The Case for Better Material Planning and Control in ERP

Intro

A number of functions in ERP systems for industrial organizations manufacturing and assembling products have not fundamentally changed since their inception. The limitation at the time of design of ERP systems lead to limited functionality in some important aspects of material planning and control of what nowadays is demanded by modern industrial organizations.

With the changing nature of production companies; bigger, more products, more variety, faster delivery requirements, that limited functionality has started to become a restriction in production, with potential cost and schedule implications.

This article is making the case for a much better way to handling the material planning and control in ERP.

For more than 4 decades I worked at the cross section of Industrial Logistics and IT. I learned a tremendous lot from the many ERP implementations I did as an ERP consultant and Project Manager. I saw many Material Planners and Purchasers struggling with the Material Functionality restrictions of their ERP system. That gave me the idea that, when adapting this Functionality to today's industrial companies requirements a lot of people working with these systems in daily live would work with their ERP system a lot happier.

Jacques Selders, ERP consultant, February First, 2021, The Hague, The Netherlands.

What is ERP?

Enterprise Resource Planning, known as ERP, stands for a set of, more or less, integrated systems that industrial organizations today use to organize, control and administer their production processes. It can be a set of separately automated systems that interconnect and integrate to form one system of control.

These automated systems are mainly supplied by global software manufacturers such as SAP, Oracle, Microsoft, Infor, IFS, Workday, Epicor, abas, Deltek and Sage (Top 10 ERP suppliers 2020) and a range of smaller software suppliers, including Dutch software companies such as Exact and Afas, which are often more tailored to specific niche markets within the manufacturing industry.

On LinkedIn I often see the demand for ERP specialists. Despite the economic crises that we have experienced in recent decades, including the worldwide Covid-19 pandemic in 2020, ERP is very much alive in industry, which says something about the extent of industrial activities that are taking place, and are still expanding and developing. Not only in the Netherlands, my home country, but worldwide.

And that is fully in line with my own experience as an ERP consultant in recent years, in which I have been involved in many ERP implementation projects at home and abroad in both smaller and larger organizations. As with all these things, spending waxes and wanes, but on a par investing in newer, better ERP systems continues unabated.

What is in ERP?

There is a range of functions in every ERP system which work to a greater or lesser extent the same in every ERP system. Examples are:

- Quotation processing
- *Customer Order* processing,
- *Purchase Order* processing,
- Shipping processing,
- Invoicing processing for Sales and Purchasing,
- Outside Services processing
- Goods receipt processing
- Forwarding

These functions support order processes within the ERP system where a series of related documents (read: order types) are used.

In addition, there are a number of functions that support the external and internal flow of goods within an industrial organization, such as:

- Receive goods in Inspection and Warehouse management,
- Goods flow management between warehouses.

Then there are series of functions in which all basic data in an ERP system is supported, such as:

- Item Maintenance and
- *Bill of Material* (BOM) Maintenance, where each material, component or raw material is assigned its "own" unique item number, but also
- Customer Data Maintenance and
- Supplier Data Maintenance
- Outside Service Maintenance
- Vendor Requests for Quotes Maintenance
- Shop Resource & Employee Maintenance

In most ERP systems from the large software suppliers, the financial administrative functions such as Administration and Chart of Accounts with sub functions are now also fully integrated. Often a series of functions are available to support financial settings and parameters in the system like Financial Site Maintenance and related functions.

There are, however, several ERP software suppliers who have created additional groups of functionality or functional areas for specific parts of the industrial organizations using those systems. CRM or Customer Relationship Management and QM or Quality Management are examples. Those additional systems or groups of functionality try to cover areas within the industrial organization with special functions like Sales and Marketing or Product Quality Control. In most ERP using organizations these groups of functionality often interrelate with the ERP system in place. Sharing the same data and tables like customer- and product tables which are used throughout the ERP system in such an organization.

ERP works from "sand to customer"

For readers who are not familiar with ERP systems and the processes that such a system must be able to support, the following happens every day in the manufacturing industry:

- A *Customer Order* leads to the demand for an end product;
    - a finished product is usually produced on the basis of a finished product *work order*;
    - a *work order* is handled based on a list of required materials and components (a *bill of materials* or BOM);
    - these components are either made by the production organization itself as a semi-finished product via a semi-finished product *work order* or
    - purchased via a *Purchase Order* if inhouse manufacturing is not an option.
- A *Purchase Order* ultimately leads to the delivery of materials, components and raw materials, which is accompanied by a receipt document at Forwarding or in the Warehouse. This means that the goods can be stored in the warehouse and entered as stock in the ERP system.
- The supplier sends an invoice based on this receipt, which is then processed in the ERP system and the supplier can be paid if the receipt is complete and in line with the *Purchase Order*.
- When the end product *work order* is ready, end products can be delivered to the customer.
- A shipping document or packing slip is created which activates the delivery.
- One or more shipping documents can lead to one or more invoices for the customer and the customer pays the invoice if the shipment is in accordance with their *Customer Order*.
- This makes the circle complete; from order receipt to sending the invoice to the customer and payment by the customer.

