ANALYZE - SIMULATE - AUTOMATE

Abels & Kemmner

WHITE PAPER

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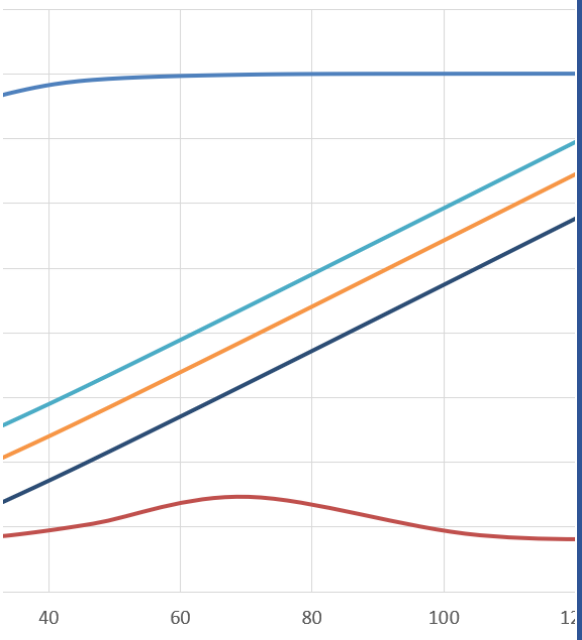
Scheduling and production control represent the heart of the company: They virtually pump the entire value and material flow through the company and the supply chain. A series of basic principles and best practice building blocks are designed to help you get your cycle going again.



Best Practice Rules for an Efficient Material Planning

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ANALYZE - SIMULATE - AUTOMATE A QUANTUM LEAP AHEAD	**Abels & Kemmner** brings the optimisation potential of supply chains to light and replaces gut feeling with facts.
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Best practice rules for an efficient disposition

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Scheduling and production control represent the heart of the company: They virtually pump the entire value and material flow through the company and the supply chain. Yet in many companies there is so little understanding of this central task that they are constantly suffering from cardiovascular problems - without even knowing it. A series of basic principles and best practice building blocks are designed to help you get your circulation going again.

When do I have to order which material so that it is available in the required quantity at the required time? In a nutshell, this is the task of scheduling. What can be summarised so briefly cannot be complicated, can it? Disposition is also not complicated if you understand the interrelationships and design the disposition mechanisms correctly.

However, a look at practice shows a completely different picture: scheduling is a frequent cause of trouble in the company - trouble that seems to be part of everyday work. Regular attempts to improve scheduling processes show temporary success at best. But it doesn't have to be this way if you consider the following basic principles and best practice building blocks of scheduling that can help forge a competitive advantage from a nuisance.

Basic principle 1: Disposition represents the heart of the company

Dispatching is the heart of the company, but top management likes to think of it as working in the coal bin.

If top management is interpreted as the head of the company, then MRP represents the heart. Disposition pumps the entire flow of goods through the company and the supply chain. In disposition, decisions are sometimes made with far greater financial reach than some management or board decisions for which one has to seek approval from advisory or supervisory boards. Every manager knows that he has to take care of his heart's capacity if he does not want to fall by the wayside at some point. In the same way, top management in a company needs to understand at least some basic principles of disposition so that the economic health of the company does not suffer. From this derives a first best practice building block, perhaps harshly worded but clearly understood:

Best practice building block 1: Top management should either familiarise themselves with the basic principles and fundamental laws of disposition or stay out of the operational business.

Why this requirement is so important becomes clearer when we look at Basic Principle 2.

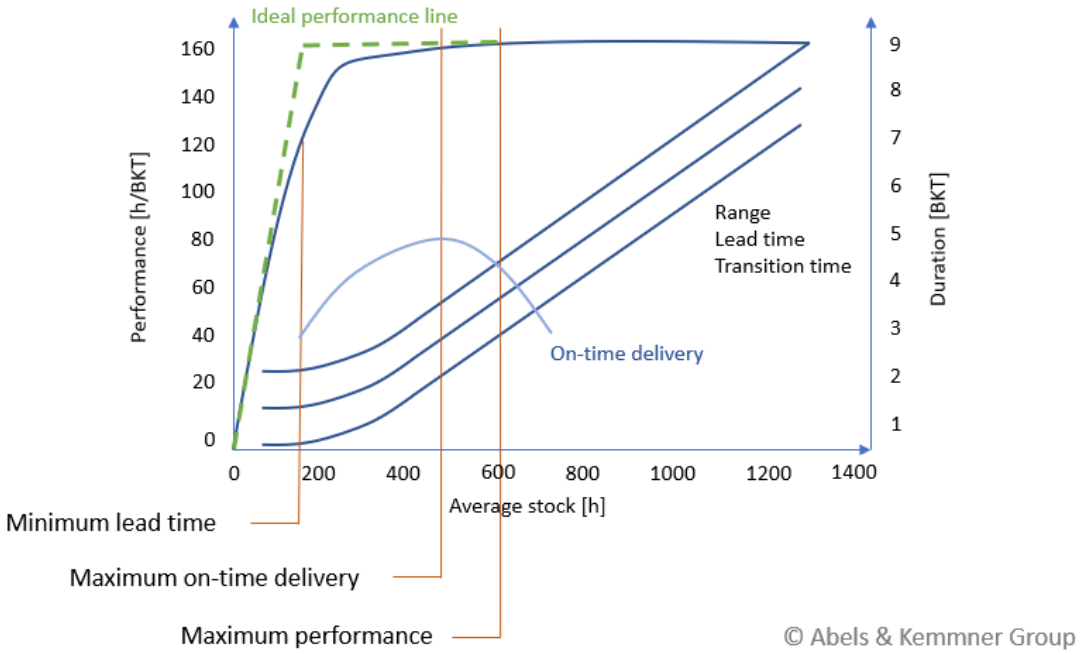
Basic principle 2: No sensible disposition without clear logistical objectives

Don't you have the feeling that logistics in general and scheduling in particular are constantly being "bounced around"? We have just discovered that our stocks are too high and everyone has to take care of reducing them, and then the customers complain about poor delivery reliability and all

attention shifts to delivering the products on time. The merry deadline chasing has not even really begun when the production manager notices that the capacity utilisation in production is in the basement and admonishes everyone to make sure that the plant utilisation increases again. In the meantime, the purchasing department has found a new, much cheaper source of supply, which, however, can only deliver in larger quantities - and the stocks are already rising again...

