

ADVANCED PRODUCTION PLANNING

Use cases with Predictive and Prescriptive Analytics in advanced production planning.



FOUR CURRENT CHALLENGES IN ADVANCED PRODUCTION PLANUNG

In its humble beginnings, production planning was a comparatively easy process as a limited number of products could be manufactured in large quantities. Over the years, many new aspects have arisen which make planners' work more complex: Customers are becoming more demanding, price wars are well underway in many markets and margins are being fought over. We have identified four factors which pose major challenges to traditional production planning.

INDIVIDUALIZATION

If you have ever planned your dream car with the online configurator software provided by well-known car manufacturers, then you will already have some idea of the high degree of individualization which prevails in this sector nowadays. A large number of models in all kinds of versions with customized features - a customer's dream, yet a production planner's nightmare.

DELIVERY TIMES

The example of the car clearly demonstrates how the desire for individualization on the one hand and the expectation of short delivery times on the other exacerbates this nightmare. When it comes to consumer goods in particular, end users are highly unwilling to wait more than a couple of days for their items and suppliers are feeling the pressure.



STORAGE CAPACITY

Why are suppliers under such enormous pressure? Because for many years, storage space has been kept at a minimum in almost all production plants for the sake of efficiency. This means that the uncertainty among many manufacturers about which quantity of which product they will manufacture in the coming weeks is automatically passed on to their suppliers. The lean production paradigm extends along the entire supply chain.

STAFF DEPLOYMENT

The production of goods usually involves a high number of employees. Sometimes specially trained workers are required in certain areas. If there are load peaks due to requirements at short notice, then extra shifts may have to be scheduled. This can make production more expensive when overtime and wage surcharges have to be paid.

BETTER PLANNING WITH PREDICTIVE ANALYTICS AND MACHINE LEARNING

Machine Learning and Predictive Analytics can demonstrate their true strengths particularly when integrating large amounts of data sources and detecting patterns and cross-dependencies. A close and recurring analysis of all influencing factors enables changes to be detected early on from which timely adjustments to planning can be derived. In this way the model learns continuously and improves its prediction quality with every iteration. Here we want to take a close look at three possible use cases and the effects they have on production planning.

DEMAND FORECASTS

As described, the great advantage of Machine Learning is that you only have to “train” the system with real data for it to detect connections and cross-dependencies independently and to derive patterns from it. Fortunately, every manufacturing company has a wealth of historical order data at its disposal which can be used for demand forecasts. If external sources can also be integrated successfully, such as meteorological data or the systematic evaluation of your own website or social media offers, then the likelihood of the derived pattern occurring can be calculated using a highly sophisticated algorithm. In this way, capacities and operating resources can be planned far better and with more foresight.

PREDICTED MACHINE FAILURES

By applying a similar principle, possible machine breakdowns or performance problems can also be predicted. In this instance, the system “learns” with real KPIs from all the machines and production stations over the preceding years. As in our previous example, the more data sources that are used, the better the predictions become.

For example: perhaps there is a connection between high outdoor temperatures and a reduction in the production KPIs? These can be anticipated in future planning processes. Backlogs and other consequential disruptions can thus be avoided.

PREDICTIVE MAINTENANCE

Predictive maintenance is closely connected to the question of predicted machine failures. Provided you have sufficient machine data in digital form, maintenance intervals can be scheduled and performed based on daily requirements. In this case, the system would be trained with machine data (e.g. temperature, noise development, cycle times, etc.) as well as data on maintenance and machine failures in the past. In this way, it can predict the optimal time to carry out maintenance. This saves unnecessary work on the one hand and prevents sudden machine failure on the other.

COMBINING PREDICTIVE AND PRESCRIPTIVE ANALYTICS IN PRODUCTION PLANNING

Imagine if you could combine predictions with sophisticated optimization models which could accurately forecast how your objectives can be achieved. This *is* possible by combining Predictive and Prescriptive Analytics. The forecast closes any gaps in the data situation and enables the Prescriptive Analytics model to unleash its full potential. It is used to calculate and compare millions and millions of various courses of action within a very short time so that the best alternative can be identified in relation to a defined objective. The following examples demonstrate exactly how Prescriptive Analytics can be deployed in production planning:

