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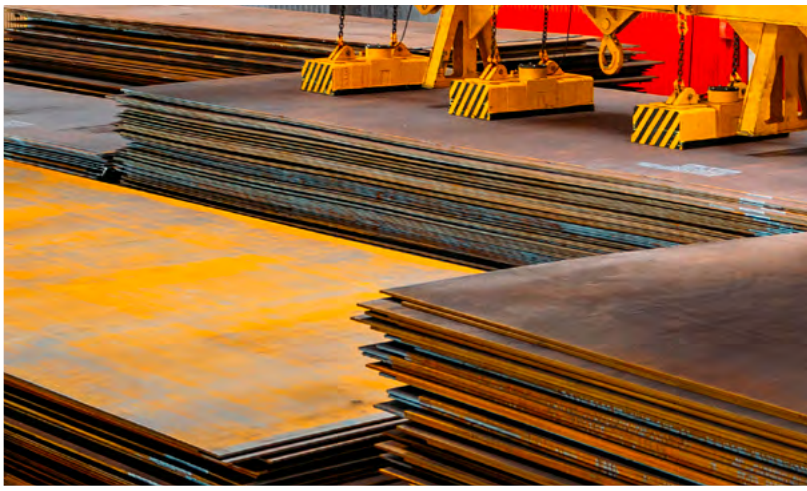
E-BOOK

Sales & Operations Planning in the metals industry

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Introduction

The metals industry has been showing increasing interest in S&OP in recent years. The reasons are clear: working capital is under permanent high pressure, raw material availability and prices are more volatile than ever due to global events such as Covid and conflicts of various kinds, and customers are becoming more demanding.

In this OMP e-book, we outline the principles of deploying S&OP in the metals industry and offer our best recommendations for running a more effective S&OP process, based on lessons learned in recent projects.

1

Why the metals industry needs S&OP

1.1 S&OP is about aligning demand and supply

Sales and Operations Planning, better known as S&OP, was developed in the 1980s as a process that allows large companies to align their business units by periodically setting the levels of manufacturing output and related activities in response to anticipated demand [*]. It operates on a tactical time horizon (typically months ahead) and includes managing future inventory, and supply and customer lead times based on sales forecasts and actual demand, as well as future capacity utilization.

More precisely, the purpose of the S&OP process is to align demand and supply departments, making sure that they come out of their silos and make decisions jointly with a view to the longer time horizon and the overall business goals. Companies producing fast-moving consumer goods, for example, must keep marketing and sales efforts in tune with supply constraints such as scarce resources and limited production, storage, and delivery capabilities. Who's happy with soaring demand if the organization doesn't deliver?

1.2 Siloed decision-making is a known issue in the metals industry

But S&OP should not be limited to make-to-stock businesses such as consumer goods. The concept is also meant to prove its worth in the more intricate make-to-order business of the metals industry. Indeed, **many metals companies also struggle with siloed decision-making and an excessive focus on the short term,** which are the prime grounds for putting in place an S&OP process. Here are a few examples from the metals industry to illustrate the point:

- **Unrealistic forecasting**—When a metals sales organization creates a forecast or books an order, they are making a series of assumptions about the production capacities that are going to be available. But our discussions with executives in the metals industry indicate that sales organizations tend to make forecasts based more on gut feeling than on quantified information of sufficient detail. We still see a lot of companies (re)setting sales quotas only once a year or once a quarter, failing to adequately monitor and update them. As a result, the volume of orders sales staff are allowed to book (or should pursue in the event of excess production capacity being available) is no longer realistic after a while. Running a genuine monthly S&OP process would solve the problem.

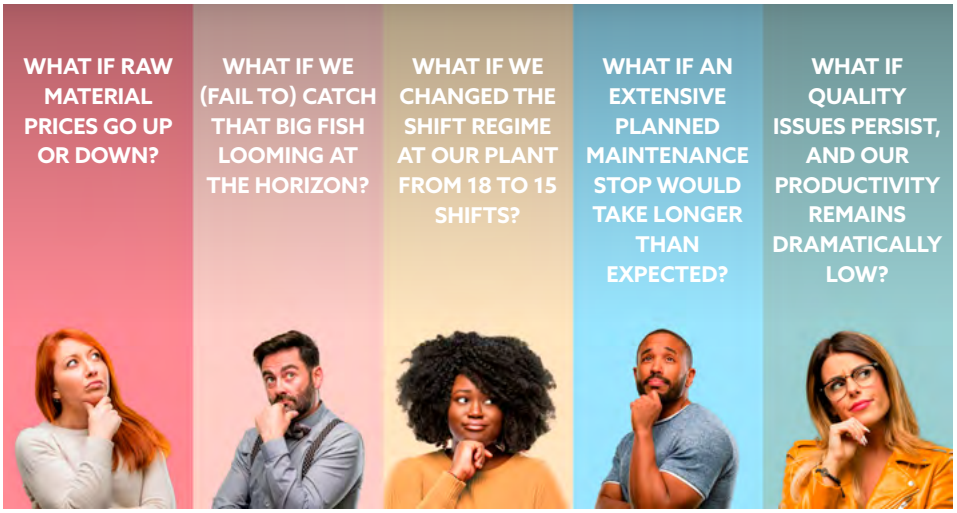
> Many sales organizations are forecasting more on gut feeling than based on quantified information of sufficient detail.

- **Victim of the bullwhip effect**—Forecasting is further complicated because metals production happens upstream in major market supply chains such as for cars, white goods, or even metal pipes for oil transport. Metals companies — producing coils, sheets, plates, bars, and sections etc. — are therefore significantly impacted by the 'bullwhip' effect from swings in downstream demand for cars, household goods, and oil.
- **Focusing on the short term**—Experience with metals companies shows that everyone across the metals supply chain focuses heavily on what happens in just the next few days or weeks, while failing to take into account the longer time horizon and act proactively. This means that firefighting prevails at the operational level and backlogs are a continuing concern.

* The term S&OP was coined by Walter E. Goddard and Richard C. Ling in their 1988 book 'Orchestrating Success: Improve Control of the Business with Sales & Operations Planning.'

1.3 The metals industry struggles with ‘what-if’ situations

Furthermore, everyone in the metals industry seems to **struggle with ‘what-if’ questions**, or at least with finding adequate answers to them.



All of this leads to **inefficiencies and missed opportunities** to optimize the product mix, which may result in rising inventory costs, running out of inventory at the worst moment, increasing lead times, lower service levels, and profits below expectations. It could also lead to last-minute changes on the production lines and products of lower quality, necessitating reworking or even scrapping.

> Failing to plan at a tactical level may result in rising inventory costs, running out of inventory at the worst moment, increasing lead times, lower service levels, and profits below expectations.

Here, S&OP can come to the rescue because it is **designed to make all the stakeholders in the organization work more closely together**, including sales, operations (production and logistics), supply chain, finance, and purchasing. S&OP also helps metals companies make decisions on a well-informed basis instead of gut feeling.