Many cooks spoil the broth - or so one might think. In our experience, however, it is not so much the many cooks that spoil the broth as the lack of a recipe for "stirring" the logistics together. Improving service level, increasing adherence to delivery dates, reducing inventories, better utilising capacities and reducing throughput times - unfortunately, none of these things go together. Given the architecture of the value chain and the order situation, there is a clear statistical correlation between inventories, capacity utilisation, throughput time and adherence to delivery dates, which can be determined in the form of a production or operating characteristic curve.

The production characteristic curve shows: Depending on the objective, different stocks must be set



Depending on your business and competitive constraints, you have to position yourself on this characteristic line. Logistical positioning inevitably means that you cannot please everyone in the company and in the market and that you have to step on the toes of the stakeholders in the company as well as in the market. Surely you don't want to leave the decision of how much to step on whose toes to your schedulers alone? Positioning the value chain correctly in terms of logistics and encouraging the scheduling department to adhere to this positioning; this is where the experience and quality of top management stand out! Either you position yourself logistically or you

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will continue to "flounder around" - there is no in-between. Thus, best practice building block 2 is simple and clear:

Best practice building block 2: Proper scheduling starts with clear logistical positioning

First of all, we need to take a closer look at a very important logistical target: the service level. This is the ability to deliver a required quantity of products, articles or components to the internal or external customer by the required or agreed deadline.

Almost all companies have an idea of how high the service level should be, without there having to be consensus between different departments such as sales, logistics and production. How strong the effects of the targeted service level are on the inventories required for it remains just as hidden in the fog of logistical fuzziness as the actual service level ultimately achieved, which only a surprisingly few companies can measure at all inventory levels. Logistical fog, however, stands in the way of efficient scheduling. That is why we dedicate ourselves to basic principle 3.

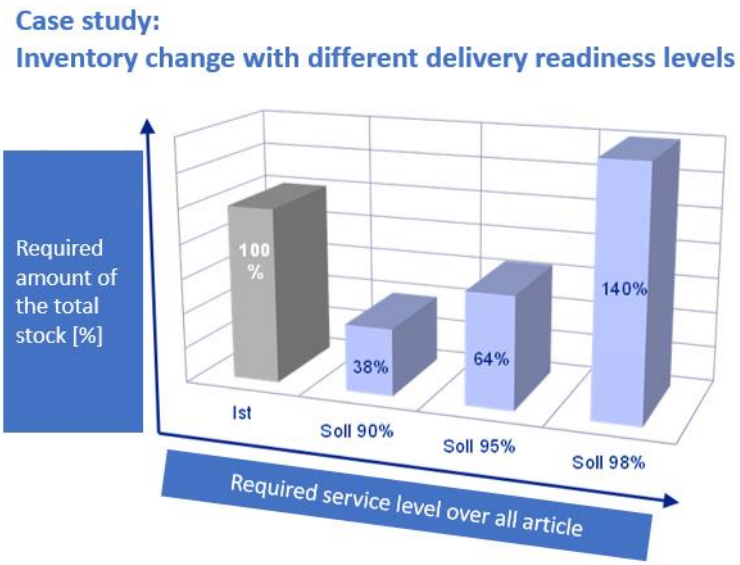
Basic principle 3: service level is not a variable

Service level is not a variable that is randomly generated at the end of a scheduling process, but rather a predefined variable that the entire scheduling process must be geared towards achieving.

The required service level to the market is an essential strategic parameter for the planning and control of the entire supply chain.

The various corporate divisions often like to define the key figures in such a way that they can best present themselves with them. We do not want to argue about the "right" definition here; depending on the boundary conditions of a company and its market situation, there may well be different truths. However, it is indisputable that a generally valid definition of service level is necessary for all areas in a company and that a clear article-specific (!) specification of the service level to be aimed for must be set by management.

If the correlations between the desired service level and the required inventory could be determined with the standard tools available in the company, the "right" service level would be fought over more intensively.



Especially for items with irregular demand, inventories explode the higher the service level to the buyer side is supposed to be. Items with regular demand, on the other hand, react less sensitively to high levels of service level.

Experience shows that you often do not need the same service level at every warehouse level and for every material and every item. Today, which service level leads to which stock levels for which articles can be precisely calculated with the help of scheduling simulation systems. In this way, you can determine exactly what your service level will cost you and whether you can and want to afford it or what you have to invest in inventory and thus money in order to stay competitive.

Best practice building block 3: In an efficient scheduling system, the required service level is defined for each item and is checked regularly.

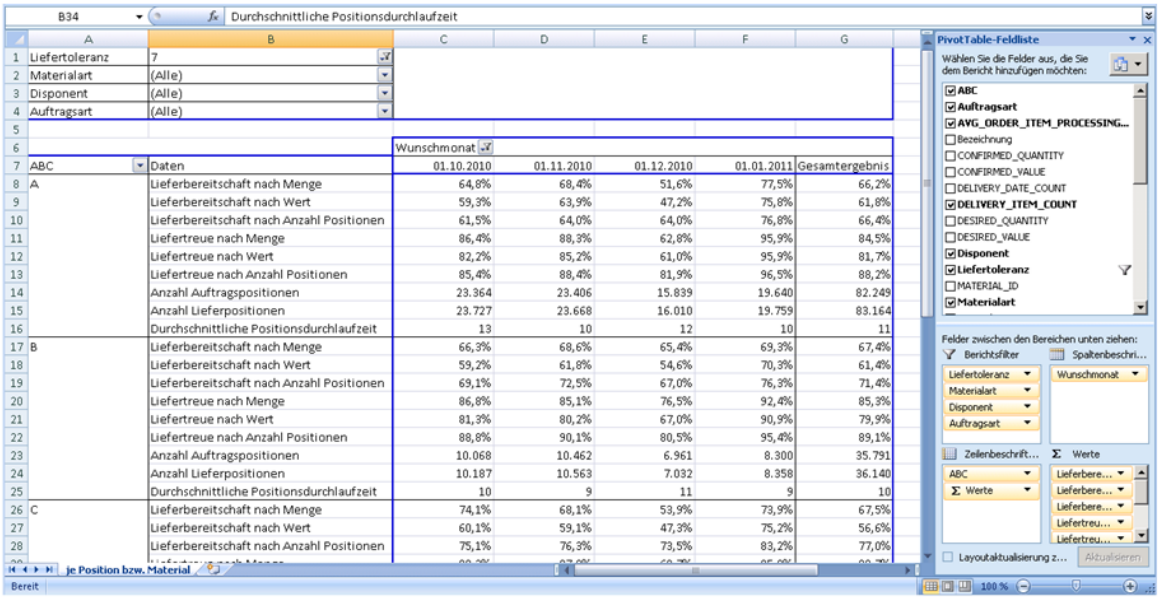
Specifying the target service level without measuring the actual service level achieved later is a pure "shoot-and-forget strategy". You will only achieve a control mechanism if you create instruments with which you can determine and track the achieved actual service level on an item-by-item basis at all warehouse levels. Unfortunately, basic principle 4 applies in most companies.