The system works “from sand to customer”, as is often quoted in the ERP world.

The nucleus of ERP

The nucleus or core of any ERP system is the Planning function, which is usually split into 2 parts: planning of factory orders and workstations on the one hand, and planning the availability, supply and removal of products, materials, components and raw materials required for sale and the manufacturing process on the other. And it is not without reason that this forms the core of the ERP system because the planning function directly supports the value adding (core) processes of the manufacturing enterprise, and the production processes, on which their value and existence in the market is based.

Production Planning Developments in ERP

Although newer versions of ERP have been developed and released, the question is, are those ERP’s much better? Or is the innovation and improvement mainly on the side of automation tools; computers, databases, cloud computing and internet connectivity, better designed (touch) screens, more intuitive and user friendly with keystrokes, Barcodes, QR codes, query functions), faster performance, and so on,

making it easier for us to operate these tools all day? But what about the fundamental concept of such ERP systems and how they actually function? Has that been developed and innovated at all? Or has that become a standard that is now no longer questioned?

If you examine the development of ERP systems over the last 30 years, it becomes evident that ERP software suppliers have been responsible for some renewal of the manufacturing process planning functions, and arrangement of the required capacity.

Various ERP suppliers have developed new ways and programs for planning or scheduling the production and manufacturing process, such as the workstations and machines on the production floor, and the deployment of the production employees; the capacity you need to actually be able to undertake production and make the products that are required by the customers of the organization.

These developments and innovations are often based on the findings of Eliyahu Goldratt[1] and Peter Senge[2] (The Fifth Discipline; theory and practice of the learning organization), who's theories became accepted paradigms in production environments. Goldratt's Drum-Buffer-Rope concept[3] has now been built into a number of ERP systems for the planning of production, the *work order*s on the production floor, and the workstations and machines.

Production and capacity planning is but one factor, and it can never be disconnected from the planning of the raw materials, materials, components and semi-finished products that are required to be able to make a subassembly or end product out of 'loose elements', materials or parts. Ultimately, making and selling end products is what determines the added value, and hence profitability, that a business organization has in its market.

But what benefits has a production plan, or planning, that functions well and indicates what needs to be made by whom, at what time, in such a way that all customers can be optimally served (on paper), while the material needed to make those products is not well planned or available? The answer is simple: production will come to a standstill and the production plan will therefore not be achieved. On time delivery will not be possible.

The ability to deliver on time, every time, and to fulfill the promises to the customer, in other words, to

[1] Goldratt, E. M., & Cox, J. (2016). The goal: a process of ongoing improvement. Routledge. (reprint of 4th edition – original version published in 1987)
[2] Senge, P. M. (2006). The fifth discipline: The art and practice of the learning organization. Currency. (2nd edition, original version published in 1990)
[3] http://www.lean-manufacturing-japan.com/scm-terminology/dbr-drum-buffer-rope-theory.html

maintain a high degree of delivery reliability, is of crucial importance for business sustainability and survival.

As an industrial organization you do not want to end up in the situation that 1 screw of 10 cents missing can stagnate the completion of a machine worth 100,000 euro's, with all the consequences that entails for both the customer and the production organization.

Material planning lags behind

In the last four decades, very little theoretical or practical innovation has been evident with regards to the planning, control and management of materials and material flows in relation to functions in ERP systems.

The only development I have come across in that area in recent years is a concept called 'Demand Driven Material Requirements Planning' (DDMRP). This involves keeping critical production items, materials and components in stock, so that production levels can be maintained. However, the MRP function included is no different from any standard MRP function within any ERP system.

Materials Requirements Planning (MRP) is a standard function in almost every ERP and it is based on the concept and thus the logic of US theorist and IBM engineer Joseph Orlicky[4], who wrote a book on MRP, in 1975.

It describes how in an industrial company the materials from the *Bill of Materials* (BOM) of the requested products in *Customer Order*s, and *work order*s, are checked for availability on a product-by-product basis. Orlicky further elaborated his concept to include forecasting demand, and demand for materials and components, from fixed production schedules called *Master Production Schedules* (MPS). The production organization enters the prediction schedules and fixed production schedules into the ERP system and maintains them on a periodic basis. A fixed production schedule or MPS is then a schedule in which certain products will always be made in a certain quantity, regardless of whether there is demand for them or not.

