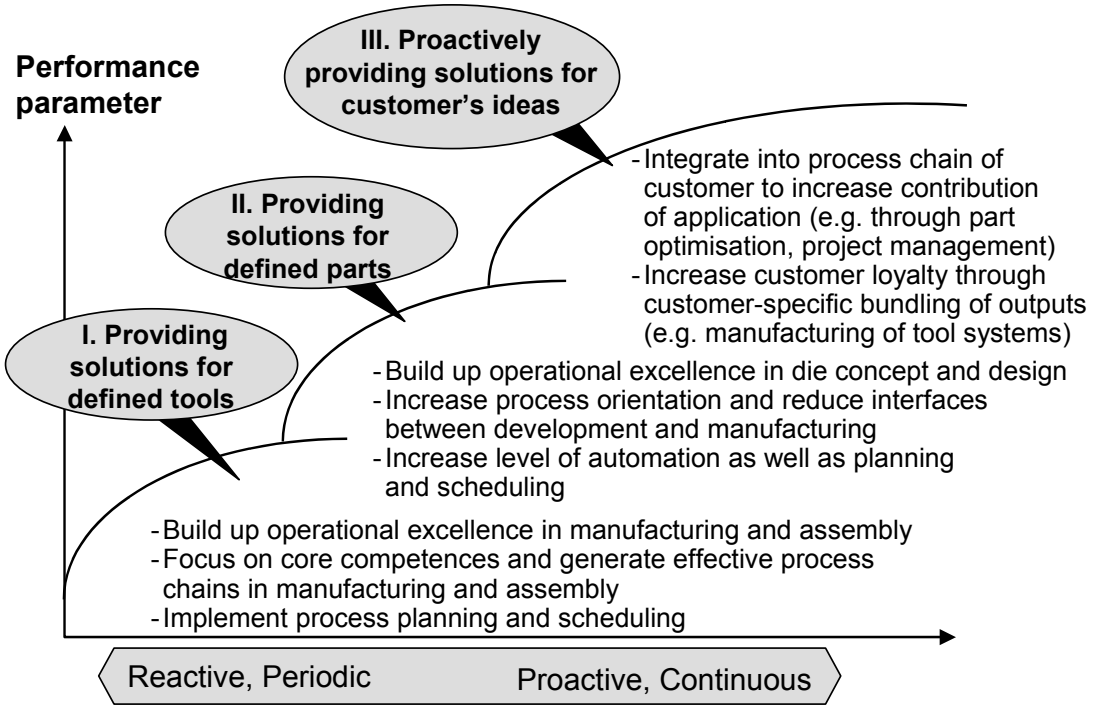


Fig. 5: Three horizons of the contribution to application

The second strategic direction extends the tasks of the tool and die shop from the tool production over the tool maintenance to the long term optimisation of the tool thus increasing the contribution of the availability and the productivity of the tools. It focuses on the functionalities of the tools which contribute to a trouble-free production process for the customer (fig. 6).