Basic principle 4: Correctly assess service level

Most companies do not know their service level and systematically overestimate it.

All problems and uncertainties in the entire procurement, production and distribution chain are ultimately expressed in two key indicators: the inventory in the entire supply chain and the achieved service level. The required service level is the decisive strategic parameter determined by the market and the competition. Inventory, on the other hand, is ultimately a consequence of the efficiency of the entire supply chain and the profitability of the value chain. Even if every company likes to reduce its inventories: the inventory remains a consequence of the supply chain and not a specification for the supply chain.

Report on service level and delivery reliability at order level



Liefertoleranz	7					
Materialart	(Alle)					
Disponent	(Alle)					
Auftragsart	(Alle)					
		Wunschmonat				
ABC	Daten	01.10.2010	01.11.2010	01.12.2010	01.01.2011	Gesamtergebnis
A	Lieferbereitschaft nach Menge	64,8%	68,4%	51,6%	77,5%	66,2%
	Lieferbereitschaft nach Wert	59,3%	63,9%	47,2%	75,8%	61,8%
	Lieferbereitschaft nach Anzahl Positionen	61,5%	64,0%	64,0%	76,8%	66,4%
	Liefertreue nach Menge	86,4%	88,3%	62,8%	95,9%	84,5%
	Liefertreue nach Wert	82,2%	85,2%	61,0%	95,9%	81,7%
	Liefertreue nach Anzahl Positionen	85,4%	88,4%	81,9%	96,5%	88,2%
	Anzahl Auftragspositionen	23.364	23.406	15.839	19.640	82.249
	Anzahl Lieferpositionen	23.727	23.668	16.010	19.759	83.164
	Durchschnittliche Positionsdurchlaufzeit	13	10	12	10	11
B	Lieferbereitschaft nach Menge	66,3%	68,6%	65,4%	69,3%	67,4%
	Lieferbereitschaft nach Wert	59,2%	61,8%	54,6%	70,3%	61,4%
	Lieferbereitschaft nach Anzahl Positionen	69,1%	72,5%	67,0%	76,3%	71,4%
	Liefertreue nach Menge	86,8%	85,1%	76,5%	92,4%	85,3%
	Liefertreue nach Wert	81,3%	80,2%	67,0%	90,9%	79,9%
	Liefertreue nach Anzahl Positionen	88,8%	90,1%	80,5%	95,4%	89,1%
	Anzahl Auftragspositionen	10.068	10.462	6.961	8.300	35.791
	Anzahl Lieferpositionen	10.187	10.563	7.032	8.358	36.140
	Durchschnittliche Positionsdurchlaufzeit	10	9	11	9	10
C	Lieferbereitschaft nach Menge	74,1%	68,1%	53,9%	73,9%	67,5%
	Lieferbereitschaft nach Wert	60,1%	59,1%	47,3%	75,2%	56,6%
	Lieferbereitschaft nach Anzahl Positionen	75,1%	76,3%	73,5%	83,2%	77,0%

The decisive strategic competitive parameter for the supply chain is the service level. And only the comparison of the required service level with the achieved service level opens up the possibility to intervene in the process.

Reacting first to the internal or external customer who is best known to the board or who shouts the loudest is not a regulation, but it is the daily business and management philosophy in many companies.

Let us therefore hold fast:

Best practice building block 4: Only the systematic measurement of service level and delivery reliability turn a second-rate "shoot-and-forget control" into a first-rate supply chain control.

Why the required service level has such a serious impact on the stocks of some items is due to the required safety stocks for items with uncertain demand, which leads us to basic principle 5.

Basic principle 5: Uncertain demand requires stocks or...

Uncertain demand requires stocks or costs service level.

If you do not know what demands will come your way, but still want to be able to deliver, then you must prepare for the unexpected by creating sufficient safety stocks. The more the internal or external demand for an item fluctuates without a systematic mechanism, such as seasonality, behind it, the higher the safety stocks must be for the same required service level. This is one of the main reasons why sales forecasting is so important in the company (cf. best practice rules for sales forecasting). Uncertainties that cannot be eliminated by a sales forecast have to be absorbed by

safety stocks. There is no way around this, even if many companies constantly try to do so by demanding high service level and lower stocks at the same time:

Best practice building block 5: Try to eliminate forecast uncertainties. The only way you can practically cushion the remaining uncertainty on the demand side is through safety stocks, whether you like it or not.

You must not overlook one essential starting point for achieving low safety stocks despite fluctuating demand:

The amount of safety stock required depends on the replenishment time, i.e. the time you need to replenish your stocks. The shorter the replenishment times, the lower the required safety stocks can be. At least when it comes to your own production, a short lead time can only be achieved in terms of planning with lower average capacity utilisation. Which brings us back to logistical positioning. Alternatively, you can change the architecture of the value chain by, for example, combining operations and thus reducing transition times. As promising as shortening replenishment times may be, reliable replenishment times are even more important than short ones, as Basic Principle 6 points out.

Basic principle 6: Unreliable replenishment times

Unreliable replenishment times make disposition hardly controllable

How do you generally react to unreliable replenishment lead times from suppliers or fluctuating manufacturing lead times of your production? If you want to be sure that the required material is actually available at the end of the replenishment lead time, you have to assume the worst case of the longest replenishment lead time in your ERP system - or cushion the fluctuation of replenishment lead times statistically - according to the required procurement reliability. The second variant is the more efficient one, but is probably not supported by your ERP system. Both variants ultimately mean, in turn, that you build up safety times and thus safety stocks - now on the stock receipt side. Because every early delivery leads to additional stocks.

Uncertainties in delivery times should be avoided as far as possible for the reasons explained. On the procurement side, a disturbance variable analysis and clever integration of suppliers into the scheduling mechanisms can be used for this purpose. In your own production, the first thing to do is to make the delay measurable at the component level and then proceed according to the system "deadlines are fixed, capacities are variable". More on this in a later article, which will deal with the supplementary best-practice modules for production control.

Best practice building block 6: Try to improve the on-time delivery performance of your suppliers. You can only intercept a lack of delivery reliability on the stock receipt side through safety times or stocks. In a professional scheduling system, this is done through safety times that are determined based on procurement security.