Where MRP 'calculates' that material shortages will arise, the system has to create so-called *Planned orders*. Such a *Planned order* is not a real *work order* or *Purchase Order* but a suggestion to create a real *work order* or *Purchase Order* in the system so that, theoretically, the intermediate products, materials, components and raw materials will still be available to process the final product *work order*s in time and deliver *Customer Order*s on schedule.

[4] Orlicky, J. (1994). Orlicky's material requirements planning. McGraw Hill Professional. (2nd edition)

A *Planned order* contains a quantity and the item number, a number with which to fabricate or purchase that item, and the latest date by which the item should be available in order to meet the requirements delivery date.

The quantity in a *Planned order* therefore represents the sum of all shortages on the respective Part that appear to arise within a certain planning period, from all *sales order*s and *work order*s, that should be ready or able to start production in that planning period, and which require the same material or component. A planning period is a time unit, for instance, a week, or number of days.

Orlicky's concept was based on the capability of the technology in his day. Computers could process multi-level *bills of materials* (BOM's); however, the computing capacity and the database storage capacity were very limited and expensive. Therefore, such an MRP run was often carried out only once a week, and, if it was a large database involving calculations of many article numbers, a run could take more than a day or night. That is why this activity was often performed during weekends.

What is a *bill of materials* (BOM) and how long does an order take?

A *Bill of Materials* (BOM) is the list of materials and components needed to make a product, similar to the IKEA bill of materials to assemble a cabinet. A multi-level BOM is the hierarchy of all lists of materials and components to make the end product. The components themselves are made up from other materials and components, and therefore each may have their own 'private' BOM- or parts list.

Consider the example of the assembly of a car consisting of a chassis, body, engine, wheels and interior. The engine itself consists of a series of components (subassemblies) wherein there are further components that in themselves consist of parts. A car therefore is composed of a hierarchy of sub-assemblies, sub assembly components and individual components.

You can completely drill down the multi-level BOM of a car to the lowest level of every piece of material, component and raw material that has to be brought in from 'outside' in order to eventually be able to make that car. The lowest level is usually the level at which the materials, components and raw materials are either purchased, or must be made available from own stock.

MRP is therefore able to calculate through such multiple levels of BOM from top (end product level) to bottom (purchase level) in order to determine the need for materials, components and raw materials at each level. MRP does consider that there may still be materials, components and raw materials in stock or semi-finished *work order*s which are going to produce stock, and that *Purchase Order*s are already running in the system.

In an MRP function, it is common for each article, material or component included in the MRP run to have an acquisition time or lead time, i.e., the amount of time it takes to acquire, or receive the item, material, or component.

For example, a *work order* takes a week for the finished product or intermediate product to be ready. The supplier, with whom a *Purchase Order* for a specific item has been placed, takes 3 weeks to produce and deliver. So, if MRP suggests a *Planned order* in case of shortages and it is converted to a 'real' *work order* or *Purchase Order*, the lead time will be subtracted from the demand date stored in the *Planned order* to 'calculate' when the *work order* or *Purchase Order* should start or be placed.

MRP does this regardless of the fact that such a start date could be placed in the past. And this can happen when obtaining materials and components through purchasing takes longer than the period required by the customer to have his goods delivered. In fact, this happens quite often, and for planners and buyers who work with MRP, it is considered as one of the most annoying problems in the ERP world. Every planner understands that planning in the past is impossible and a system that suggests this will only result in misinformation and confusion.

MRP output leads to confusion

As previously mentioned, a *Planned order* is the sum of all shortages of a certain material or component in a defined planning period. However, demand for that material or component is not just from *sales order*s and *work order*s, but also from forecasting demand and fixed production schedules or MPS. All requirement quantities (as the demand for materials and components is also called) are combined in such a *Planned order*.

It is therefore impossible to identify from the *Planned order* exactly where the various needs originate from, and what exactly such a *Planned order* will cover if it is to be converted into a 'real' *production order*, or *Purchase Order*, to cover those needs or requirements.

If you, as a material planner or buyer, seek to know where those needs or requirements come from in more detail, and how such a *Planned order* could cover which requirement at what point in time with what quantity, you will have to go to an overview screen in the ERP system that provides that information. Such an overview screen is usually called *Material Planning Window*, where you can analyze item by item, material by material and component by component which orders, of which type, have caused the demand and which *Planned order* could possibly cover this at what specific moment in time.

That analysis of demand and coverage is then calculated on that screen, by the screen program for only that specific material or component making it transient information, that disappears as soon as the next component or material is called up on screen for the same analysis. This analysis and its detailed results are not stored in the database with standard MRP, so they cannot be used in subsequent analyses and other programs within the ERP system.