2

The metals industry is often at odds with standard S&OP theory

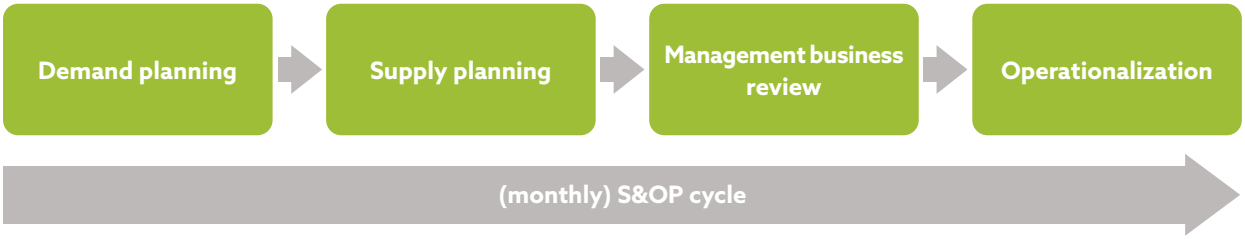
2.1 A lot of metals companies are disappointed with S&OP

But our discussions with executives indicate that a lot of metals companies are somewhat disappointed with the results of their preliminary S&OP initiatives. Barely workable, no real progress, only marginal gains, no scenario thinking: these are some of the reactions we got when we took part in executive meetings and talked to supply chain stakeholders in the metals industry.

2.2 S&OP theory in brief

But why should S&OP be less successful in metals? To get a handle on this, let's zoom in a little on S&OP theory, which has been well studied and documented, for example in the SCOR (supply chain operations reference) digital standard [*]. The S&OP process can be summarized as follows:

- **Demand planning**—The company's sales organization develops a sales forecast for the next 12 to 36 months, depending on the industry and market they are in. The resulting plan is called the tactical unconstrained demand plan.
- **Supply planning**—The supply planning organization uses this unconstrained demand plan to develop the related production, procurement, and distribution plans for the same period. They in fact create multiple scenarios, based on different assumptions about demand and supply, to deploy different ways to meet that demand.
- **S&OP validation**—The executive meeting, with C-level representatives from all parts of the organization, evaluates and compares the scenarios against multiple business criteria, and eventually decides which plan will be operationalized. This includes decisions on sales limits to be respected, opportunities to be exploited, volumes to be outsourced (make or buy), maintenance to be (re)planned, capacities to be shut down or reopened, and stock levels to be built up or reduced.
- **Operationalization**—Based on the decision made, the sales organization reworks the demand plan to fit the constraints of the selected scenario. The resulting demand plan is known as the constrained demand plan or the sales plan. Depending on the industry, this may include creating sales reservations (or quotas) for sales staff. In addition, the decisions are communicated to the supply organization and implemented, settling on the shift patterns to be run, new subcontracting to be organized, and additional raw material suppliers to be identified.



A typical S&OP process consists of demand planning, supply planning, taking management decisions, and putting these decisions into action (Source: OMP)

[*] www.ascm.org/corporate-transformation/standards-tools/scor-ds/

2.3 The supply-driven make-to-order reality challenges the standard theory

S&OP theory has been described at length in an extensive body of literature. However, most S&OP guidelines and textbooks focus on the consumer goods industry and fail to provide accurate advice on how some of the other industries can successfully implement it. The metals industry is a prime example challenging this standard theory because the industry is very different in many ways. Here are three root causes.

2.3.1 A volatile mix of orders

The demand side of metals companies is a complex and volatile mix of orders coming from three sources.

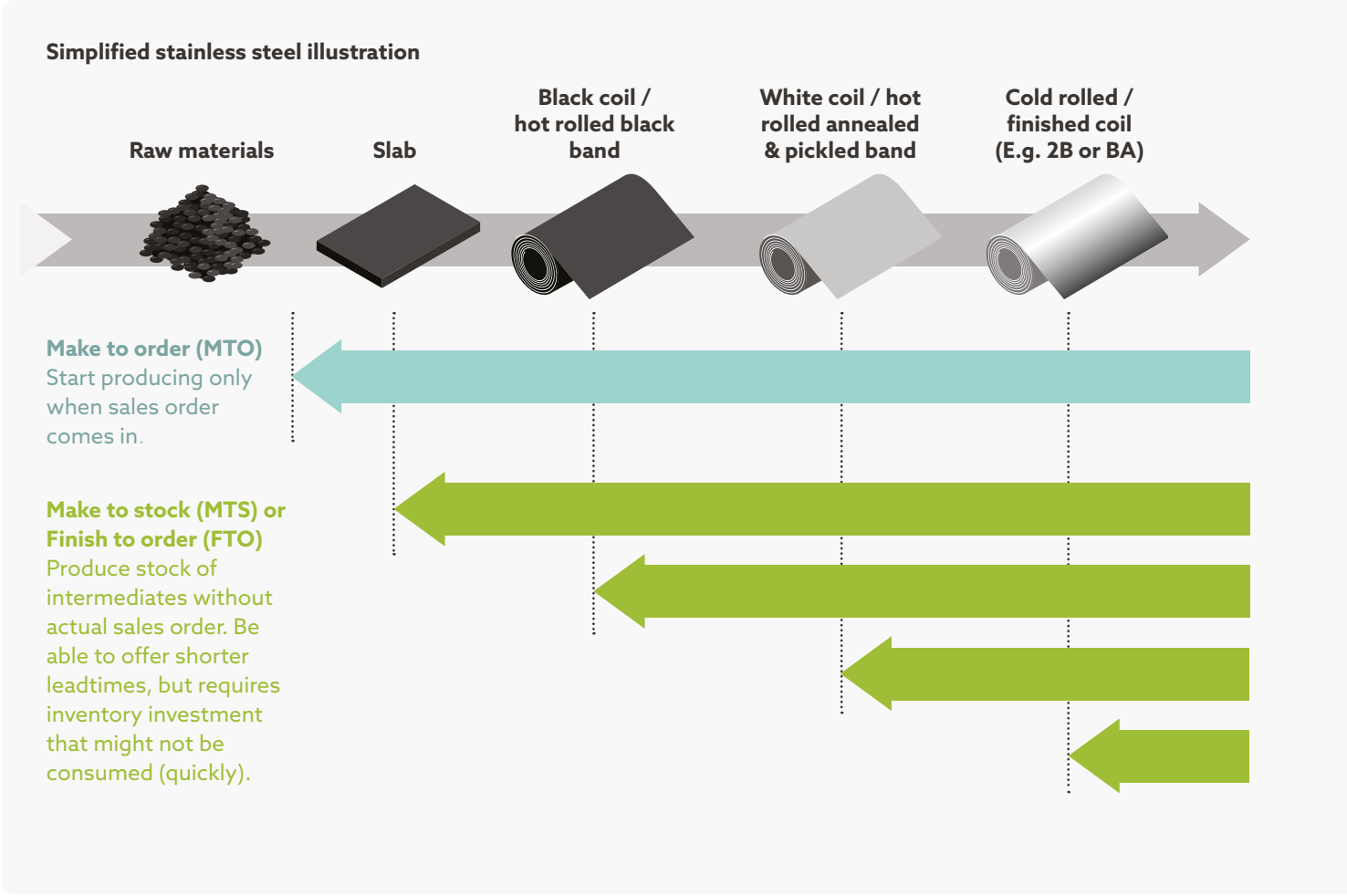
- Recurring business ruled by **long-term contracts** is the easiest to be planned, although many metals companies confirm that it can be challenging to track the volumes that have already been (partially) delivered and the volumes that still need to be planned. In addition, long-term contract business is not always the most profitable.
- A significant part of the production capacity is taken up by **larger one-off** projects such as major construction sites running over multiple years. These projects also have very complex and somewhat dynamic (re)planning and execution journeys, putting the metals supply organization under pressure and complicating the development of reality-based supply scenarios.
- The **spot business** generated by distributors, resellers, and transformers is the third source. It typically isn't popular on the supply side because it generates last-minute orders, forcing the organization to adapt its plans.