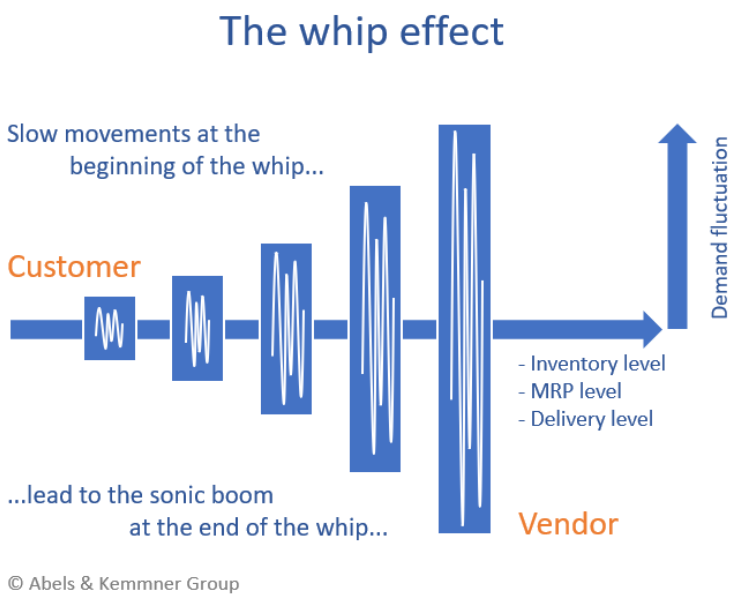
Short and stable replenishment times are unfortunately still not sufficient for best-practice disposition. You must also observe the 7th basic principle.

Basic principle 7: Leap changes in replenishment lead times

Jumps in replacement times lead to jumps in demand.

Do you know the easiest way to get your customers to bring forward their requirements and send you more orders at short notice? Tell them that your delivery times (for whatever reason) will be temporarily extended by two weeks. If the organisation works for your customers, then their schedulers will enter the extended replenishment time into the ERP system (unless they switch to an alternative supplier - here the concept has a "small" flaw).

During the next MRP run of the ERP system, the requirements of two additional weeks are suddenly due and one day later you have a two-week requirement of additional customer orders or call-offs on the table. If you are like most companies, you are not prepared for this wave of demand on the procurement side, whereupon your ERP system quickly reorders raw materials and purchased parts. You can imagine what happens next:
A maelstrom of demand sweeps through the supply chain and sucks the warehouses dry from one planning level to the next.



If you later take out the two-week extended replenishment time in one fell swoop, the reverse mechanism happens and the demand backlog leads to a wave of overstock that pushes through the supply chain.

But that's not all: the consumption or order history of the affected items will show stronger fluctuations in the future, which may lead to safety stock levels being ramped up in the supply chain.

As you can see, even the intermittent change of replenishment or delivery times can lead to a logistical earthquake!

Instead of making sudden changes to replenishment or delivery times at longer intervals, it is important to communicate even minor changes to your own customers on a regular basis. You

should demand the same from your own suppliers and at the same time continuously measure the change in delivery times of your suppliers.

However, practice often looks different: In supplier integration projects, we repeatedly find that replenishment times have not been maintained for months and sometimes years. The simplest method for us to shorten delivery times is therefore often to simply ask the supplier if they can deliver at shorter notice. So let's hold on to that:

Best practice building block 7: Changes in replenishment lead times must be checked and updated regularly and at short notice, and delivery times must be communicated to customers regularly and at short notice. This avoids the whip effects in the supply chain described above. A set of tools that allows you to continuously monitor changes in replenishment and delivery times is indispensable for best-practice planning.

If you have the replenishment times under control, you have to turn to another basic parameter of logistics, the batch size. Here, basic principle 8 applies.

Basic principle 8: Isolated batch sizes jeopardise adherence to delivery dates

Batch sizes set in isolation for individual materials jeopardise adherence to delivery dates, service level and low stocks.

Why do you work with batch sizes in scheduling? Typically because lot size "1" sounds fancy and trendy but is often not feasible for various reasons. You will only be able to order or manufacture a few products in lot size "1" because it is too expensive. Larger lot sizes in procurement often allow purchasing to negotiate cheaper unit prices and reduce freight costs. Larger lots in production reduce the frequency of cumbersome and occasionally expensive set-up.

If one questions fixed minimum and rounding lot sizes, one often finds that, especially in production, most lot sizes have been determined more by gut feeling than by objective criteria. However, the setting of lot sizes intervenes deeply in the sensitive dispositive gears between parts and storage levels. Correctly set batch sizes can save a lot of money; incorrectly set ones can destroy a lot of money. Five factors play a decisive role in batch size optimisation:

1. Economic efficiency,
2. the technology,
3. Capacity,
4. the spread of order times and
5. the quantity synchronisation of the production stages.

How many of these criteria do you take into account when determining your batch size?

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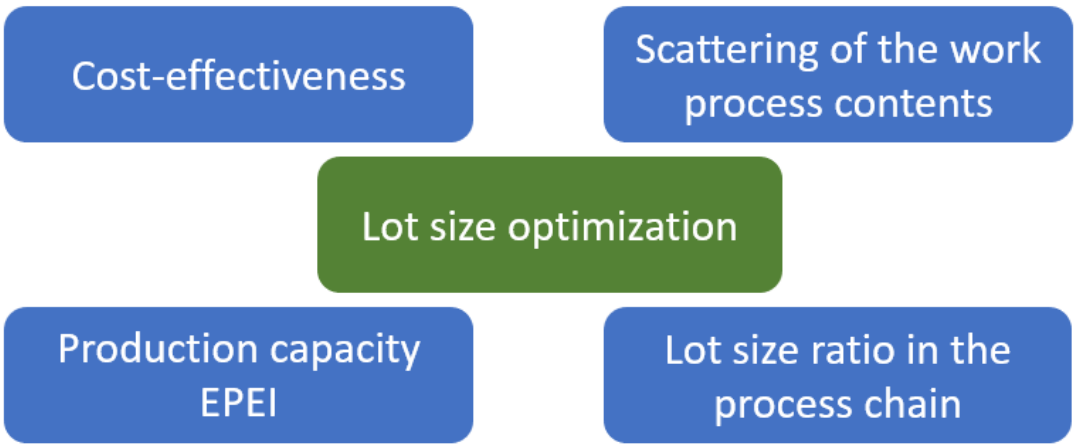
Influencing parameters in lot size optimization



Partly, batch sizes or batch size increments are technically determined. If eight parts are produced simultaneously in an injection mould, then it is sometimes technically difficult to use only four nests of them in the production process. More problematic, because it is usually linked to larger batches, is a process like barrel plating. If your process is set to a batch size of 3000 parts, you cannot run through this process with a significantly different number of parts without compromising quality.

