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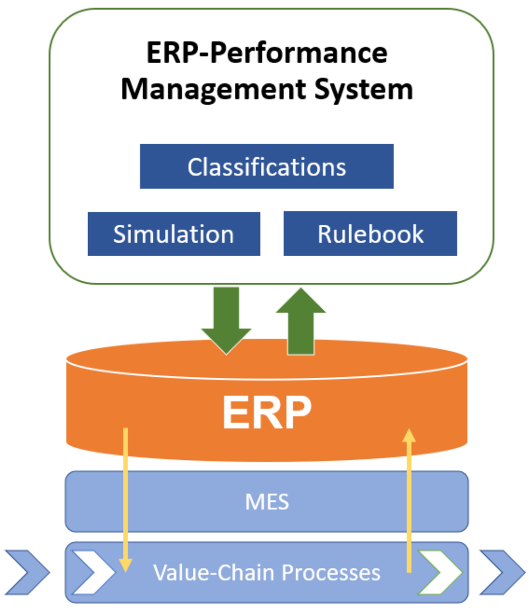

A Smart MRP for the Smart Factory

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ANALYZE – SIMULATE – AUTOMATE A QUANTUM LEAP AHEAD	**Abels & Kemmner** brings the optimization potential of supply chains to light and replaces gut feeling with facts.
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A Smart MRP for the Smart Factory

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The implementation of a smart factory concept requires automatic scheduling (Smart Scheduling). Two management experts explain that this term does not just describe a vision but is a reality already. In the best case, the extra revenue from this essential exercise can finance a company's digitalization strategy.

Today we are on the threshold of a new automation phase in industry, for which the buzzwords "smart" or "digital" factory have been coined. According to Siemens, Smart Factory means achieving production advantages through connected, flexible, dynamically self-organizing production of highly individualizable products. The essential technical bases for Smart Factory are known by two other buzzwords: cyber-physical systems and the internet of things. Put simply, the two terms refer to independent communication between different components (software, mechanical and electronic elements) in the production, value and supply chains.

Inherent to the idea of Smart Factory are decentralized structures that no longer have to obey a general plan. Here the workpiece "tells" the machine tool what new component it would like to be processed into and finds its way independently through the factory and through the various warehousing stages. The machine tool independently places an order for the required tools in the ERP system. But also in a Smart Factory, a central and automatic coordination and planning will be required, because parts have to be replenished and production orders have to be planned. This is made clear by the following examples:

- Even if production material finds its own way through the factory, the flow of different materials must be synchronized.
- In order for an ERP system to order parts automatically, reliable decision mechanisms must be established.

Mechanisms for "Smart Scheduling" already exist but only a few performance leaders use them today. The crucial key to Smart Scheduling lies in an intelligent analysis of the enormous and continually growing quantities of data generated in today's ERP systems, thanks to the increasing digitization of processes.

Scheduling – the "Heart" of the Company

With increasing digitization of processes, ever more data is being generated in companies. This is equally true for data from production processes and data from administrative processes. Unfortunately, there has been relatively little development in the systematic collection and analysis of this data. To allow meaningful conclusions to be drawn, data analysis must be matched exactly to the questions and be designed very specifically (details on this later). To filter information from these large volumes of data, intensive work is being carried out on suitable mathematical methods and algorithms and the first practically applicable solutions already exist.

The intelligent analysis of the enormous quantities of data in an ERP-system is essential for Smart Scheduling, because scheduling is the “heart” of every company, pumping the entire material stream through the supply and value chains. It follows that the quality of scheduling is highly important for the economic efficiency of a value chain. Scheduling quality depends on the scheduling parameters, because they determine product availability, inventory turns, capacity utilization, and lead times in procurement, production, and distribution and therefore determine how economically the entire

Hoped-For Economic Benefits of ERP System So Far Not Achieved.