Typical split in stainless steel: around 35 to 50% from contracts, 15% from projects, rest from spot (Source: OMP)

2.3.2 Make-to-order culture

In addition to the volatile mix complicating the planning, metals organizations have a deeply rooted make-to-order culture, meaning that they may start production only when the actual sales order comes in. This culture conflicts with the practice of anticipating demand, which is the very idea behind S&OP.

The make-to-order culture is deeply rooted because many sales orders are rather specific and difficult to forecast, especially in a context where stockpiling raw materials and semi-finished goods is extremely expensive and financially risky due to the volatile cost of raw materials. Nevertheless, some executives say they are willing to move to a kind of 'supermarket' approach, which involves adopting a make-to-stock and finish-to-order approach for some products or customers. Unsurprisingly, this can further complicate the metals supply chain.



An effective S&OP process is a requirement for a successful MTS or FTO strategy (Source: OMP)

2.3.3 Supply and raw materials set the pace

In metals, the supply side is clearly in the lead because of the very complex, expensive, and often inflexible production assets. For example, it is very difficult and costly to modulate or stop a blast furnace, which means that, in this case, liquid metal is pushed into the supply chain and needs to be consumed in the most optimal way, even though it is not yet the subject of booked orders or uncertain forecasting. Constraints related to the organization of manufacturing campaigns may also mean that products might be produced one or two weeks later (or even later) than requested by the customer (unless campaign constraints can be taken into account at the time of order).

This lack of flexibility is also driven by constraints related to raw materials and the sometimes extreme volatility of material prices.

LME Nickel Closing prices graph

Extreme raw material price volatility: In March 2022 a daily price limit was introduced on all London Metal Exchange base metals futures (Source: London Metal Exchange)

Furthermore, supply is often fragmented across multiple plants and locations, meaning that the interfaces and flows between the plants need to be managed, adding to the supply side's lack of flexibility. Sales staff tend to allocate forecasts and orders to the plants they know best, a practice that reinforces silo thinking and hampers overall optimization of the network.

This situation contrasts starkly with the much more flexible consumer goods industry where the demand side takes the lead in validating market outlook and launching promotions in a collaborative multi-level effort.

2.4 The metals industry sets specific challenges for S&OP

The special characteristics of the metals industry bring with them challenges when implementing an S&OP process. Five of them require particular attention.

2.4.1. The forecasting challenge: a more sophisticated approach needed

It is difficult to forecast demand in the metals industry. The complex mix of orders, the impact of one-off multi-year projects, and the supply-driven make-to-order culture mean that companies cannot successfully predict demand based on historical sales figures. In the metals industry, there are rarely two orders alike.

The complex mix of orders, the impact of one-off multi-year projects, and the supply-driven make-to-order culture mean that companies cannot fully predict demand based on historical sales figures.

Demand is also very susceptible to raw material availability and prices, which are difficult to predict in the longer term. When prices are high, resellers will postpone replenishing their stocks and a significant element of the customer base will be on the lookout for substitute materials. When prices are low or begin to increase, demand will surge but customers will also expect fast delivery, meaning that much of the potential increase in sales depends on the supply side's responsiveness.

The particular dynamics of long-term contracts can also lead to upward or downward spikes in demand at the beginning and end of contractual periods.

This all means that pure statistical forecasting, which in normal circumstances is the standard approach in consumer goods, will simply not do the trick in metals. More sophisticated approaches to forecasting are needed, involving capturing sales outlooks intelligently. However, this need for a more complex forecasting apparatus tends to further nourish the suspicion that many companies in the metals industry have regarding forecasting. Some executives tell us that they haven't seen a single reliable forecast since they started making them. It's no wonder that many metals companies currently see forecasting as more of a nice-to-have than a real differentiator.

2.4.2. The operational challenge: becoming more flexible and agile

Uncertainties in demand put pressure on the metals supply organizations, which is particularly frustrating because of the intricate manufacturing processes with limited operational flexibility. Metal manufacturing is also very capital-intensive with profitability heavily dependent on how efficiently assets are utilized. No metals company can afford to have a melt shop, a casting unit, a rolling mill, or any bottleneck machine standing idle for several shifts or even just a few hours.

For similar reasons, many metals manufacturers will decide to mothball some of their assets during a relatively lengthy downswing. But they want their assets to be operational again fairly quickly once market circumstances improve, which creates extra pressure on the organization to become more agile.

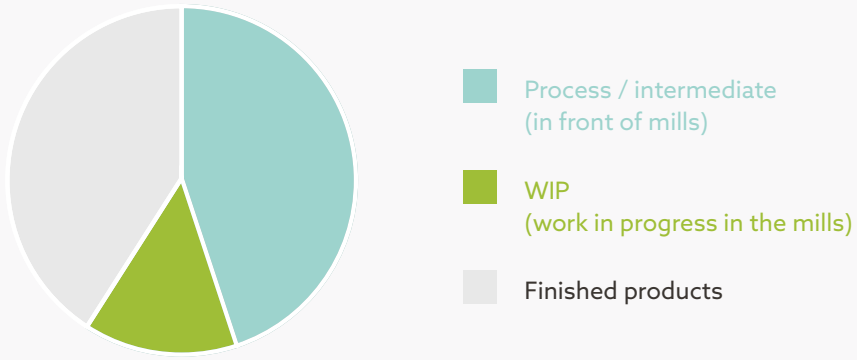
2.4.3. The inventory challenge: quantifying the gains of inventory strategies

The inventory challenge is directly linked to the need for efficient asset utilization and the high cost of raw materials.

Historically, stocks in the metals industry have been sized with a view to keeping the machines running with as little interruption as possible. But the prices of metallic raw materials are high and fairly volatile, and consequently work in progress levels can severely impact the company's financial strength. Most companies now keep lower inventory levels in an effort to strike a better balance between financial and operational constraints.

But, in contrast with the consumer goods industry, inventory in the highly MTO-driven metals industry is not so much about finished goods, but rather about raw materials, intermediates or work in progress (WIP).

Example: inventory distribution for a long steel products producer in April 2022



Typically, most of a company's inventory is process or WIP inventory and not finished goods (Source: OMP)

Importantly, mainly due to campaign constraints, a very significant proportion of product lead time (as much as 80% or more for metals) is not because of the processing time itself but is time spent by product waiting to be processed at the machine or in an (intermediate) warehouse. Since this kind of inventory represents huge amounts of capital, it is vital for companies to manage stock levels carefully. In the metals industry, product lead times, campaign rules, machine utilization, and inventory levels are inherently connected and cannot therefore be treated separately.

Nevertheless, supply chain leaders in the metals industry tell us that their **inventory policies are not fully grounded in solid facts and figures**. One manager we spoke to said that his proposals for investing in building up strategic inventory levels are being rejected because he's not able to quantify the gains on turnover (while the pains are more obvious).

2.4.4. The service level challenge: crucial for maintaining customer relationships

While a company's service level is an important KPI in any industry, the exact figure depends very much on the business context. There would be uproar in a company producing consumer goods if its service level fell below 98%. That's because every customer not served means lost sales, lower revenue, and lower profit.

Metals producers, however, rarely achieve such service levels. Figures vary across the industry, but the overall service level seldom goes above 90%, due to the industry's make-to-order culture and its somewhat inflexible supply apparatus. Some customers, especially distributors generating spot business, are accustomed to these relatively poor service levels and tend to accept them, as long as the delays stay within reasonable limits. But this could lead to a vicious circle, with companies tending to overbook orders if they know customers might accept such delays.