If you manufacture several parts over a production capacity and reduce the batch sizes for each of these parts, you may find that the number of set-up operations increases to such an extent that the available plant capacity is not sufficient for set-up and production. You can solve the problem to some extent through setup optimisation. At some point, however, set-up optimisation becomes so expensive that it no longer makes sense. The limited capacity, the required set-up effort and the required production time result in precisely calculable production lot sizes that cannot be undercut. A smaller batch size might be desirable, but is not feasible for capacity reasons. In almost every production there are such cases of capacity-related batch sizes.

If your product is structured in several BOM levels, then you usually also produce in several sequential production levels. The lot sizes on the individual production levels should be in an integer ratio to each other, unless they vary synchronously from order to order. This further restricts you in determining the lot sizes.

After these de facto batch size requirements and restrictions, there is little room left, at least in manufacturing, for one of the supposedly most important batch size criteria: economic efficiency. When determining economic batch sizes, inventory costs on the one hand are compared with ordering or set-up costs on the other. By combining larger requirement quantities, sometimes from the distant future, into a production or procurement lot, you allocate the necessary procurement costs or set-up costs to many parts so that the costs per part become lower.

On the other hand, you have to keep the parts in stock for a long time, which increases inventory costs. The usual methods for calculating economic batch sizes used in companies struggle with

numerous shortcomings. Cost variables included in the consideration are often inaccurate, the economic efficiency calculation does not take capacity limits into account and ignores the interaction of lot sizes at the different disposition levels. It almost doesn't matter that all popular methods for calculating economic lot sizes are purely approximations, which are sometimes far off the true economic lot sizes.

Last but not least, the working hour contents of different production orders that are run via the same production capacity should be as equal as possible so that you can achieve a high capacity utilisation with low circulating stocks and thus short throughput times. This requirement also ultimately translates into batch sizes.

These considerations should make it clear:

Best practice building block 8: Efficient scheduling cannot do without batch size optimisation, but it requires systematic batch size management and not isolated command actions.

Especially when it comes to lot sizes, it becomes clear how uncritically and without a sufficiently deep understanding of the interrelationships many companies and users mess around not only in lot size determination, but in the entire disposition. Your interest in these explanations already shows that this statement does not apply to you.

Especially not if you also handle safety stocks properly, because:

Basic principle 9: Manually set safety stocks are mostly wrong

Disposition is very often about statistics, and it also plays a major role in the determination of safety stocks. Unfortunately, humans do not have a sense for statistical correlations. This can be seen very clearly in an example outside of logistics: every year, an average of five people die worldwide from shark attacks, while 150 people are killed by coconuts on beaches. Despite this, beaches in the tropics are full of sunbathing tourists. However, if a shark is reported to have been seen within tens of miles of a beach, no one goes into the water.

Since one cannot rely on a reliable sense of statistical correlations, it is extremely clumsy to set safety stocks manually. The supposedly sharp look at past stock trends, sediment analyses or the acute experience of a stock-out are also poor advisors for determining the size of safety stocks.

Unfortunately, most ERP systems are of limited help in the statistical determination of safety stocks: if safety stocks can be determined automatically at all, they are usually based on insufficient statistical concepts and only refer to supply safety stocks and not to procurement safety stocks. The fact that the ERP system cannot do something is no excuse when it comes to achieving best practice levels; sufficient tools and mechanisms exist to determine safety stocks correctly. Therefore:

Best practice building block 9: Safety stocks on the stock receipt and stock issue side as well as in production must be automatically calculated, adjusted and built up based on robust statistical mechanisms in order to achieve best practice disposition.

Determining the amount of safety stocks correctly is critical. But creating them in the first place can be even more problematic. The reason for this is the next basic principle 10.

Basic principle 10: It is too late for safety stocks

If safety stocks are needed, it is too late to build them up.

Safety stocks are unpopular because they supposedly only cost money but bring in nothing. Many companies are therefore reluctant to actually build up safety stocks. On the other hand, they take every short period of time during which they did not have to touch the safety stocks as an opportunity to reduce the stocks again. When there is actually a fire - and there will be a fire! - it is too late to build up the stocks.

In the best case, the build-up takes time and the market exercises patience. Often, however, the supplier or the company's own production is no longer able to deliver the required quantities. Safety stocks can usually only be built up at times when they are not yet needed. That is why we should hold on to them:

Best practice building block 10: Identify the required safety stocks regularly and build them up in time, i.e. before they are needed.

Stocks are an organisational lubricant in the logistical gearbox. Consequently, inventories are also very suitable for evaluating logistical performance.

Basic principle 11: Basic stocks versus safety stocks

Basic stocks result from the architecture of the value chain, safety stocks from its process stability.

Let's imagine that the entire value chain would function without any disruptions: no irregular replenishment times, one hundred percent adherence to production schedules, no quality problems whatsoever, customers collecting their ordered goods on time, etc. Would such a process chain be inventory-free?

If it is to work as cost-effectively as possible, of course not, as we know! It would hardly make economic sense, for example, to procure each screw from China individually and deliver it in sync with demand. Stocks that are necessary for the operation of such an ideal value chain are called basic stocks.

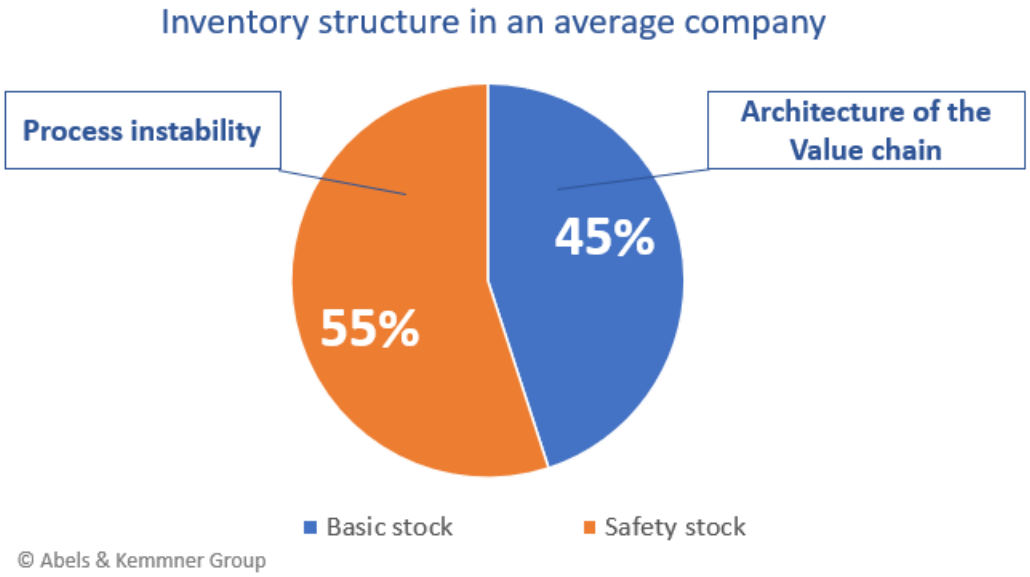
Working without stock, i.e. without basic inventory in the value chain, is a theoretically conceivable solution, but not one that makes business sense. At some point in every supply chain, you reach the point where the further reduction of inventories at other points in the value chain causes more costs than the inventory savings reduce. We refer to this total cost minimum in the following as the "optimal operating point".