In Orlicky's time, this way of working was understandable. In those days, a material planner or buyer worked with perhaps between a few dozen and a few hundred article numbers, materials and components and the whole of the material planning was easy to oversee. As previously mentioned, computer and storage capacity were limited and expensive. In addition, most of the industrial enterprises of the day worked with the idea that you could produce anything 'on stock'. The assumption was that what you had made would be consumed or sold at some point in the future anyway. Production on stock was the norm and not surprising, Orlicky's MRP concept supported that completely.

Changes at production companies

However, a lot has changed in recent decades in the field of controlling and managing production processes, and production organizations, due to market demands and the pressure on the processes from the perspective of cost control and cost development. Competition both nationally and internationally has increased enormously, and product prices are under constant pressure. No longer do production organizations make and sell only one product or one type of product, but often a whole range of different end products and variants to overcome that competition. Leading not just to a few hundred article numbers, but thousands, if not tens of thousands. Besides that, they are also forced to produce at the lowest possible cost and pass on the price advantage to their customers in order to maintain their market share.

Changes in automation

Digital technology developments have not stood still either. As early as 1975, Intel CEO Gordon Moore wrote an article about the development of the number of transistors on computer circuit boards that has been published as Moore's Law[5], which is the observation that the number of transistors on an integrated computer circuit board doubles every two years. This is due to the simple fact that transistors, circuits and chips on a computer circuit board are getting smaller and smaller, and buyers of circuit boards are demanding more and more functions on an ever-smaller circuit board surface.

[5] https://www.investopedia.com/terms/m/mooreslaw.asp

Consider the development that have taken place since 1975; the computers used when sending people to the moon in the 1960s could only do a fraction of what computers (or your smart phone) can do today and that development will continue in the same way for the time being.

Storage capacity has become much larger (and cheaper) and with advanced databases and database tools we can now do much more, at a lower cost and with faster computers. This in turn put pressure on software development and developers as the market becomes less and less willing to continue to pay high rates for software development for those computers.

A different material planning approach is required

What does all this have to do with developments in ERP systems in general and with, and about, new ways of material planning and control specifically? As discussed previously, a *Planned order* generated by standard MRP does not provide sufficient granularity of data on the total materials and components requirement.

And when you look at what is required of production organizations today, that is precisely the problem. Detailed information about the demand for articles, materials and components and their coverage is crucial to control the demands required. And the way planning and control of both production and materials work currently should be aligned with this.

The logic of the current MRP is based on the capacities of past computing, ergo: that logic is now no longer valid. It is necessary to develop a new kind of MRP mechanism in which everything that the MRP encounters in terms of requirements calculations can be recorded in detail in the ERP system. Producing 'on stock' is outmoded and no longer fit for purpose.

Most production organizations only start producing and purchasing when there is a demand from their customers for their product. Only those materials and raw materials that cost little and are widely used are still kept in stock for a long time. So being able to know in detail exactly where the demand comes from and who, or which order is responsible for it, has become crucial. Additionally, being able to:

- identify exactly to which order, or which piece of stock, that the production organization already has 'in house' could be allocated, or
- the production result of which semi-finished product *work order* could be allocated to which end product *work order*,
- or which *Purchase Order* that still has to be delivered can be assigned to which end product *work order* or *sales order*,

has also become crucial. But if all information is merged, as is the case with *Planned order*s in an ERP system with standard MRP, you do not have access to such individual detailed information.

It is therefore incredible that such an MRP concept and the standard MRP function in ERP systems have not been developed and evolved in that direction. Lack of computer power and the costs that it entails can no longer be the argument, given Moore's Law.

Huge increase in product variety

There is another argument that has become of crucial importance for material planners and buyers in modern production environments. Due to the increase in the variety of products, materials, components and raw materials, the number of items numbers in the ERP database, which MRP uses to perform its analysis and create *Planned orders*, has increased significantly. Whereas in the seventies a few dozen to a few hundred article numbers had to be managed, nowadays it is easily a few thousand to tens of thousands of production article numbers, components, materials and raw material numbers.

As a material planner or buyer sitting behind a *Material Planning Window* to do your work, while the set of *Planned order*s generated by the system can change daily, it is hopeless (and thankless) to work through thousands of item numbers, screen by screen, to try to understand the consequences of the MRP results for the production and ultimately the *Customer Order*s and consequently the customers. In the many years that I have spent as an ERP consultant, at many companies, I have never encountered a material planner or buyer who was able to do that.

There is a standard function in MRP that allows for the creation of exception reports, article number by article number, that indicate, for instance, that certain *Purchase Order*s must be postponed in time, or that certain required stock has too much or too little available. But if you have to work with thousands of item numbers, the number of exception reports is almost unmanageable and provides more confusion than useful information to the people who have to work with it every day.