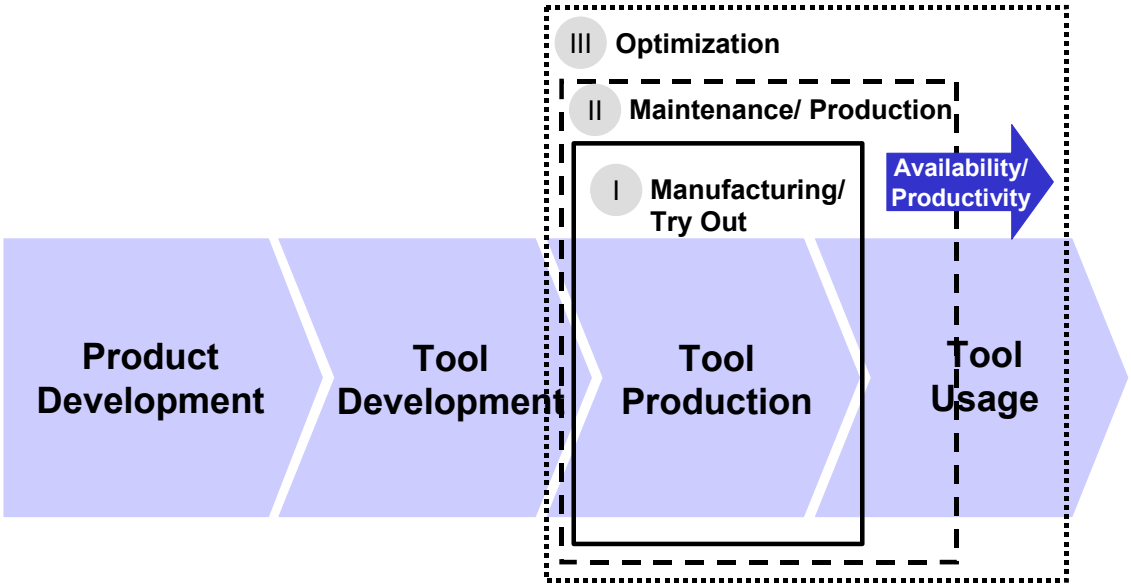


Fig. 6: Extended gameboard through contribution to availability and productivity

The contribution to availability and productivity also comprises three horizons of development from a reactive and periodic to a proactive and continuous approach. In the first horizon the tool and die shop enables the customer to perform the basic operations of the tool. This means that the tool and die shop builds up operational excellence in manufacturing and assembly, builds up facilities and know-how for the

try-out of the tools as well as conducts briefing and consultation for the production personnel of the customer in how to use the tool most effectively.

In the second horizon the tool and die shop additionally takes on tasks of maintaining and operating tools. The tool and die shop integrates into the process chain of the customers through small batch production and maintenance, increases process orientation and reduces interfaces between tool manufacturing and tool usage as well as implements the process of process optimisation under production conditions for the manufactured tools.

In the third and last horizon the tool and die shop takes on tool optimisation for specific production requirements. In this horizon the tool and die shop takes on the long term optimisation of the tool and increases customer loyalty through customer-specific bundling of outputs, e.g. by giving the guarantee for a fully operational tool and for a specific quantity of products (fig. 7).

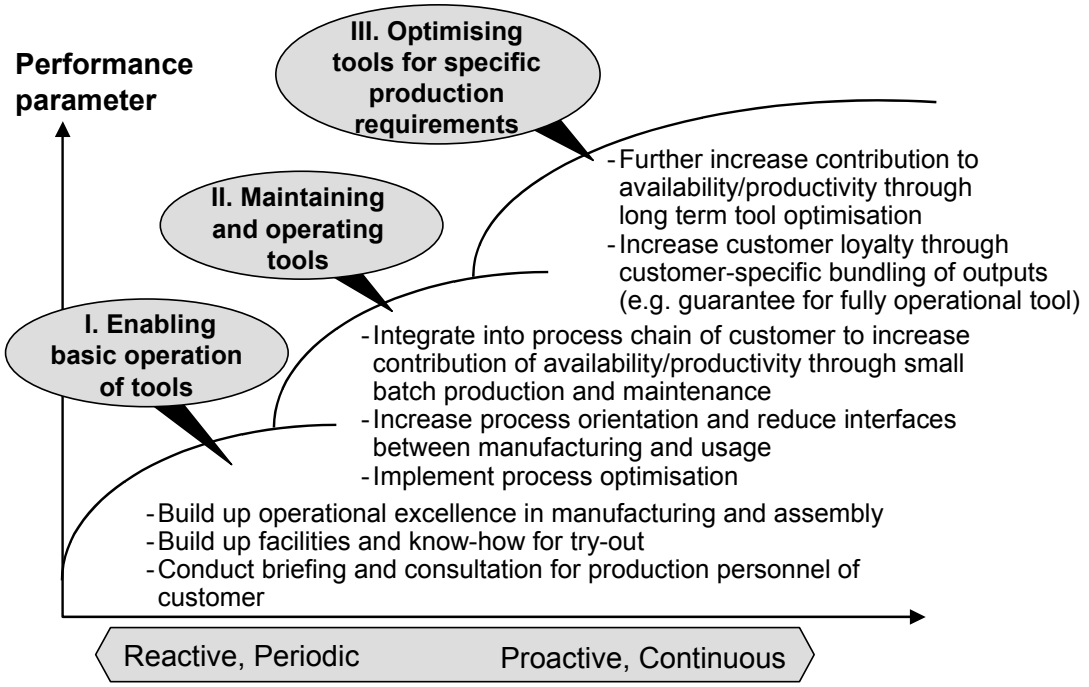
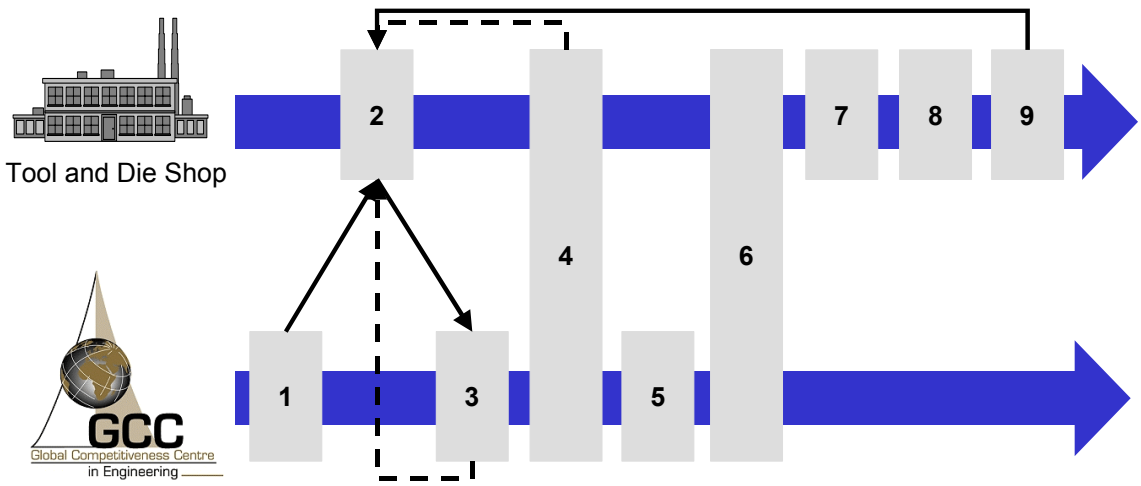