Skilful changes to the architecture of the value chain make it possible to work with lower basic stocks at the same costs, i.e. to shift the optimal operating point towards lower stocks: By creating variants late in the process, as close to the customer or market as possible, you will manage with lower basic stocks.

The same applies to a smaller number of inventory stages, a very early logistical decoupling point or highly flexible production. Not every measure is technically feasible and almost every one also incurs costs. The optimal operating point will therefore probably never be at basic inventory zero.

Even if we succeeded in realising an economic value chain with basic inventory "zero", we would still not necessarily manage without inventory in the real world. In the real world, the value chain is affected by an infinite number of disturbances, most notably fluctuating demand, unreliable delivery times in procurement and production, and quality problems.

To cushion all these disruptions, the safety stocks already discussed in detail are necessary. Safety stocks are no small matter! In the average company, safety stocks account for 55% of total stocks compared to 45% basic stocks!



Basic and safety stocks are therefore a good indicator of where in the value chain further improvement measures need to be considered. Required basic stocks indicate starting points for improving the architecture of the value chain, while the necessary safety stocks point to places where process instabilities need to be reduced. While everyone likes to look at logistical measures to reduce base stocks, often without being aware of the difference between base stocks and total stocks, logistical process safety is often forgotten. As a further best-practice building block, it should therefore be noted:

Best practice building block 11: Unreliability in the logistics chain that cannot, should not or must not be eliminated must be intercepted by safety stocks.

If the central logistical variables discussed are set correctly, the task is to use them to plan and control sensibly and efficiently:

Basic principle 12: One must understand disposition mechanisms very precisely

One has to understand disposition mechanisms very precisely in order to be able to judge under which boundary conditions which procedure is suitable and how its parameters have to be set in order for it to work.

Classic push controls such as MRP II are no longer "cool", but rather "out". Everything is striving for lean production and "pull control": reorder point control and above all kanban (shuttle cards) are "in". Both are very old procedures that were already in use before the age of computers, pendulum cards at least as early as the Middle Ages. There are many reasons for the renaissance of pull control, but people tend to overlook the fact that push control was once developed to overcome certain disadvantages of reorder level control and that there is practically no such thing as pure pull control.

Pull control in its classical form is primarily suitable for uniform average requirements of recurring articles with a fluctuation variance of up to 1. Pull mechanisms can be deformed in such a way that they also function for one-off and small batch production, but then they no longer provide any advantage over push control.

Reorder level control 100 years ago meant that a mark was placed in the warehouse at the stock level at which new material had to be reordered. Reorder level control today means that the stock level in the warehouse is tracked via the book inventory and the reorder is triggered when the book inventory level is fallen short of. In order to save booking effort, retrograde booking is popular today. Material is only booked out of a warehouse when the production order requiring the material has been processed and confirmed. The old material is only debited when the new material is added to the warehouse. As a result, the book inventory always lags a little behind the physical inventory: not a happy starting situation for electronic reorder level control. Retrograde posting and reorder level control do not go well together.

Kanban control is also nothing other than reorder point control, but one that is oriented towards physical stock. In contrast to reorder level control, in the kanban system one observes the increasing empty containers and not the decreasing stock in the warehouse in order to trigger replenishment. A manual Kanban system has no problems with retrograde debiting of book inventory, for example. Problems in the Kanban system occur in many companies when it comes to calculating or recalculating the required number of cards or containers in the control cycle.

While reorder points are regularly adjusted, Kanban stocks are left constant for as long as possible. While at least qualified planners know that a reorder level is made up of basic requirements and safety stock, the safety stock in the kanban control loop is often forgotten or set "by feel". The fact that the required service level must be included in the calculation when designing a kanban control loop is no longer even part of the expertise of many consultants.

Classic multi-level reorder point and kanban control cannot cope with seasonal demand and trends. In such cases, it is not enough to regularly re-dimension the control loops and reorder points. Instead, special mechanisms such as parabellum control or reorder level control with MRP are needed to adjust to increasing or decreasing demand at lower planning levels in time to be able to serve the increase or decrease in demand at the higher planning level. If you do not know how to

handle this because you do not have the knowledge or the functionalities in the ERP system, then it is better to use MRP in such cases.

Several articles ordered from the same supplier or procured with the same transport carrier must be planned in combination in order to, for example, achieve full containers, exceed minimum order values or adhere to order budgets.

The examples could be continued at will, but it should already have become clear:

Best practice module 12: An efficient disposition uses a broad repertoire of disposition procedures depending on various boundary conditions and item characteristics and never lumps all items together in terms of disposition.

However, the differentiated application of different scheduling procedures for different articles only shows the tip of the iceberg of efficient and process-stable scheduling, because there is no static relationship between articles and all their master data and parameters that has to be set once. Rather:

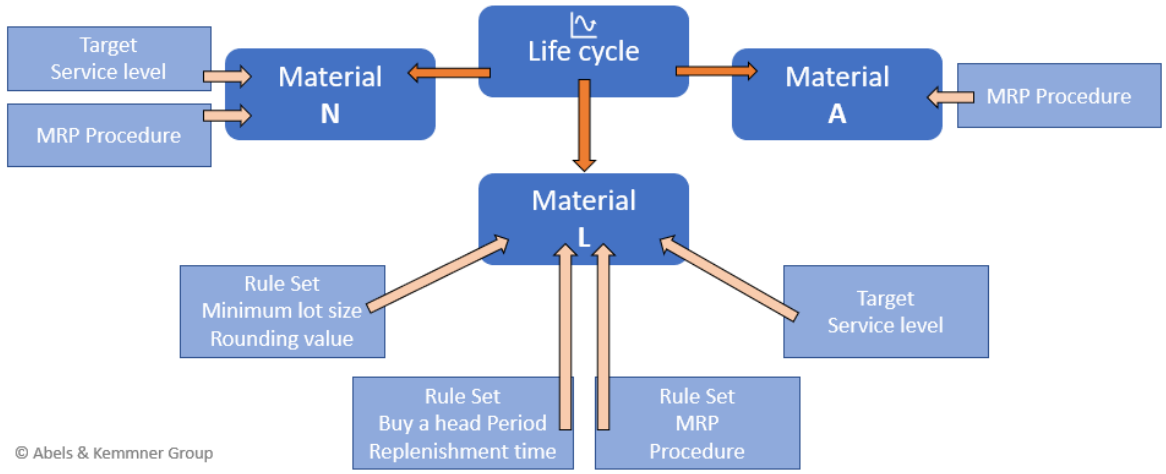
Basic principle 13: Continuous adjustment of master data and parameters

The planning, forecasting and scheduling procedures and master data of an item must be continuously adapted to changing requirements.

