METHODS AND TOOLS TO DEVELOP PRODUCTS AND PROCESSES

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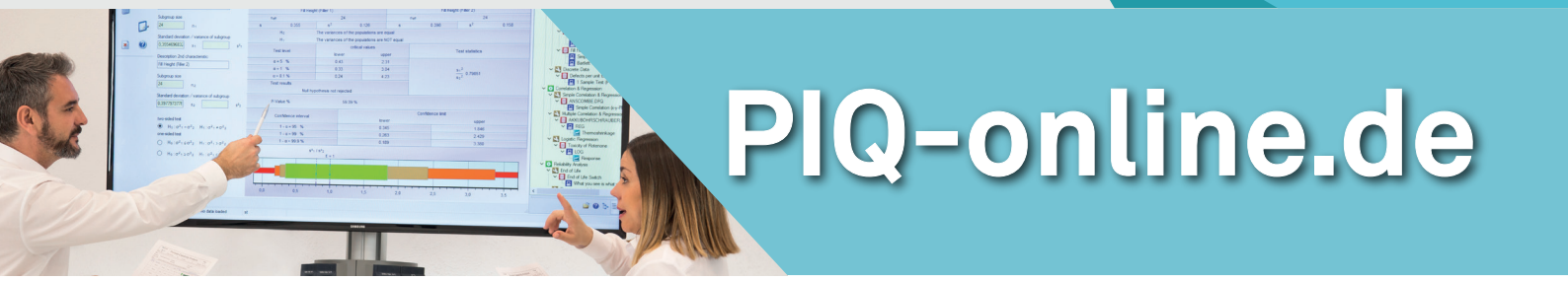

Part 1: Introduction and overview

Industrial production has ever since focused on the optimisation of processes. Together with quality assurance and controlling experts, engineers strive for quicker and more cost-efficient processes providing the highest level of quality.

Significant milestones are e.g. Total Quality Management, Lean Management, Theory of Constrains, Six Sigma or Business Excellence. Each of these strategies is based on a process-related approach. Sophisticated roadmaps arrange methods and tools along a timeline in a way that available resources help you perform the respective tasks in an optimal way. This also requires a truly effective project management, of course.

The diagram on the next page shows an example of such a process-related approach. Please consider that the “activities” describe the performance that is actually delivered. Activities always include the planning, qualification and improvement of measurement and production processes.