Fig.7: Three horizons of the contribution to availability and productivity

In the two strategic directions best practices for the human resources, the technologies, the IT-infrastructure and the organisation have to be distinguished and taken into account when taking on enterprise engineering.

Benchmarking Masterplan

The Benchmarking Masterplan contains a process to improve the position of the tool and die shop using a benchmarking procedure. It describes the tasks of the university and the enterprise in conducting a benchmarking-project and supports them with descriptions, examples and templates. The Benchmarking Masterplan follows the benchmarking procedure used by the WZL to conduct their benchmarking-projects [3] (fig. 8).



1: Forwarding of Questionnaire
2: Collection of Basis Data
3: Calculation of Benchmarks and Plausibility Check
4: Visit of the Tool and Die Shop and Discussion of Benchmarks
5: Analysis of the Visit and Evaluation of the Tool Shop
6: Determination of Current and Desired Situation and Deduction of Measures to Reach the Desired Position
7: Deduction of a Transition Plan
8: Preparation and Conduction of Projects
9: Evaluation of the Results

Fig. 8: Benchmarking Masterplan

IMPLEMENTATION INTO EDEN

The three roadmaps have been implemented into the framework of the enterprise design navigator EDEN to use the collaborative features as well as the document management- and the knowledge management-functionalities of the framework. In the Product Lifecycle the Tool and Die Development Roadmap corresponds to the Product Development Roadmap. In the Enterprise Lifecycle the Tool and Die Enterprise Design Roadmap corresponds to the Enterprise Design Roadmap and the Benchmarking Masterplan corresponds to the Business Process Reengineering Masterplan as implemented in the Generic Enterprise Design Toolkit application.