Today many factories lack effective scheduling: although most companies use an ERP system, the desired inventory reduction, for example, does not materialize or the planned delivery readiness is not achieved. Key reasons why companies fail to meet their economic ERP targets are well known: scheduling parameters are often not maintained at all or only at long intervals. This is due firstly to the excessive manual effort that data maintenance requires. But even in companies that invest a degree of maintenance effort, the quality of the scheduling parameters is usually poor. This is firstly because far too few parameters are taken into account and secondly because the parameters, generally speaking, continue to be set by the responsible schedulers to the best of their knowledge.

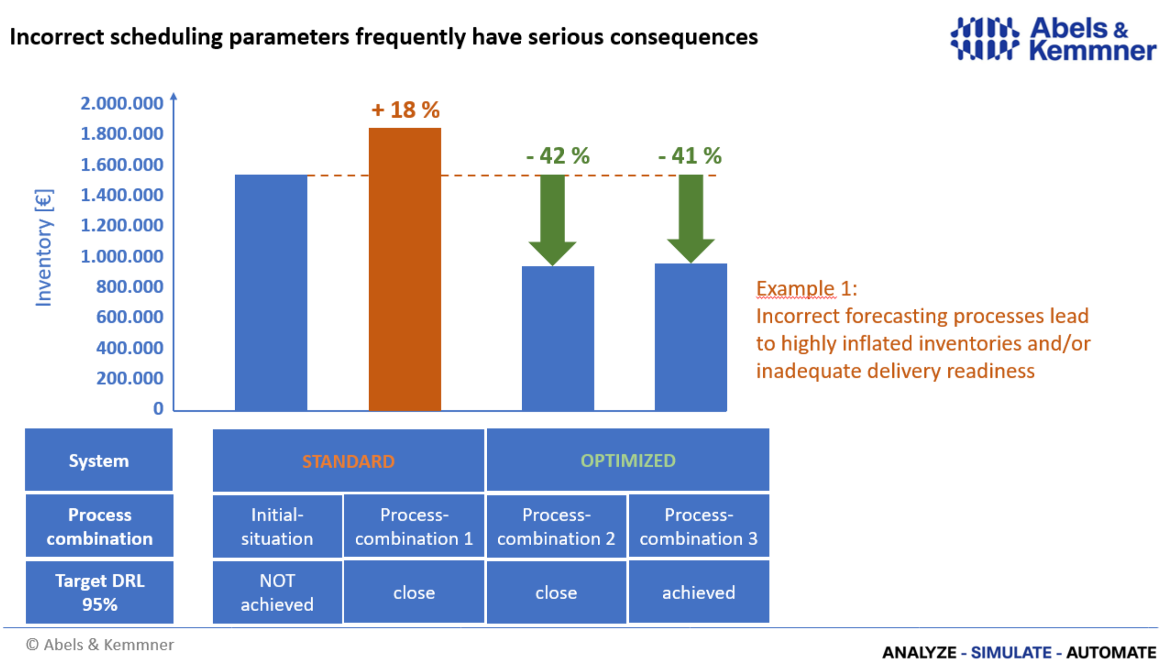

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Fig. 1: Incorrect scheduling parameters frequently have serious consequences

But the challenges will increase. The available time that schedulers can affort to use for data maintenance will inevitably decrease and, based on demographic changes alone, the required personnel will be in shorter supply. But probably even more important is that users only have a limited understanding of the effect that scheduling parameters have on economic replenishment and order scheduling; even acknowledged experts can no longer reliably foresee their complex interaction. Finally, most ERP systems lack of tools to optimize scheduling parameters.

Although many managers realize that the data quality in ERP systems is unsatisfactory, they still doubt that adjustment of scheduling parameters will achieve much in the end. But (correct) setting of scheduling parameters is not just a matter of tuning an engine that is already sufficiently powerful in order to squeeze the last drop of performance from it but rather of making an engine run correctly for the first time. The following practical example from an international production company makes this plain.

The example shows how dramatically different process settings can affect inventory and delivery readiness (Fig. 1). The aim of the business unit was to ensure a delivery readiness to the market of 95%. Through suitable setting of planning and scheduling parameters in the ERP system, the company was able to ensure the required delivery readiness but at the cost of an 18% higher inventory level (process combination 1). Through further optimization, enhanced by an expanded scheduling and forecasting functionality, the required delivery readiness was ultimately attained with a 40% lower inventory level (process combination 3).