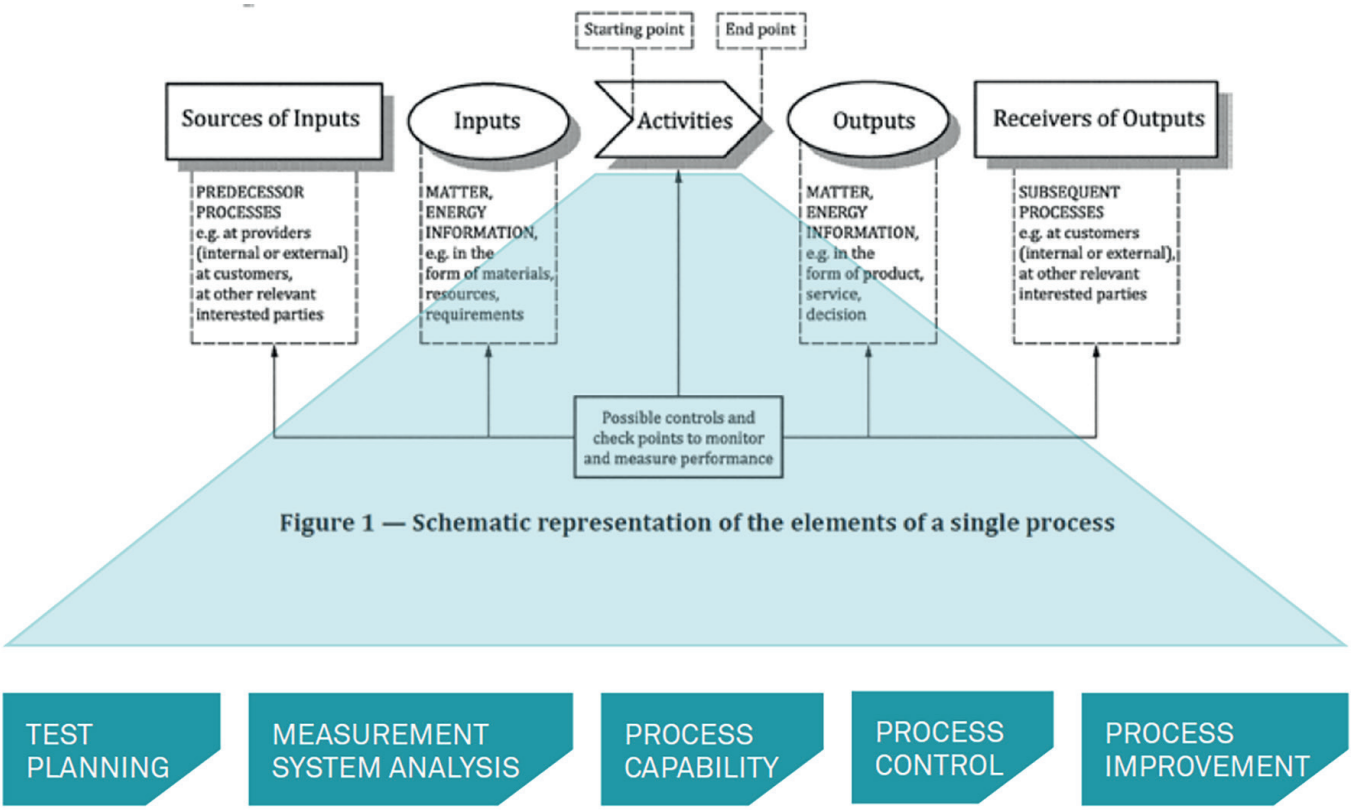

Figure 1: Source ISO 9001:2015 (upper part of the diagram), supplemented by typical categories applied in the manufacturing industry

The optimisation of production processes is already on a high level since it has to meet increasing requirements and applies advanced and supporting methods and tools.

However, there are some open questions: Why do so many processes require extensive optimisation **after** their development? Why do we not succeed in designing processes in a way that they meet the requirements right from the start?

There are several reasons.

1. Controlling does not become effective before products have been physically created. You do not count (physically available) rejects before then. The performance upstream processes (development and design) did not produce or delivered only insufficiently is hard to describe based on these figures.

2. Developers and design engineers are suppliers and measurement system at the same time. The capability to assess the delivered performance (analogous to process capability) and the ability to assess this capability as "good" (analogous to measurement system analysis) always depend on the skills of the responsible staff members. The degree of stability and capability we expect from our production processes are not part of the strengths human beings possess.

3. Controlling the processes of design engineers is **triggered by events** (analogous to production processes) and is thus hard to realise. An error might affect many processes that are to follow. In the worst case, it even has to be fixed in production.

4. Statistics describing the "performance" of design engineers frequently relate to a specific time span. You first cumulate data collected in a specific interval and then take the mean. This is the reason why the feedback loops are quite extensive.

5. Products are often not developed where the actual manufacturing process will take place. This local separation makes the communication between production and development extremely hard.

The following diagram gives an overview of the processes preceding manufacturing. By way of illustration, it is simplified considerably and only shows few iterative processes. You have to set the diagram in the context of

"management", "planning", "engineering" and "optimising", at least from a notional perspective, until you reach acceptable risks. Each symbol implicates an approach, method or tool, each arrow indicates the application of these methods and tools. Moreover, (at least) one transfer function is created. It also involves resources (experts, software, time ...) and an intelligent timing of the required activities, i.e. project management.

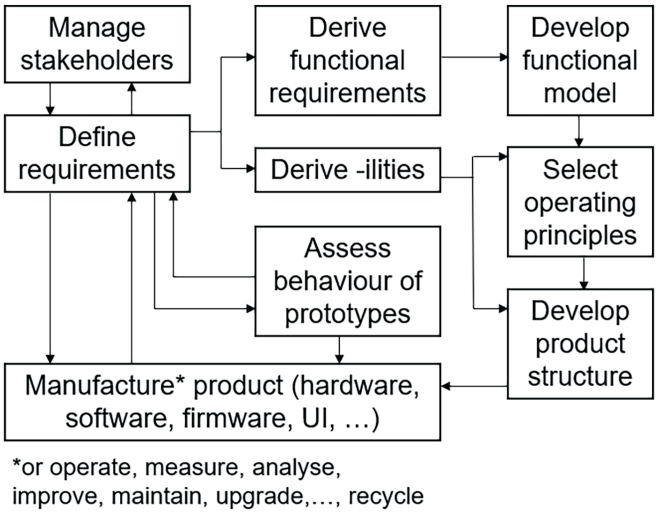

Figure 2: Overview of important phases in the early stages of a product lifecycle

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