Even if it rarely happens in practice: There is a consensus that central logistical master data, e.g. batch sizes or replenishment times, must be regularly adjusted to changing situations. That the ongoing readjustment also applies to the other logistical parameters of each article is much less well known. An article that used to be subject to strong fluctuations in demand may now run quite smoothly. Whereas in the past few customers demanded this article or the end product in which this article is incorporated, today it may be ordered by a large number of customers. With such changes, a different MRP procedure may need to be set for the item. The ongoing updating of MRP procedures, parameters and master data is not an exception, but a regular requirement that is often ignored in practice.

Which rules are to be applied to which articles and how does not depend on the logistically relevant characteristics of the articles. Necessary criteria to be considered in any case, but far from sufficient, are the importance of an item for turnover (ABC), the fluctuations in demand for an item (XYZ), the number of demand generators behind an item (STU) or the life cycle in which an item is located (ELA).

Example of a decision tree for MRP-relevant logistical quantities of materials



The realisation that articles need to be maintained leads to corresponding activities only surprisingly slowly in many companies. Dispatchers are often instructed to check and adjust the master data of their articles more regularly. So everyone does what they think is right - one does this, the other does that! A strange generosity that the same companies do not grant their production. For the production processes, it is clearly defined with which technical procedures, which process parameters and in which work steps the parts are to be processed. Anything else would hardly lead to reproducible, reliable manufacturing processes. In order to arrive at an efficient best-practice disposition, the following applies as a matter of course:

Best practice module 13: The parameters, planning, forecasting and scheduling procedures that are set under which boundary conditions must be uniformly defined in clear business rules and not left to the individual views of the individual schedulers. The parameter settings are defined as a function of logistically relevant item properties.

How do you achieve uniform business rules? Please, not by rounding up the entire disposition and discussing the right hiring rules together! Here it is necessary to observe another 14th basic principle.

Basic principle 14: Gut feeling as a stock driver

The dispatchers' gut feeling is one of the biggest inventory drivers in the company.

The term "behavioural economics" is used in economics to refer to numerous papers on the influence of gut feelings and supposed experience on business decisions. It would go too far to discuss the details here. But the conclusion of the studies can be reduced to a simple denominator: Neither professional nor private investors beat the market. Successes achieved through "good", or better formulated "lucky" decisions in one place are cancelled out in another. The reasons for this are the same for disposition as for shares and other securities and lead to disposition makers overestimating their own experience and gut feeling. Moreover, scheduling decisions and thus

scheduling rules and regulations have a greater impact on the entire value chain than any human being, no matter how experienced and intelligent he or she may be.

Rules set by hand or based on the supposed experience of schedulers or consultants alone may lead to reproducible scheduling results, but they also cement the "underperformance" of the entire value chain. Bad scheduling cast in clear rules still remains bad scheduling. The following therefore applies to top companies:

Best practice building block 14: The right scheduling business rules for high-end scheduling are optimised by means of simulation for maximum logistical performance and minimum value chain costs and not set according to experience and gut feeling.

If you have defined clear rules and, by means of a differentiated simulation, set the rules in such a way that you achieve the required logistical positioning with the lowest possible costs, then you have taken a big leap forward. Now don't make the mistake of trying to regularly maintain the settings of the articles by hand according to the set of rules, because:

Basic principle 15: Do not maintain data manually

Data maintenance is too time-consuming to be carried out manually.

To keep the data quality high, the parameter settings must be maintained monthly according to the rules and regulations. This cannot be done manually for two reasons:

Firstly, the pure item-specific monthly entry of changed master data according to the rules and regulations would be too labour-intensive and time-consuming and thus not manageable manually.

The second reason is the classification of articles: Sets of rules are largely based on classification properties of articles. For example, if an article belongs to the class of articles in the process of production, it is handled differently from an article that belongs to the class of articles in the process of production. The classification of an article is sometimes based on extensive calculations. This is already clear from the "standard classifications "ABC" and "XYZ". These calculations must be updated with each maintenance run, which cannot be done manually.

Software systems that can process such sets of rules suggest the necessary setting changes per item to the user. The suggestions can still be revised by the user and must be released by him for uploading into the ERP system. This semi-automatic method is the only way to ensure that the "mass" data maintenance that is actually required is actually carried out on a regular basis. Therefore:

Best practice module 15: Rules and regulations must be applied semi-automatically to the entire range of articles on a monthly basis. For this purpose, the articles must be reclassified according to their logistical characteristics.

Slowly, you have fought your way through the undergrowth and cultivated the forest of disposition again. Reliable disposition parameters were an essential step towards this, but still apply:

Rationale 16: Does ERP system help with decisions?

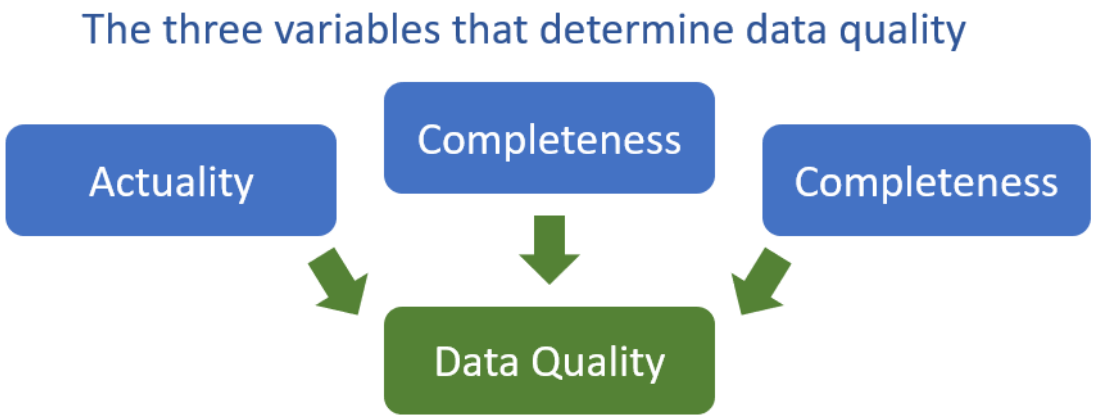
An ERP system with yesterday's information cannot make decisions for tomorrow.