Conventional Data Maintenance Does Not Lead to Success

Before discussing how such figures are achieved without testing planning and scheduling procedures for months or even years, we would like to clarify why conventional maintenance of scheduling parameters does not lead to success.

Firstly: conventional maintenance of scheduling parameters is far too time-consuming and expensive.

Imagine you were responsible for 1000 articles and wanted to concentrate on the ten most important scheduling parameters. You intend to look at these four times a year, in other words every three months. Let us assume you will require one minute per scheduling parameter since each material number has to be called up, the masks with the desired parameters must be loaded and the correct setting must be reviewed, looked up or even calculated. The one minute per parameter sums up to a maintenance time of 666 hours per annum; roughly 40% of your annual working capacity.

Secondly: conventional maintenance of scheduling parameters does not deliver reproducible scheduling results.

Every specialist in the area is aware of this but most companies do little about it. Every user interprets facts differently and furthermore only has an overview of a part of the whole process. With every stand-in for staff on vacation or sick leave, with every personnel change, the scheduling world of the affected items changes, which once again has impacts on all subsequent scheduling stages.

Thirdly: conventional maintenance of scheduling parameters does not deliver economically optimized results.

Economically optimized results cannot be achieved by gut feeling because the interaction of the different scheduling settings is extremely complex. In the end, it is all about statistical effects and interdependencies between parameter settings and economic results. Even if you start with the assumption of ten parameters, it is no longer possible for anyone to gauge the logistical interaction between these settings nor therefore their economic effects.

Up to 130 Parameters for Each Item

In modern ERP systems, however, far more than 10 parameters can be set per material number. In an SAP system, for example, some 130 parameters are available for each item and this does not even include settings for historical data, quotations, delivery schedules, and contracts. Of course, no-one needs every parameter for every item at the same time; but, in practice, it is always far more than ten.

At first sight, it seems difficult to set planning and scheduling parameters correctly under such circumstances.