There are also customers who are much less willing to accept delays, especially in the contract and project businesses. Performance and service are among the primary selection criteria for customers looking to sign long-term supply contracts. They are also important in the project business, which is subject to potential penalties if milestones are not reached. In other words, performance and service level in metals are less about lost sales and more about maintaining good customer relationships in the long term. Metals companies therefore need to carefully differentiate between customers, and it will very much depend on the type of customer whether service is a major priority.

Metals companies who don't run effective S&OP processes are suffering most from the rising backlogs due to the post-Covid market upswing.

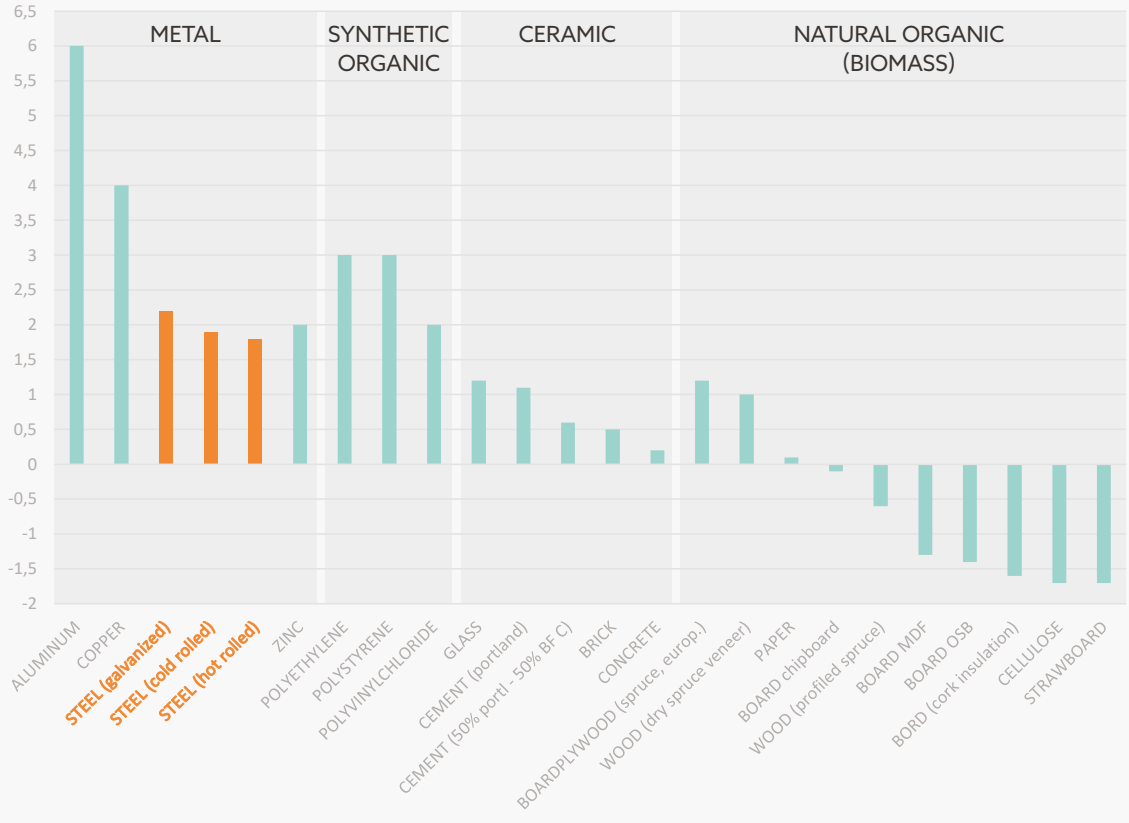
In 2021 and 2022, the service level challenge has materialized in unprecedented ways. Metals companies are facing extremely high demand as the business picks up following the worst of the Covid-19 crisis and metals consumers try to recover their losses as far as possible. This has led to huge backlogs for metals companies, sometimes running into tens of thousands of tonnes. And it is metals companies who don't run S&OP processes or scenarios suffering the most.

2.4.5. The decarbonization challenge: minimizing CO_2 emissions

Climate change is a further complicating factor. Metals manufacturing is a business with a very significant CO_2 footprint. At present, producing one tonne of steel corresponds to 3 or 4 tonnes of direct and indirect CO_2, and that will have to change for producers to remain credible and profitable. A McKinsey study published in 2020 states that "14 percent of steel companies' potential value is at risk if they are unable to decrease their environmental impact." *

CO_2 regulations and related environmental legislation are evolving and expected to profoundly impact asset investment and utilization strategies, further increasing the need for rapid and efficient decision-making. In the foreseeable future, it will be commonplace for metals companies to optimize their product mix and profits while keeping an eye on **reducing CO_2 footprint**. **

Carbon Dioxide Intensity Ratios (CDIRs) by weight-in-use for 24 common building materials



Example: Steel (and other metals) are considered a net source of CO_2 for building applications, and new regulations and legislation is expected to have a profound impact on the metals industry (Source: Carbon Dioxide Intensity Ratios, by Richard MacMath)

* www.mckinsey.com/industries/metals-and-mining/our-insights/decarbonization-challenge-for-steel
** omp.com/blog/how-steel-manufacturers-can-reduce-carbon-footprint

3

The business goals of S&OP and the benefits it can bring

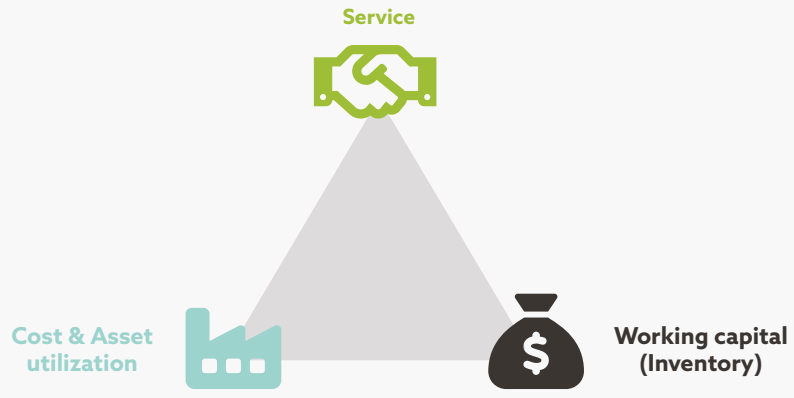
3.1 Visibility, profitability, and performance

S&OP in the metals industry serves multiple interrelated goals, all of which contribute to increasing company profitability and resilience in the long term. The three major goals involve the following actions:

- **Improving supply chain visibility and managing it as one single company**—What are the risks of running short on raw materials and intermediate product? Is there any chance that lead times will exceed customer expectations? Companies want a clear view of what's happening across the entire supply chain so that risks can be identified and reduced. The best way to achieve this is to have one integrated digital supply chain planning solution covering all functions and time horizons. *

> S&OP can help to establish the best mix of products for improved profitability and, among other factors, supply chain impact, lower CO_2 emissions, and better service and strategy.

- **Maximizing profitability**—Which product groups are to be produced in the next time period and in what quantities? This does not just depend on confirmed orders and expected demand. Companies seek to establish the best mix for improved profitability and, among other factors, its impact on other parts of the supply chain, the resulting CO_2 emissions, commitments to customers, and strategy.
- **Balancing costs, performance, and inventory**—What will be the volume of work in progress and the levels of valuable stock? What combination of products and manufacturing routes reduces overall costs to a minimum? How much raw material will have to be purchased? How much will the inventory need to be built up at each stage? What will be the resulting service level? Companies want their overall network costs to be as low as possible while providing excellent service and achieving good performance with assets utilized efficiently and bottlenecks avoided.