And that, too, is a complaint I heard from material planners and buyers at many of those companies: MRP provides more questions than answers in the execution of the material control and planning work, and; the lack of clarity due to the enormous number of exception reports.

How to determine priorities?

What would have to happen in ERP systems to allow planners and buyers much better information? It started with a question from a material planner employed by one of the many manufacturing companies I have worked with and it got me thinking. This material planner was also responsible for

procurement of the materials he planned within that company:

> *"After running MRP, how can I see in the ERP system which Purchase Orders, that have already been created in the system, are actually no longer needed because the need for the items, materials and components, noted in the Purchase Order line, has disappeared and these items, materials and components within the current set of production orders and Customer Orders are now NO longer required and are therefore no longer needed according to MRP?"*

For a buyer, having hundreds of *Purchase Order*s running in the system at the same time, and where those *Purchase Order*s must match the demand for end products from *Customer Order*s as closely as possible, it is a fairly obvious question. The material planner/purchaser in question needed detailed exception reporting on this point because he simply did not have time to review all MRP results related to all *Purchase Order*s. However, with the results from standard MRP with only *Planned orders* that do not highlight the *Purchase Order*s or *work order*s that are no longer needed, that question is impossible to answer, while for a production company, that is not an illogical question to ask, both from the perspective of flow of goods as well as cost control.

A new kind of MRP

To be able to do that, you actually need a new kind of MRP that would be able to record the calculations and the result of material requirement analysis in detail in the ERP database; a mechanism by which both the intermediate and the end results are stored into the ERP database at the moment that they arise. Both in, or with, *sales order*s and end product *work order*s. That should be seen as 'from'(demand) information: where does the demand for products, materials, components and raw materials actually come from?

In addition, it needs to record the available stock and *work order*s recorded in the ERP system that must 'deliver' their production results to other *work order*s along with the *Purchase Order*s that are already running in the system and have yet to be delivered, wherein it is recorded, in detail, which *sales order*s or *work order*s, with product at the highest level of the BOM, can be covered by those *work order*s at lower levels of the BOM and/or *Purchase Order*s. You can see that as the 'to' (deliver) information: where should this piece of stock, or quantity produced in this *work order*, or quantity to be purchased by means of this *Purchase Order*, actually be delivered to?

For each *sales order* and/or finished product *work order*, it should be recorded in detail which part of the stock and/or which part of the already running semi-finished product *work order*s, and/or which part of the *Purchase Order*s created in the system, can be used to achieve coverage of the demand for the item that is on that *sales order*, or in the BOM of the finished product *work order*.

If there appears to be insufficient stock to cover a *sales order* or finished product *work order*, the system should check whether there is a semi-finished *work order* that could take care of that cover in the short term or whether it could be covered by one or more pending *Purchase Order*s if the manufacturing organization has outsourced production of such a material or component. For that stock and semi-finished product *work order* as well as that *Purchase Order*, it would then have to be recorded in detail who (so which *sales order* or *work order*) requires coverage and with what quantity.

If there is not enough stock and/or no semi-finished product *work order*s and/or no *Purchase Order*s, this should lead to the creation of a *Planned order* for the requested material or component, whereby the source of that demand can be recorded in detail.

The acquisition time or lead time should be subtracted from the requirement date in the *Planned order*, so that the program ensures that the date on which the *work order* or *Purchase Order* should start does not end up in the past, but at least on the date on which this new kind of MRP program is running.

And if this threatens to jeopardize the coverage that that *work order* or *Purchase Order* must provide, because that *work order* or *Purchase Order* cannot 'deliver' on time, a warning or alert should immediately be raised and flagged in the system, for this specific *work order* or *Purchase Order*, to allow the material planner or purchaser to focus his or her attention on this.

This whole mechanism could then be extended to include demand from forecasting and fixed production schedules (MPS schedules) where a comparable detailed recording of demand and coverage can take place.

What is the priority setting by the degree of coverage?

The sequence in which this new kind of MRP should fulfill the requirements of those *sales order*s and end product *work order*s should be the delivery date requested by the customer and/or the desired date of the end product *work order*, i.e., the date when that *work order* should be ready. All open *sales order*s and *work order*s in the ERP system should then be included in that 'new type of MRP' sequence.

Standard MRP is based on a requirement calculation from item to item in the order items are stored in the article table in the ERP system. All article numbers in the article table of the ERP system are checked article by article to determine whether or not a *Planned order* for such an article should be created in the system, and with what quantity, and at what moment in time.

The MRP mechanism that I propose does this with open *sales order*s and *work order*s where the sequence, and thus the priority, is determined by the delivery date requested by the customer for *sales*

*order*s, and the desired date of *work order*s on which the *work order* should be ready.