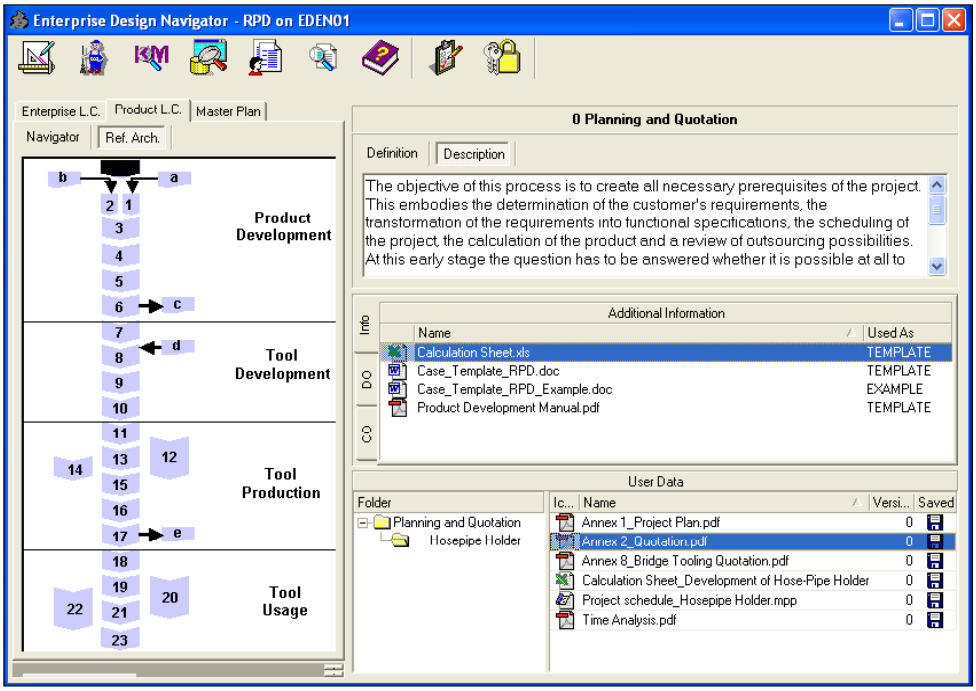


Fig. 9: Screenshot of EDEN for Tool and Die Manufacturing

The implementation facilitates the user to manage best practice and knowledge in the reference architecture of the tool and die industry. Fig. 9 shows exemplarily the screenshot of the Tool and Die Development Roadmap implemented into EDEN.

BENEFITS AND PROSPECTS

The benefits of EDEN for Tool and Die Manufacturing are the following:

- The tool and die shops can use the tool for managing knowledge and best practice in the reference architecture of the tool and die industry.
- The tool can be employed for the training of students and employees of enterprises by the university.
- The tool can be used to support the benchmarking activities between university and enterprises.

The continuing conduct of benchmarking-projects in an industrial sector leads to converging industrial standards and thus to a decrease in strategic differentiation of the enterprises. Furthermore research of institutes and enterprises generates new strategic options which may lead to quantum leaps in best practices. For these reasons best practices have to be checked and renewed in the sense of a control cycle in the course of time (fig. 10).

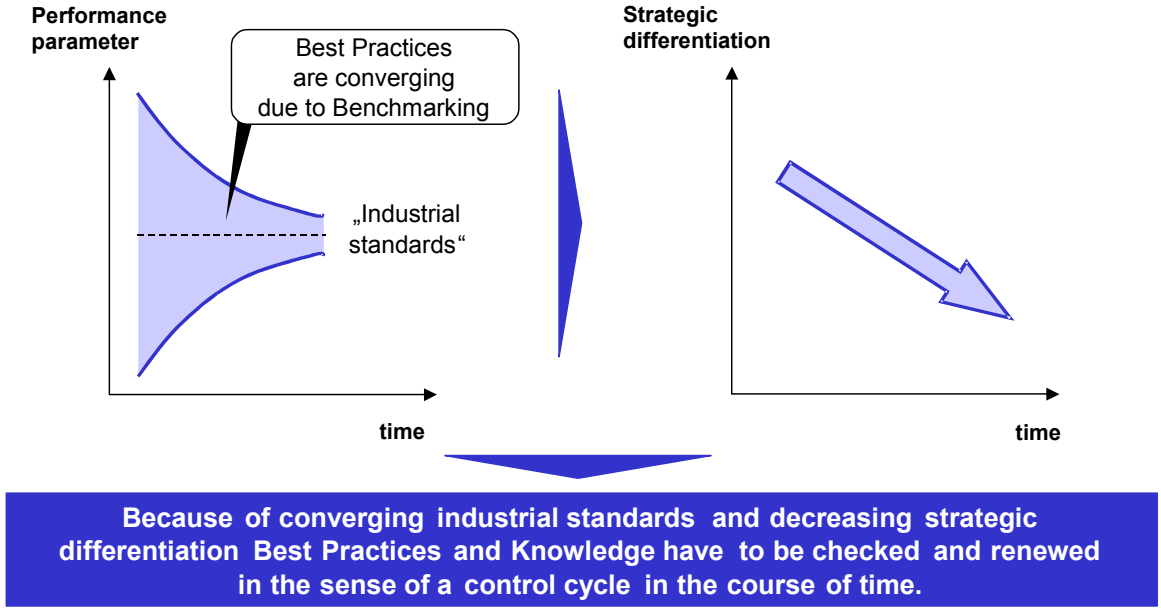


Fig. 10: Prospects

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