Unfortunately, it is not enough to have determined correct logistics sizes for specific articles and to have coordinated scheduling procedures. If the ERP system lacks information about the current status in production, procurement and delivery, it will be of little help to you.

How is the ERP system supposed to make correct inventory decisions if the inventory information in the system is wrong or available much too late? How is it supposed to schedule production orders correctly if the required input material is not delivered on time by the supplier? If procurement does not regularly check this important and critical date and at least enter schedule changes in the ERP system when it becomes aware of them?

In the case of production orders with longer lead times through production, the completion of individual operations may need to be reported back so that the ERP system has a sufficiently up-to-date overview of the capacity loads on the individual production lines. We have already discussed elsewhere how seriously incorrect delivery times affect the support efficiency of the ERP system.

These few examples already prove: maintaining the scheduling parameters alone is not enough to build a usable ERP system. Just as a car is useless without petrol, an ERP system is useless without data fuel in the form of current transaction data. In this context, transaction data includes not only inventory values, but also delivery, replenishment and throughput times, production progress and delivery status.



A company whose ERP system maintains all data accurately and up to date is on the verge of bankruptcy - it is too time-consuming and cost-intensive to keep all values up to date. Even in residents' registration offices, which operate "citizen data management" with large departments, the data quality is below 100 %! The art of data quality management in the ERP system is to know under which boundary conditions at which point in the planning steps which accuracy is required and how strongly deviations in topicality, quality and completeness of the data affect the planning quality of the ERP system.

As a key best-practice building block, we must therefore state:

Best practice module 16: Status information on procurement, production processes and capacity loads must be reported back to the ERP system in a sufficiently timely, complete and error-free manner so that the system can make reliable decisions. Regular audits must check whether feedback is sufficiently up-to-date, complete and error-free.

A well-maintained and properly tuned ERP system lays the foundation to move forward on the best practice path and work on eliminating another deficiency in many companies:

Basic principle 17: ERP system only expensive typewriter

In many companies, ERP systems are only used as expensive typewriters

Imagine that in production everyone does what they want. There are work plans, but you don't necessarily have to stick to them if you know better. Instead of working according to clear specifications and quality criteria, everyone does it the way they think is right and of sufficient quality. You mean that doesn't exist in modern companies? Certainly not in production, but it does in the handling of planning and scheduling processes. Worse still, the proportion of companies that work in this way is on the increase!

Paradoxically, the improved user-friendliness and transparency of many ERP systems as well as the development of so-called cockpits, which present all the information required for a user decision in a clear and often graphically supported manner, have played a major role in this. The supposed transparency of information often acts as a gut feeling amplifier for the user, and it is out of the deceptive feeling of false security that decisions are now really made.

This regularly recognisable effect does not speak against the improved user-friendliness of such tools. But it does show that discipline is required in their use. Even if this is often not demanded because people are not aware of its necessity.

You can only achieve process-stable, reproducible planning and scheduling processes that are more independent of the fluctuating experience and overestimation of humans if you automate your planning and scheduling processes more strongly and humans only intervene for two reasons: Firstly, to correct wrong decisions of the system that result from the fact that the system could not have known certain decision-relevant information. Secondly, to readjust the "tuning" of the system (the rule sets) if the system has made a "wrong" decision that it could have made correctly if the parameters had been set correctly.

Of course, these principles cannot achieve the precision and reproducibility of the CNC programme of a machine tool. However, the goal must be that 80 % of the system proposals can be "waved through". This can also be achieved if the best practice rules discussed above are consistently taken into account. For the remaining 20 % of system proposals to be corrected - and only there - the "cockpit effect" tends to have a positive impact. However, there is always the danger of replacing wrong proposals with wrong gut feelings.

A best-of-class disposition must therefore also offer system-side support for special disposition cases, such as discontinuation and run-in planning, spare parts management or the joint disposition of several articles.

Best practice building block 17: Planning and scheduling processes must be automated in a way that is as process-stable as possible and therefore strongly rule-based, and system support must also be available for special scheduling cases.

The ERP system is set up correctly, data is reported back cleanly, scheduling processes run automatically as far as possible - what still stands in the way of success? In many companies, first and foremost the poor forecast data on which scheduling must be based. An essential prerequisite for the success of scheduling is the sales and demand forecast, because the following applies:

Basic principle 18: Vague assumptions are poison for any disposition

Vague assumptions about future needs are deadly poison for any disposition.

Rarely can the disposition allow itself to be based on concrete customer needs. For a large part of the items, you will have to rely on assumptions about the future development of demand.

Steering effectively with a poor demand forecast is like trying to sail a powerful ship successfully without knowing which way the wind is blowing.

We have already discussed the best practice rules required for an efficient sales and demand forecast elsewhere (see Best Practice Rules for Sales Forecasting). Here we just want to state:

Best practice building block 18: A best practice disposition builds on a best practice forecast and a powerful plan distribution calculation.

If you meet the best-practice criteria described, then your scheduling is really working at a world-class level. With regard to production control, however, there are still some lights to be lit in order to regulate production according to best-in-class criteria.

A new world of disposition

Companies that have implemented the best-practice building blocks described live in a new disposition world:

Disposition decisions are made faster and more reliably and are significantly less dependent on the experience and gut feeling of the individual user. Staff turnover in scheduling is less critical.

The ERP system finally does what it is supposed to do: It handles the mass of routine tasks and leaves the schedulers the time to deal with the really tricky issues. The planning and control process becomes more transparent and efficient, stress, hecticness and frictional losses between the company divisions decrease.

However, the new world not only offers a calmer working environment, but also hard-hitting business advantages: A more stable service level in the market leads to more satisfied customers and

lays the foundation for sales increases and higher market shares. It also leads to less rerouting in manufacturing, which has a favourable impact on production costs, reducing the total cost of the value chain.

Experience from numerous projects shows us that an inventory reduction of 15 % to 25 %, combined with a more stable and better service level, can be achieved if the control systems have been optimised in a sufficiently differentiated manner. In addition, further automation of the scheduling processes reduces the required personnel expenditure by 25 % to 45 %.

A new world that can be reached without risks and bestows its benefits on everyone who consistently sets out on the path!