Where do you want to be in the triangle?
You can optimize one corner (such as asset utilization), while minimizing another (working capital), but then you'll need the third as your flexible buffer (reduced service for certain customer segments). (Source: OMP)

* OMP describes such a solution in this Unison Planning™ e-book: portal.omp.com/Static/temp/UnisonPlanningEbook.pdf

Our recommendations

To maximize profitability and balance costs, performance, and inventory levels, we recommend establishing a robust series of KPIs that is shared and accepted across the entire organization. This can be a challenge for many companies in the metals industry who may use multiple types of service level KPIs. Typically, the production department could have a KPI measuring against the internal promised date instead of the date requested by the customer which, from the customer's point of view, is the one that counts. Or they may use volume-based KPIs instead of on-time-in-full (OTIF) indicators. Both approaches have their merits, but we recommend aligning KPIs across departments.

Other metrics useful in S&OP include the overall raw material cost reduction year on year, end-to-end profitability, and the contribution margin per hour utilization on bottleneck machines. Choosing the right KPIs is vital because you'll always miss if the target isn't clear. *

3.2. What benefits can be expected from S&OP (and what cannot)?

If the scope and goals of S&OP are clear, metals companies might still wonder whether it's worth the investment. Often, companies believe that it's better to invest only in improving operational planning and scheduling processes, which are closer to the shop floor. To get a better handle on this, let's first summarize the differences:

- **S&OP** refers to planning aggregated product families (grade or dimension groups, application segments, sales regions) in weekly or monthly overall volumes.
- **Order planning** happens on a more detailed level. It is about promising and planning individual sales order lines and/or replenishment orders, rather than just planning volumes. Orders for exact grades and dimensions are planned per week or per day, on aggregated machine groups or individual machines.
- **Detailed scheduling** and sequencing involve the process of sequencing on a continuous time base (represented by a Gantt chart), per heat, coil or batch.

Based on our experience with companies in the metals industry, we analyzed the impact of each of these planning processes on a series of established business metrics. The table below summarizes our findings.

	KPI	DRIVER	MARGIN		CASH	COST		IMPACT SHARE OF PLANNING PROCESS		
	Performance metric	**Main improvement**	**Extra Sales**	**Optimized mix**	**Stock/ WIP**	**Transfor -mation**	**Material**	**S&OP**	**Order planning**	**Detailed scheduling**
UPSTREAM PRODUCTION	Leadtime	Internal/external service level	✓		✓					
	Asset utilization (OEE - T1)	Sales volume	✓		✓	✓				
	Yield (e.g. slabs to hot rolled coil)	Material cost	✓		✓		✓			
	Raw materials cost	Material cost			✓		✓			
	Hot end inventory	Inventory efficiency	✓	✓	✓					
	Raw materials inventory	Inventory efficiency	✓		✓					
	Adherence to S&OP plan	Full cost		✓	✓	✓	✓			
	Adherence to short term plan/schedule	Internal/external service level		✓	✓	✓	✓			
DOWNSTREAM PRODUCTION	Leadtime	Internal/external service level	✓		✓					
	Asset utilization (OEE - T1)	Sales volume	✓		✓	✓				
	Yield (e.g. hot rolled coil to finished product)	Material cost	✓		✓		✓			
	Finished goods inventory	Inventory efficiency	✓	✓	✓					
	WIP Inventory	Inventory efficiency			✓					
	Adherence to S&OP plan	Full cost		✓	✓	✓	✓			
	Adherence to short term plan/schedule	Internal/external service level		✓	✓	✓	✓			

* This blogpost elaborates on how steel manufacturers can reduce carbon footprint by optimizing planning: omp.com/blog/how-steel-manufacturers-can-reduce-carbon-footprint

Both S&OP and order planning can have a significant impact on improving hot-end as well as finished goods inventory, which potentially leads to extra sales, a better product mix, and a lower stock/WIP ratio.

A number of conclusions can be drawn from the analysis:

- S&OP is a powerful tool for companies wanting to achieve a better product mix, for example with a view to improving profitability or reducing emission levels.
- S&OP will mainly improve the overall inventory levels of finished goods, and positively impact the cost of raw materials, mid/long-term asset utilization rates, and conversion costs (in cases where swinging/swapping volumes or orders across plants is a lever to explore).
- S&OP will also improve service levels since more realistic sales quotas will lead to more realistic promises.
- S&OP will have limited impact on improving work in progress (WIP) and yield.

S&OP will improve overall inventory levels of finished goods, and positively impact the cost of raw materials, mid/long-term asset utilization rates and conversion costs.

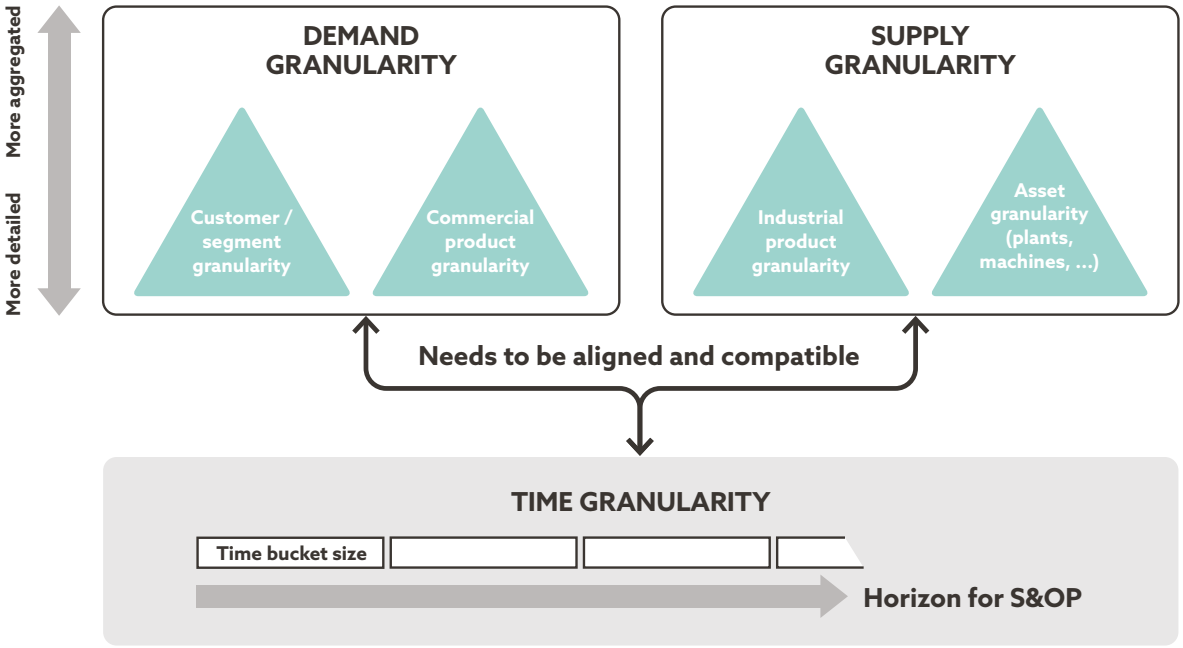
4

Tuning the S&OP model to the metals industry

Standard S&OP theory doesn't have all the answers the metals industry needs. We therefore need to define S&OP more specifically, addressing the challenges outlined above. This includes defining a clear scope and developing an industry-specific apparatus of S&OP tools.