Such a method of sequencing and prioritizing is much more appropriate for today's complex business organizations working with ERP, since it better determines what is important and at what moment in time, which the standard MRP is unable to do.

Because new orders are added every day in a dynamic business environment; deliveries take place, *Purchase Order*s are received; production orders are created and completed; new products are added; production processes change; all of this impacts on everyday priorities. This new kind of MRP will give valuable insights not currently available.

Coverage with stock reservation is another matter

The experts of ERP systems will probably say or think: but if you record in such detail in an order where the coverage must come from, and record in detail in the stock or *Purchase Order* what it is intended for, then is that not the function 'allocate' or 'reserve' that most ERP systems are already capable of in some form?

Whilst this may seem to be the case, there is a big difference: allocation or reservation often takes place on a limited scale for one or perhaps a few orders; if material has to be put aside for this, for example. However, the MRP mechanism that I propose deals with ALL open orders, of every kind, and analyzes and maps the complete material situation, and position, of the entire production organization. This creates insights into the course of the goods flow processes, and the goods position, of the entire industrial enterprise, which is a fundamental difference.

Exception reporting provides time savings and insights

The entire handling of this new kind of MRP and all calculation results, and intermediate results, are thus recorded in detail in the ERP database. Consequently, almost any form of analysis reporting of the results, be they the cross-sections of demand on the one hand, or the coverage on the other, can be made. The reporting can then be organized in such a way that only the exceptions are reported, and the orders that can be fully covered are not reported separately again.

A material planner and/or a buyer then only has to invest time and energy in the exceptions and not in the things that are running well. The additional benefit is that a material planner and/or purchaser can work in a very focused way and solve material planning and control problems much easier and faster

than with the one type of *Planned order*s from standard MRP. The well-known 80-20 rule[6] would most likely apply, i.e., 20% exceptions or special situations to report, in which to invest 80% of his or her time, while 80% continues as 'business as usual' without any problems.

It will make questions such as, which *Purchase Order*s have actually become redundant after running the analysis because there is not a single *sales order* or *work order* in the system that requires the materials or components on the *Purchase Order* line, relatively simple to answer.

All *Purchase Order*s in the ERP system that should still be delivered but where no requesting order is noted in the *Purchase Order* line next to the item number, where the 'to' or 'where to' information is missing, could be selected on an exception report that filters on this.

All data (read: *Purchase Order*s) that appear on this exception report qualify for further analysis because they are apparently no longer needed. This raises the question why were the *Purchase Order*s created in the system, and perhaps also by whom, and what value do they represent. This does, of course, only apply to those *Purchase Order*s which have not yet been delivered by the supplier. Purchasing items that are not actually required is not a useful activity for a business organization, especially considering the cost of stock.

Recording intermediate and final results in detail helps management

If you consider the possibilities for a business organization to additionally create or, realize for itself, in terms of control of the business organization as a whole, and based on detailed data and information recorded in the ERP system by such an MRP mechanism, you will perhaps come to astonishing conclusions. This method and way of working creates special and positive side effects: –

With additional analysis and report programs, you can determine and calculate how well, as a business organization, you are able to meet all demand for products in all *Customer Order*s, and *work order*s, at any point in time.

- You can express that as a percentage; the percentage of covered *sales order*s compared to the total *sales order*s currently running in the ERP system, for example.
- And you can do that with *work order*s too; how well are all requested materials and components covered, expressed as a percentage of the total number of *work order*s that exert that demand for materials and components. Not only with finished product *work order*s, but also semi-

[6] https://www.investopedia.com/ask/answers/050115/what-are-some-reallife-examples-8020-rule-pareto-principle-practice.asp

finished product *work order*s. Additionally, you can also do this with *Purchase Order*s, for instance.

- It could answer the question: how well is the entire set of pending *Purchase Order*s, expressed as a percentage, able to meet all requirements and needs for items, materials and components and what percentage of all pending *Purchase Order*s 'does not actually serve anything?' In a well-functioning company, that has its planning in order, this percentage should be zero.
- And if you were to run such a type of MRP function every day, you could additionally plot that data in a trend analysis, over time, and use it for Key Performance Indicators (KPIs) to determine the qualitative and quantitative performance of these processes within the organisation.

This allows for meaningful answers to the management question: "How well is the organization actually doing and where should adjustments be made?" I am not aware of an ERP system where the standard MRP function is able to produce such data and answer such questions.

Save material planners and buyers from routine and manual work

In the ERP system with such a function, it is therefore possible, with that 80-20 rule in mind, to further automate the 80% regular flow of orders. Instead of just generating *Planned orders* where coverage is lacking, you can also have *Purchase Order*s and/or semi-finished product *work order*s automatically created with a particular administrative status. These would only need to be checked by the material planners and buyers, and then finally approved with a particular status, when pending orders are to be entered and released in the system. All the routine work of manually entering *work order*s and *Purchase Order*s is thus taken off their hands.