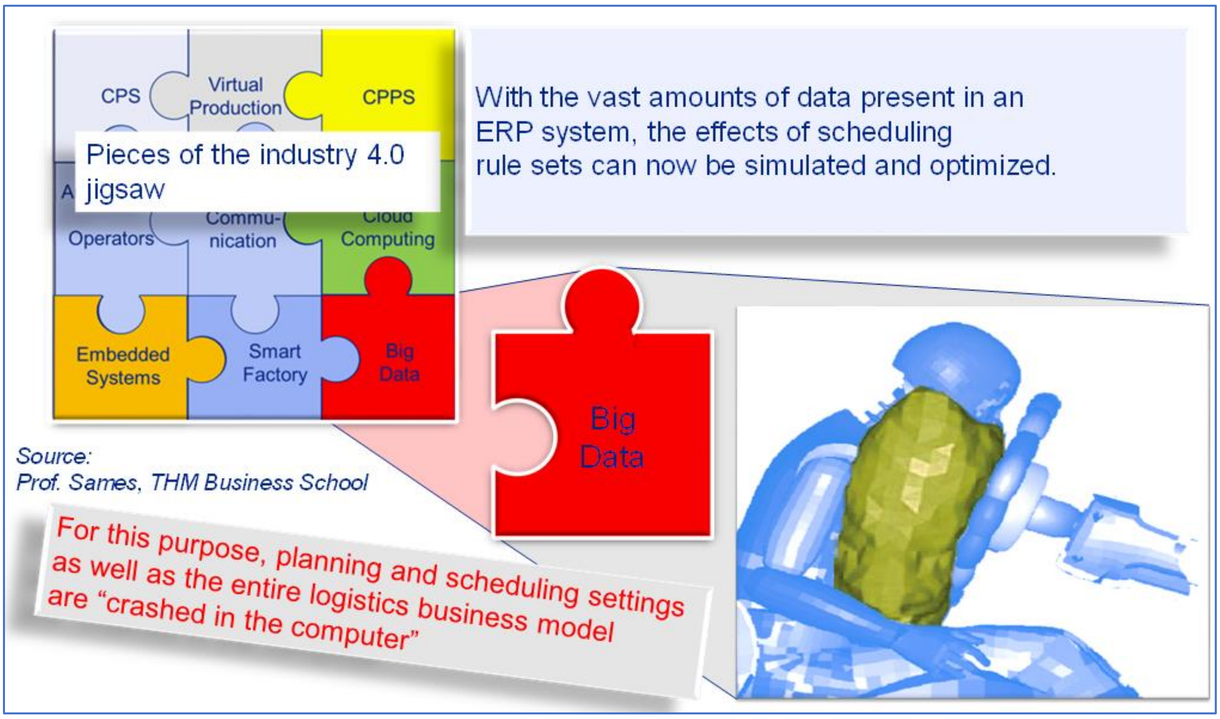

Fig. 2: Big company data analytics opens up a wide range of possibilities for Scheduling 4.0

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Big Company Data Analytics Simulate the Economic Consequences of Planning and Scheduling procedures

However, with DISKOVER SCO (supplier: SCT GmbH, Herzogenrath, Germany), a first Smart Scheduling solution is already on the market. This tool uses comprehensive data sets from the ERP system to determine optimized parameter settings and continually maintain planning and scheduling parameters in the ERP-system. Even if this is not a big data application in the strict sense, which normally involves the processing of unstructured and globally distributed data, nevertheless the system fulfils the third requirement for this categorization, namely uncovering structures in a sea of data and gaining insights from them (Fig. 2).

The core of the analysis involves simulations, which are used to test how a certain combination of settings affects the economic efficiency of the scheduling results. Simulation approaches are widely employed today. For example, car bodies are “crashed” in the CAD system during the development stage and optimized based on the simulation results. A similar approach is used in the design of molds for production processes such as injection molding. The DISKOVER system “crashes” the whole planning and scheduling world in the computer before the parameter settings are implemented in practice.

Up to today and probably for some time still, the simulation does not completely replace the specialist, who can then interpret the results and draw conclusions from them. But it does speed up optimization processes, reduces risks, and achieves far better results. The simulation results are used to develop planning and scheduling rule sets. On the other hand, extremely dynamic parameter settings, such as safety stocks or forecast values, are automatically optimized by simulation processes.

Four Stages of Data Analysis and Maintenance

The simulation approach allows to check for each individual item and material whether the required degree of delivery readiness can be achieved in practice and which target inventory will be required.

The basic process of data analysis and simulation can be divided into four stages:

- Stock movements, delivery readiness levels, and ranges of coverage are calculated from stock ingresses and stock issues
- Target stock coverage and delivery readiness are determined by varying scheduling parameters and scheduling strategies in simulations.
- Decision tables and rule sets define the settings in relation to boundary conditions that enable optimized inventory levels, and delivery readiness.
- The rulebased parameter settings are daily and automatically fed back into the ERP system; manual maintenance of planning and scheduling parameters is therefore unnecessary.