4.1 Tailoring the S&OP setup to the metals industry

When we talk about an S&OP model, we are referring to a system with the level of detail and granularity needed for mid/long-term tactical demand and supply planning, making sure they are consistent and aligned.



For an effective S&OP model, demand and supply granularity need to be compatible, and aligned with the time granularity they each use (Source: OMP)

4.1.1 The time horizon: looking far ahead but planning in weekly buckets

S&OP is about **planning on a tactical level**, which takes the company's mid/long-term strategic plans as input to create mid-term plans and related targets. These plans are propagated as constraints to the operational level where production campaigns and batches are planned and scheduled.

For most companies in the metals industry, we recommend that tactical planning be carried out for 6 to 12 or 18 months ahead, although we advise some companies to look as far ahead as one or more years, especially if the business depends heavily on multi-year projects and long-term contracts, or involves highly specialized products with extremely long lead times. An extreme example is the aerospace industry, which requires steel manufacturers to demonstrate that they have sufficient capacity for the next 2 to 5 years.

Whatever the horizon, it is essential that the time unit used for planning the next horizon be sufficiently small.

While many metals companies are still planning in monthly buckets, we strongly recommend them to consider tactical supply planning in more precise weekly buckets, at least in the mid-term. The reason is that steel is produced in sequential operations that can span multiple weeks for a single order. Melting and casting are carried out in sequence while the metal is in a liquid state. Hot rolling can then be carried out a week or more later, while cold processing and finishing may happen much later. With capacities planned in weekly buckets, planners get a better view of the multiple operations and potential bottlenecks.

However, supply planning on a weekly basis means that demand signals should be provided weekly too, so that smart netting and breakdown rules can properly connect weekly and monthly commercial information with supply planning. But this input may not always be possible, and consequently the precise horizons and buckets schemes need to be defined in agreement between the company's demand and supply organizations.

4.1.2 Granularity: segmenting products, assets, and customers

In the metals industry, S&OP is about planning the production of **tonnages of a series of material and product groups**, including different steel grades and alloys in different formats and sizes. In essence, a solid S&OP plan considers these three dimensions: products, assets, and customers.

Products

Which individual products and product groups are going to be produced? This requires the company to establish a smart classification of products and product groups.

We recommend that the classification should have sufficient detail. For example, it would probably not suffice for a stainless steel manufacturer to group products into grade groups and finishing like slab, hot rolled, hot white band, 2B or BA, if this does not fully correspond to machine capabilities. Some machines can process wider or thicker products while others cannot. Some production routings are limited to certain thicknesses. This means that it makes sense to include width and thickness ranges into the S&OP product classification.

The product classification should have sufficient detail and be harmonized across plants.

We also recommend companies invest in harmonizing their data across plants, otherwise it's impossible to define clear rules determining which volumes can be shifted from one plant to another. For example, if a company wants to optimize supply for multiple upstream and downstream mills, it is a good idea to define volumes that could be swapped between plants. This will allow multiple S&OP scenarios to be evaluated against each other.

This is especially important in a context of growth through acquisition of mills, each of which may have developed their own historical way of coding products. Such aspects as product shape, product grade groups, width, and thickness ranges all need to be harmonized – at least as aggregated S&OP and commercial product definitions.

It is also recommended that a high-level classification of raw material sourcing be established to allow the company to better organize alternative sourcing when circumstances are difficult.

Assets

Which assets and groups of assets are to be reserved for the selected products and product groups? To provide answers, smart asset classification is needed. Metals companies tend to plan capacity and campaigns around the melt shop and hot rolling production phases. But many fail to consider downstream production lines and ignore the fact that phases may not be aligned if there are multiple upstream and downstream plants.

We therefore recommend identifying the bottleneck machines that impact overall end product output volumes in each phase. Definitions should be aligned across plants if you want to be able to plan them as possible alternatives.

Customers

Who are the customers we are going to produce for? This calls for a smart customer segmentation framework. Many metals companies just make an overall volume plan based on historical sales data and subsequently allocate the constrained supply to sales entities such as 'Global Appliances', 'Global Automotive', 'RegionX Direct', and 'RegionX Indirect' (through service centers). However, market dynamics can differ significantly across entities.

We therefore recommend considering sales entities and business types from the outset, the moment the volume plan is developed. This means finetuning the volume plan based on historical and forward-facing data on the different sales entities and business types. For example, the volume planner should at least be able to differentiate between contract business and spot business so that in the event of capacity shortage, capacities can primarily be allocated to the more profitable spot business, as long as the minimum contracted volumes are respected. For the same reason, we recommend companies finetune their segmentation to include very big customers as separate entities.

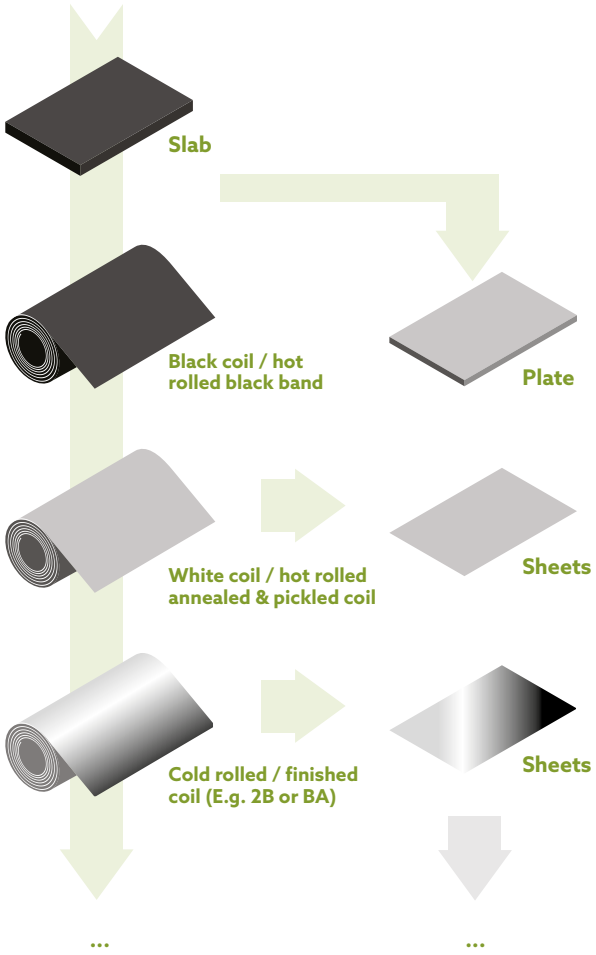
The recent demand boom following the Covid-19 crisis also illustrates the importance of carefully segmenting the customer base. Indeed, we see that metals companies who have perfected their S&OP process are better able to decide who they are going to service, considering the limited production capacity and with a view to maximizing the relevant business KPIs.

4.1.3. Selecting an appropriate S&OP model

Metals companies should choose their level of granularity in accordance with the type of decisions they need to make. To clarify this point, the cases below compare four models with increasing levels of granularity for stainless steel. For each level of granularity, we highlight the benefits, limitations, and trade-offs.

CASE 1

Granularity level
BASIC



Model

S&OP products are differentiated according to shape (slabs, coils, plates, sheets) and finish (hot rolled, annealed and pickled, 2B, BA). No differentiation is made according to grade, width, thickness, or segmentation.