Preventing waste helps the environment

Such a way of working also fits very well with the current societal developments in the field of environmental sustainability. The motto is to eliminate waste and promote reuse of scarce materials, resources and raw materials, and from an economic point of view, prevent the waste of money.

If the business model is client or demand driven, then such a new kind of MRP mechanism would check first what can be drawn down, because it is possibly already available as usable stock. If out of stock, determine first to make what is required or purchase it, but only if there are *Customer Order*s against it. That way you ensure that neither too much, nor too little is made and consumed. This prevents waste of materials and raw materials and by definition has a beneficial effect on both the environment, cost of production, and the pricing of products.

Purchasing in large quantities because it would be cheaper, appears in the long run to yield no price and/or cost advantage at all, and it risks creating stock that is either no longer sellable, or needs to be processed into different intermediate and end products, or thrown away. This is a waste of potentially valuable materials and raw materials and entails costs that by definition erode the company's margins.

Proof of Concept

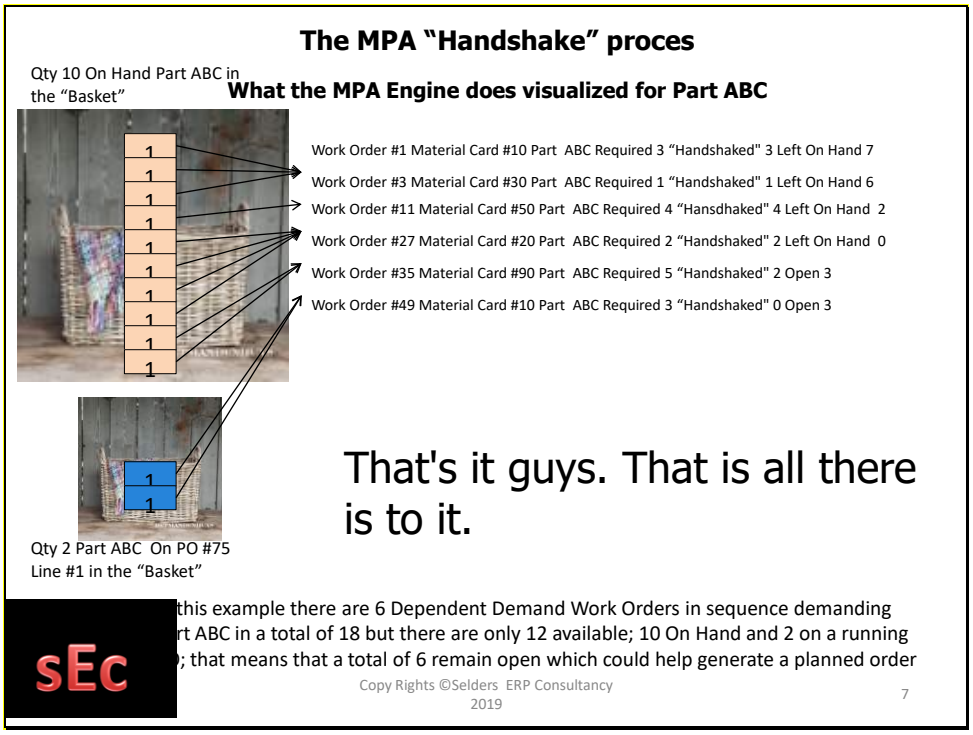
Perhaps you are now wondering why am I so sure that such a new kind of MRP function and mechanism could work in ERP systems in the way I describe? The answer is because I have tested it in an ERP in a working production environment. Thanks to a client where I implemented an ERP system in the past, I have had the opportunity to build a pilot program. And it does exactly what I have described above.

All intermediate and final results of this new kind of MRP calculation are recorded in detail for all requesting orders as well as supplying stock and orders. Everything I have indicated regarding analysis and reporting possibilities with such a new kind of MRP function turned out to be possible, detailed useful information is truly 'available'.

What is that concept and how does it work?

The concept of the pilot program is actually very simple. As already mentioned, all current *sales order*s and finished product and semi-finished product *work order*s are listed in order of requirement date. The order that should be delivered first, according to its requirement or demand date, is also the first to make a claim on the required item number and quantity. This claim with the requested quantity can be done on the free stock, current semi-finished *work order*s or *Purchase Order*s, which are going to deliver the requested item.

In the first instance, it is always checked how much of this item number is in stock, or still in stock. In the list of orders placed in sequence by demand date, there are almost always several orders that require the same material. But the first order to act may also be the first to claim the available stock.