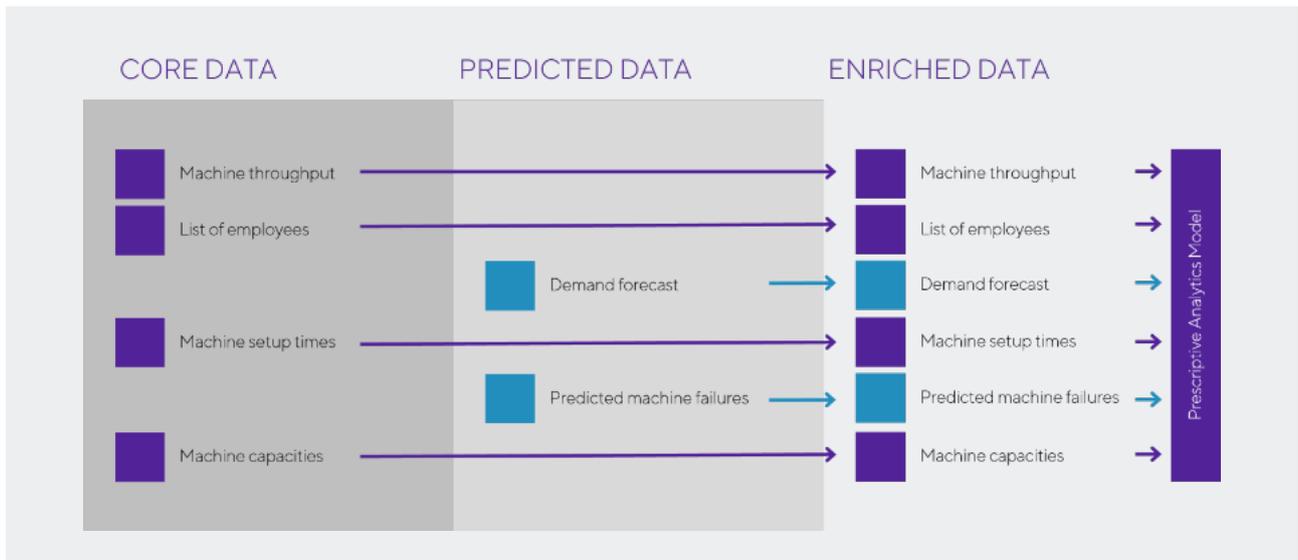


Abb. 1: How Predictive and Prescriptive Analytics interact

PRIORITIES AND MACHINE CAPACITY

If the high degree of individualized products makes it difficult to allocate orders and if delivery times are too closely timed, traditional planning methods soon reveal their limitations. By applying Prescriptive Analytics you can group batches so that you use as many of the same parts as possible, reduce the number of set-up procedures and times and still observe delivery dates. The system relies on hard facts such as product blueprints, parts lists, machine KPIs, etc. as well as on forecast data such as demand forecasts. In this way, optimal plans can be created which contribute towards the defined business objectives, despite increasing complexity.



EMPLOYEE LISTS AND SHIFT ROTAS

Combining predictive as well as real data not only enables you to run machines at capacity optimally and efficiently, it also supports your personnel planning. Depending on which skills are required, the system takes into account the contractual working hours in order to create a schedule which avoids overtime or extra shifts whenever possible and ensures that the workload is evenly distributed among the employees. If there is any overtime, the system creates a plan to reduce it while ensuring that ongoing operations are not disrupted. This means that your personnel planning is in alignment with actual requirements at minimal direct and indirect costs.

ORDER OF DELIVERIES

In order to execute orders on time, part-delivery may be necessary. Prescriptive Analytics can consider the commissioning and delivery of the goods directly in production planning based on available data. This may refer to just-in-time delivery, the raw materials needed, semi-finished products as well as the company's own deliveries. This type of end-to-end consideration is difficult to map manually, but possible with mathematically optimized planning.

Mathematical Optimization is a true multi-tool for improving processes and structures. If you would like to learn more about the possibilities it offers, then contact us today!



WOULD YOU LIKE TO LEARN MORE?

Are you interested in a free-of-charge OPTANO demonstration or would you like to meet us and discuss how mathematical optimization can benefit your company? We can help!

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OPTANO provides innovative solutions, enabling businesses to plan faster, better and more easily. Thanks to mathematical optimization, OPTANO finds the optimal solution to any problem.

OPTANO is customized to suit your specific needs. Whether you want to optimize your supply chain, your entire network or your production plans, OPTANO makes your planning process efficient, clear and flexible.

And that's not all: OPTANO supports you in your strategic decisions using Prescriptive Analytics. This means that you can consider

various options in what-if scenarios and get sound recommendations for action - based on the sound analysis of your data and targets.

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