Type of decisions

- Bottlenecks can be identified at a high level but with low realism.
- Inventory investment requirements can be assessed at a high level.
- The impact of planning major maintenance stops, shift changes, and productivity drops can be evaluated at a high level.
- Sales can be reserved at a high level (most probably not close to realistic).
- Raw material requirement projections are not realistic.
- Basic volume comparison scenarios can be created.
- Realistic revenue/cost/profit scenarios cannot be made.

Model complexity

- The model is very compact, with typically fewer than 15 S&OP products.
- At this low level of complexity, volume-balanced base plans can be made using Excel, with capacities being modeled in available production tonnes per month or week. However, an Excel-based model would make calculating and comparing scenarios very complex and time consuming.

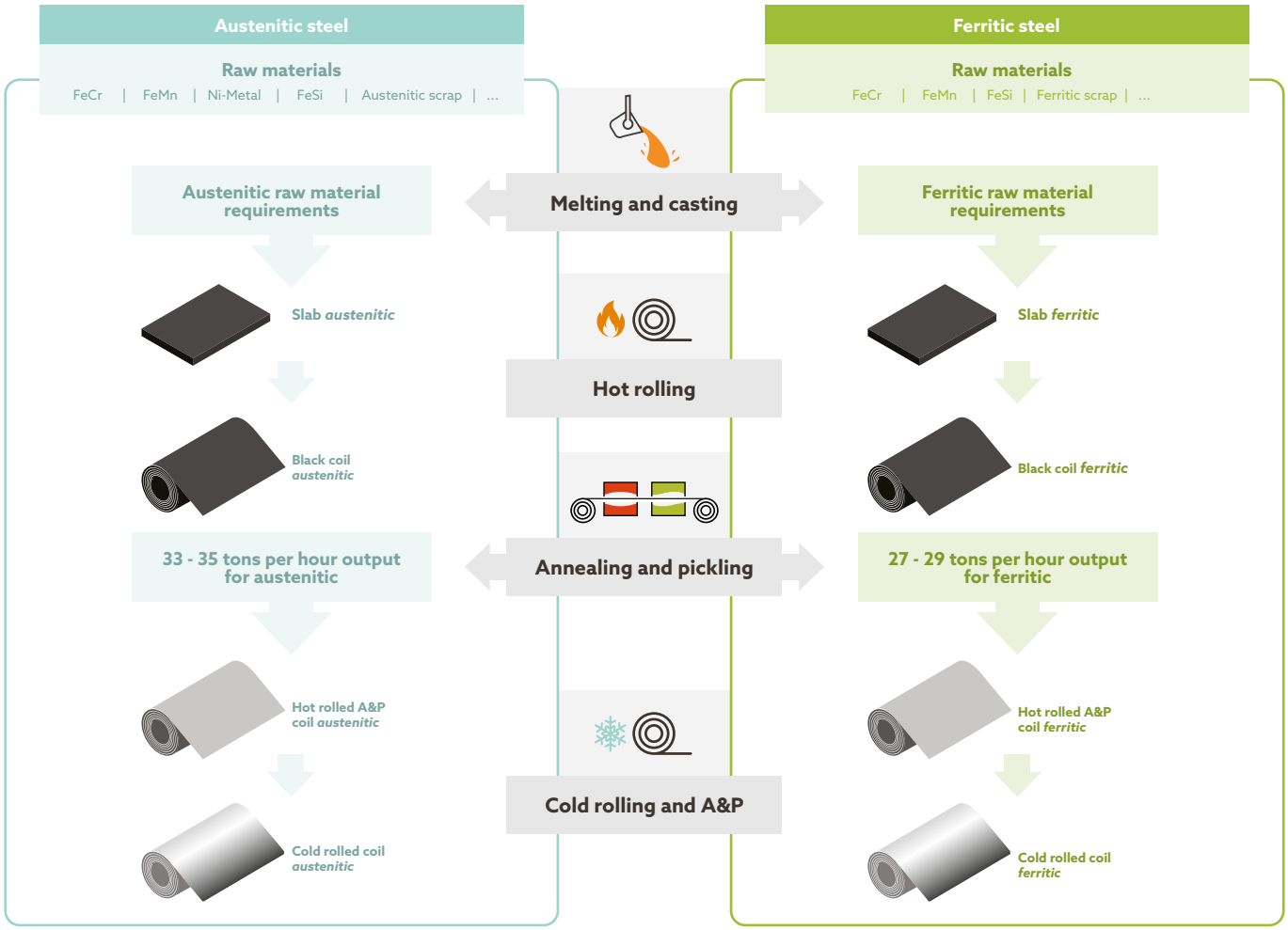
Conclusion

This level of detail basically means 'a tonne is a tonne'. Differences in machine output with regard to products are not considered.

CASE 2

Granularity level

DIFFERENTIATE GRADE GROUPS



Model

S&OP products are further differentiated by grade group (austenitics, ferritics, austenitics with molybdenium, etc.).

Type of decisions

- A more realistic production plan can be created, including grade-based campaigns and variations in production output based on grade groups.
- Basic realistic cost and revenue scenarios can be developed due to more detailed raw material prices and sale price segmentation.
- Stock value projections are realistic.

Model complexity

- This level of differentiation adds quite a lot of complexity. For example, the model becomes five times as large and complex if five grades are considered.
- An advanced planning solution like OMP for Metals is able to consider the impact of different products on machine utilization because capacities are calculated in machine time instead of in tonnes (for example, tonnes of output per hour production in the rolling mill compared with the number of hours available, as defined in the shift model).
- This is a major advantage of APS-based S&OP solutions compared to Excel-based S&OP.

Conclusion

'A tonne is a tonne' no longer applies because production outputs per alloy group are considered.

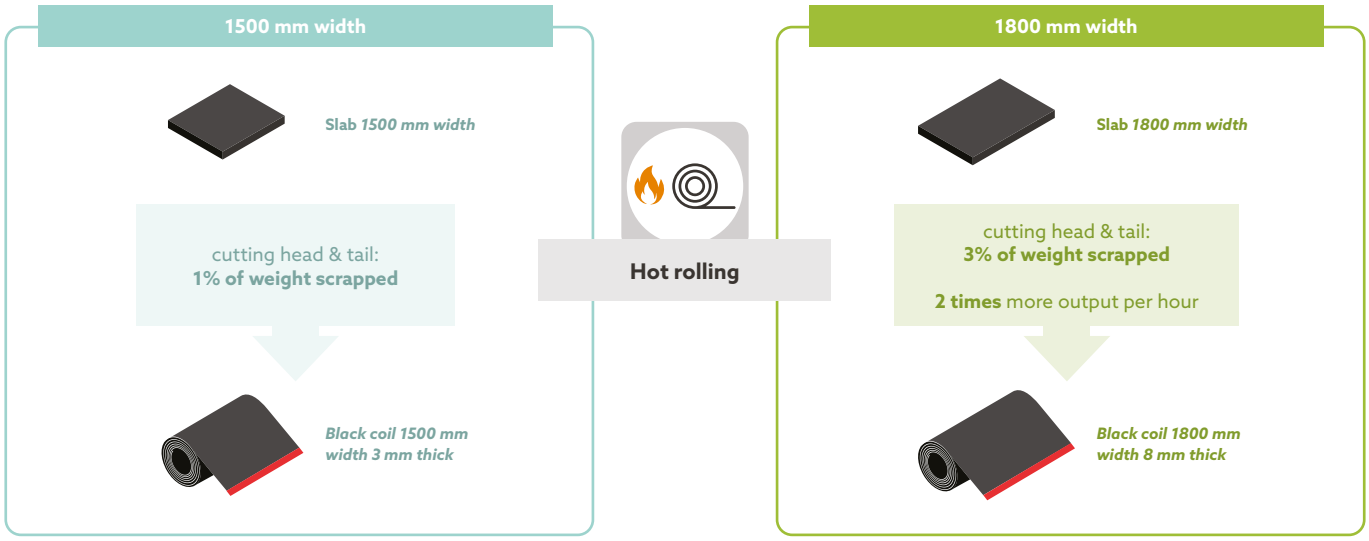
Realistic sales quotas can be determined: 1 tonne of austenitics cannot simply be swapped for 1 tonne of ferritics, since the impact on capacity needs to be verified.