Visualizing the Concept of this new kind of MRP

An example:

Suppose there are 10 pieces in stock of item A and the first order in the line, Order #1, needs 4. The program then records in the *sales order* line, in addition to the quantity required, the quantity that may be taken from that stock. There are then 6 left for succeeding orders.

With that stock item A, it is recorded that 4 pieces of the 10 could be allocated to order #1. Now order # 2 is next and it asks for a different article number; but the same thing happens. Now order #3 is next and it appears to have a need for item A; 8 pieces to be precise. But there are only 6 left that could be allocated from the free stock.

In the *sales order* line of order #3, next to the required quantity 8, the 6 pieces fulfillment from the free stock is recorded and it is additionally recorded that these 6 are coming from free stock. However, 2 more pieces have to be found for order #3. The program will then search for a *work order* that is already in the system and from which item A will be produced. Should such an article be able to be purchased, as well as manufactured, manufacturing it is generally faster and cheaper, therefore the program first searches for a *work order*.

Suppose there is not (yet) a single *work order* for the item, perhaps simply because item A has never been manufactured but always purchased. The program will then continue to search if there is already a *Purchase Order* with one or more *Purchase Order* lines with which item A can be purchased.

Suppose there is a *Purchase Order* #20 with that item number that has not yet been delivered, with quantity 10. Two of these are 'claimed' for order #3 and 8 pieces are still open for subsequent sales or *work order*s that will have a need for item A in the course of the program. In the *sales order* line of order #3, in addition to the 6 pieces that were already committed from free stock, the 2 pieces are also recorded, and that they come from *Purchase Order* #20. So, the *Purchase Order* ID is also recorded there. In the *Purchase Order* line of *Purchase Order* #20, in addition to the quantity 10, the quantity 2 is recorded and also to which *sales order* and *sales order* line those 2 could be assigned. So, the order ID and order Line ID of order #3 are recorded in the order line of *Purchase Order* #20.

If there is no *Purchase Order* at all for item A, item A is eligible to have a *Planned order* created, in which case it is noted that the requirement (in this example, the remaining quantity of 2 pieces) comes from order #3.

And so, the program continues until all *sales order*s and *work order*s that require items, materials and components have been completed.

After this run, all orders now have the detailed data of the free stock coverage and/or the coverage from semi-finished product *work order*s and *Purchase Order*s. It is then known over the entire set of orders how the free stock and *work order*s and *Purchase Order*s are used to provide coverage. And in the stock records and order records of the *work order*s and *Purchase Order*s that provide that cover, specific details of intended cover are provided.

That stock, and those semi-finished product *work order*s and *Purchase Order*s that do not contain this detailed information, are then clearly not requested by any *sales order* or end product *work order*. And where *Planned orders* have arisen, there is apparently a shortage that must be supplemented in the foreseeable future in order not to stagnate production. But because all this data has been recorded in detail, material planners and buyers can also work in a very targeted manner utilizing real, and realistic, exception reporting.

Material Positioning Analysis: more than just a new kind of MRP

The current way of working, nor the concept behind it existing in current ERP systems with standard MRP is no longer adequate. Much more can be done with material requirement planning than current

standard MRP provides for industrial organizations working with ERPs in the 21st century.

I have called the concept and function Material Positioning Analysis (MPA), because of the analysis possibilities offered by the approach as well as the way in which materials, components, semi-finished products and raw materials are placed and positioned in the business production process by the program, and by the function, and have registered it at the Benelux Office for Intellectual Property.

Through the proof-of-concept test, it is my considered opinion that it can completely replace the MRP mechanism and the MRP function in ERP systems. The preconditions under which this function operates are the same as those that also apply to standard MRP.

In the ERP system, all stocks listed therein must be accurate and reliable and must correspond to the actual physical stock in the warehouses. The article table and BOM table must be in order and properly maintained. The parameters that are set in the article table for each article in the ERP database in order to run MRP properly and optimally also apply here. Here too, in the event of shortages, so-called *Planned order*s can arise, which, before they are converted into real *work order*s and *purchase order*s, can be assessed by material planners and purchasers. The *Material Planning Window* and the mechanism to convert *Planned Orders* into real ones are still valid here as well, and in principle, MPA is possible with all ERP systems that have standard MRP.

There is one caveat, however. Business organizations that would like to work with MPA must fully switch to the new mechanism. It is not possible to do both standard MRP and MPA simultaneously, as it would duplicate the *Planned orders*, so that ultimately the material coverage would never be correct should they be converted to 'real' orders.

If you would like to have more information about how the system works and why it works, please let me know at email address: j-t.selders@wxs.nl or search on LinkedIn for: Jacques Selders and send a message.

The Hague, The Netherlands, 1 February 2021