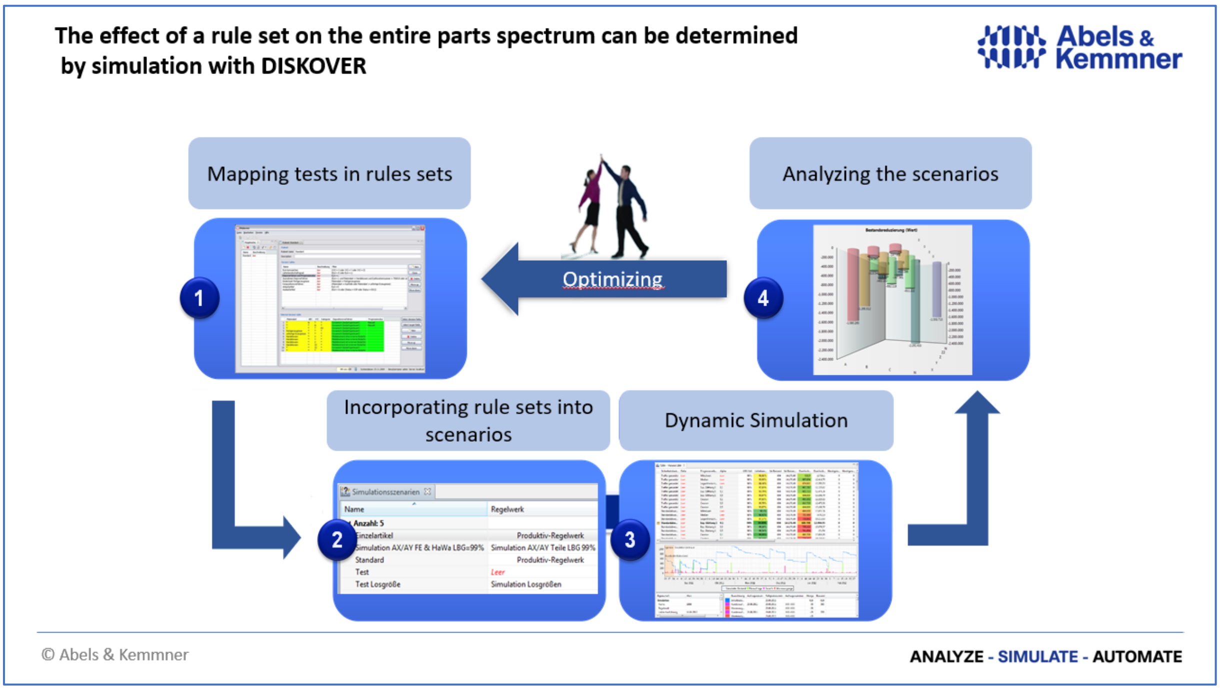

Fig. 3: The effect of a rule set on the entire parts spectrum can be determined by simulation with DISKOVER

In the DISKOVER system, different parameter settings or whole rule sets are incorporated into scenarios and imported into the simulation process to simulate the effects of alternative scheduling settings for different article groups. The results may be viewed directly as an overall result over all items or as individual results for each item in order to derive useful information for optimization approaches. In this way, users can run through alternative courses of action and compare them (Fig. 3).

As the result of the data analysis, users not only gain information on the correct parameter settings in the ERP system but also strategic knowledge and organization rules, which can be of great importance for corporate strategy.

ERP Performance Management (EPM) – the Central Task of Smart Scheduling Systems

You no longer get very far today with the "scheduling manual" or "rulebook" of the 1990s or simple operating procedures. It is far too costly and time-consuming for users to consult numerous data maintenance rules for each item. But even more important: the rule sets are based on many different material classifications that have to be recalculated regularly. For a systematic implementation of Smart Scheduling, a strategic tool is required, which continuously maintains the scheduling parameters of the ERP system and thereby optimizes logistics performance – this could be called an "ERP Performance Management System" (EPM-system) or simply a Smart Scheduling system (Fig. 4).