This level of differentiation cannot be maintained in Excel with a reasonable amount of effort. A dedicated solution with an appropriate data model and time-based capacity modelling provides great benefits.

CASE 3

Granularity level

WIDTH AND THICKNESS GROUPS



Model

S&OP products are further differentiated by width and thickness groups.

Type of decisions

- A more realistic production plan can be created where machines have constraints regarding width or thickness.
- It is possible to consider dependance of production yield on width or thickness. For example, in practice, the yield of coil cutting depends greatly on the width and thickness to be processed.

Model complexity

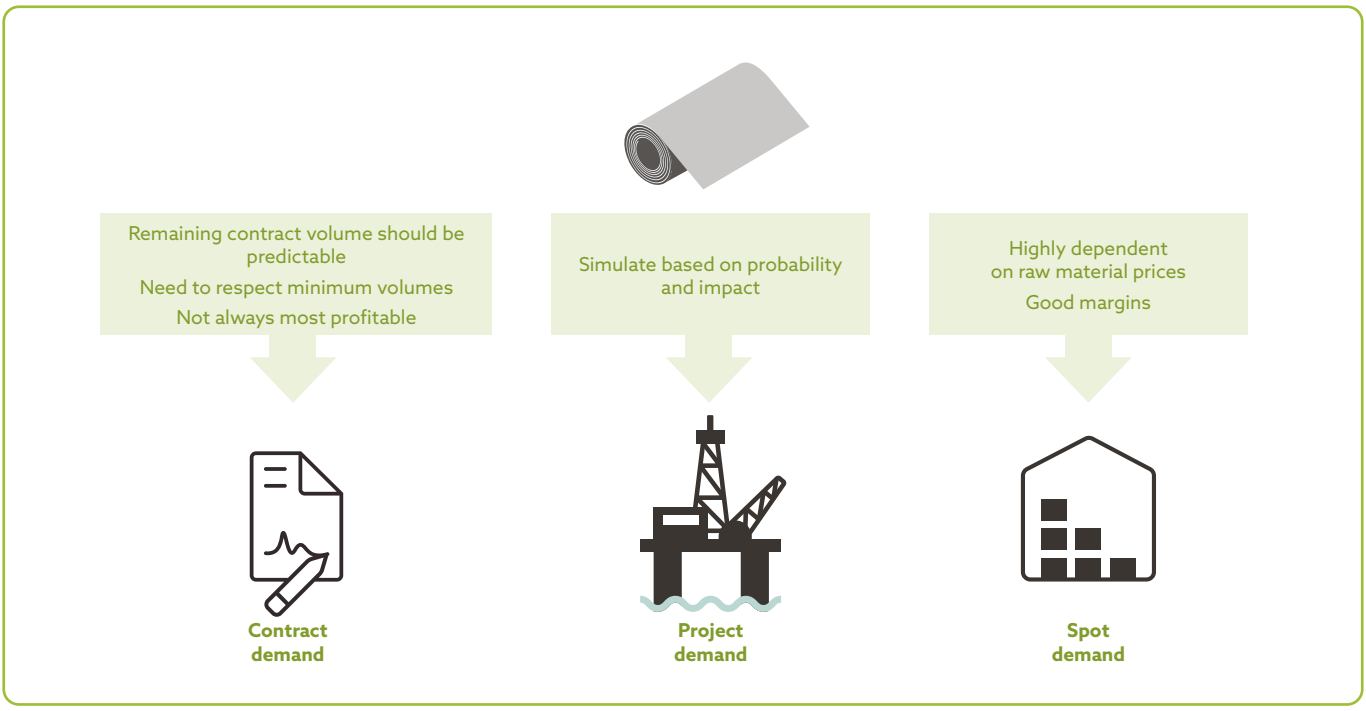
It is best to model widths and thicknesses that can be planned similarly in width and thickness groups. This keeps the model complexity manageable.

Conclusion

With a more complex model, much more accurate outcomes can be achieved. However, a significantly greater effort is needed to get the input data right.

CASE 4

Granularity level
DEMAND SEGMENTATION



Model

Demand is segmented into basic demand types (contracts, projects, spot).

Type of decisions

- Demand can be prioritized when making the supply plan, for example by allocating the maximum volume to the most profitable segment.
- It is possible to define and evaluate the maximum acceptable backlog.
- Probability-based supply scenarios with and without projects can be made.

Model complexity

If demand segmentation is an objective, the model becomes significantly more complex. An advanced planning system with 'pegging' functionality is required, allowing demand and supply transactions to be linked.

Conclusion

Scenarios can be developed and evaluated with a very high level of realism, offering good opportunities for optimizing the product mix.

S&OP model conclusions

We recommend companies first outline the types of decisions needed, for example whether grade-based campaign planning is a priority or whether machine constraints regarding widths and thicknesses need to be considered.

Implementation starts with a basic model, extended and refined gradually depending on the types of decisions needed. Forecast accuracy also needs to be considered when defining the granularity.

A stepwise approach is recommended, starting with a model that allows the more operational metrics in service, asset utilization, and inventory to be balanced. A financial model can then be implemented, considering revenue, costs, and profit, in addition to a green model which considers the impact of active and passive CO_2 emissions.

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Conclusion

S&OP is a somewhat different game in the metals industry than it is in the consumer goods industry. While some metals companies are slightly hesitant to implement S&OP, they should know that it can significantly improve supply chain visibility so that the company can be managed as a whole. It also allows profitability to be maximized while costs, asset utilization, inventory, and service can be balanced, differentiated, and explored using what-if scenarios.

We expect that in the metals industry, S&OP will significantly increase in importance, both as a tool to remain profitable when planning for market downturns and to fully take advantage of opportunities in times of market upswing.

Fresh challenges are constantly emerging and need to be brought into the equation rapidly, including CO_2 emissions and energy consumption. We are convinced that the metals industry will pick up the gauntlet.

About the authors

Paul Vanvuchelen

Fifteen years at Aperam and ten years at OMP have given Paul an enviable grasp of the metal industry's challenges. With a passion for digital transformation and model-based optimization, he helps companies worldwide achieve sustainable supply chain excellence.

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Michael Walter

With 20-years' experience in multiple Voestalpine companies – in positions ranging from product development to managing director – Michael now helps reinforce the connection between the OMP for Metals solution and the realities of the metals industry.

About OMP

OMP helps companies facing complex planning challenges to excel, grow and thrive by offering the best digitized supply chain planning solution on the market. Hundreds of customers in a wide range of industries — consumer goods, life sciences, chemicals, metals, paper and packaging — benefit from using OMP's unique Unison Planning™ concept. Acclaimed for more than a decade by Gartner for its vision and execution, OMP has been building strategic partnerships with its customers since 1985.

Respected for its commitment to achieving the very best outcomes for customers, the company invests in a sustained R&D effort to create its visionary road map for the future, in partnership with key stakeholders.

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