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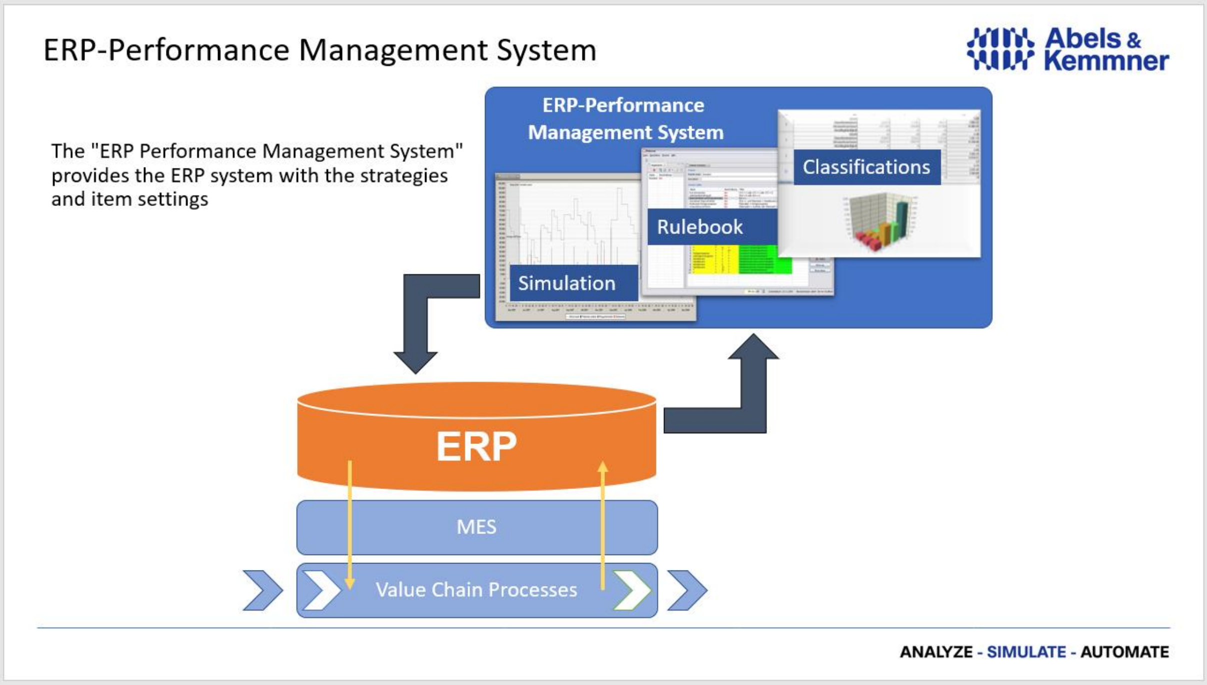

Fig. 4: The "ERP performance management system" feeds the strategies and article settings to the ERP execution system

Such an EPM-system continuously readjusts the parameter settings in the ERP system. For this purpose, it must

- analyze a broad spectrum of basic data from the ERP system,
- classify numerous items and determine key characteristics,
- map rule sets and decision tables,
- possess comprehensive simulation functions, and
- return the setting adjustments to the ERP system.

For classifications and simple rule sets, there are various solutions on the market allready. Simulation functions still separate the wheat from the chaff

Extra Revenue from Smart Scheduling finances the Smart Factory Strategy

Even if the range of products offered is still thin on the ground, ERP performance management based on "big company data" has arrived in practice and is already being used by technology leaders.

Hansaflex AG, one of the world's leading system providers for hydraulic components, owns almost 400 fully automated regional warehouses. Demand forecasts, warehousing and disposition strategies are specified by DISKOVER through automatic simulation and a sophisticated set of planning rules, which controls the replenishment decisions in the SAP system.

Trost SE, one of the leading automotive parts wholesalers in the independent aftermarket in Germany and Europe, now part of WM Group, manages the scheduling of its two central warehouses and about 150 local warehouses via planning and scheduling rule sets, also defined in the DISKOVER system.

STO Group - internationally leading manufacturer of paints, plasters, paints and coating systems as well as thermal insulation systems –continuously optimizes replenishment strategies for its European warehouses as well as production strategies for the production sites by means of its EPM-system DISKOVER, in order to achieve a high delivery readiness with low inventory in the supply chain.

In all three cases significant inventory reductions, improved readiness to deliver and more effective disposition processes were achieved. All three companies see the implementation of Smart Scheduling through an EPM-system as a strategic investment to increase their competitiveness and profits.

Our factories will have to increase the level of digitization in order to stay competitive. But the examples show that it is not necessary to start your digitalization strategy on the shopfloor, where significant initial investments will be required. Investments that - to a considerable extent- can only become effective if other conditions such as Smart Scheduling are met. With Smart Scheduling and ERP performance management, companies are not only laying a vital foundation for the digital factory but are also generating extra revenue, well needed to finance the adventure of digitalization.

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