ADEXA Predict, not just response

Why Attribute Based Planning is essential

Abstract

Did you know that there are more attributes than pronouns? They allow us to describe how we feel, what we want and describe our preferences. Think about anything that you buy from grocery shopping to electronics or clothing items, we ask for certain properties such as fresh, high resolution or soft texture!

For the makers of these products, it is impossible to have an SKU number for so many variations and even more importantly, to be able to peg the right product with thousands of different variations to the end demand.

Attribute-Based Planning (ABP) addresses this issue without having to specify millions of SKU, and at the same time provides the means to translate every demand to the right supply, not just at the finished goods level but through the entire supply chain.

Attributes provide a means to define business rules and priorities as your supply chain changes. To this end they are a representation of the behavior of your supply chain. To create a true digital twin both the *representation* and the *behavior* must be included.

Keywords: Attribute-Based Planning, Supply Chain Planning, Demand Planning, Factory Planning.

"In addition to just the *representation* of the supply chain, Attributes are intelligent constraints that define the *behavior* of the supply chain to create a true digital twin"

This whitepaper describes how Attribute-Based Planning (ABP) is used in order to model supply chains without having to define an exponentially large number of SKUs or customization as well as having the ability to easily change the model as the business processes improve and supply chain changes.

Why Attribute-Based Planning

Almost any product that you buy has properties that can be specified by the buyer or built-in by the manufacturer to differentiate against other competing products. Attributes can be simple such as "High Priority" customer or "Red and Large" sweater. Often built-in code is used in order to define these basic attributes. However, there are many more that may not be possible to describe using pre-existing code or assign a separate SKU.

This may lead to a proliferation of too many SKUs and in some cases may not even be feasible. An example of the latter LED manufacturing where each product can have a range of dispersion, wavelengths and brightness that must be matched to customer specifications.

Another example is distinguishing shades of a given fabric color when different batches are combined within the die bank. In electronics industry, there are some very critical needs that must be accurately represented, which can easily be done using attributes. Examples are temperature and speed variation of the end products, approved processes, or qualified suppliers.

Same products could be made in two different countries but the customer may specify that only region A and supplier B are acceptable. Despite having the same SKU, the attributes of the product are different from meeting the demand.

When you add additional attributes of processes, type of material used, product specification, supplier qualification, shades of color, and others, it is easy to see that not only the number of SKUs can grow exponentially but the number of bill of materials and routings will grow into unacceptably large numbers.

It can be seen that with such large number of BoMs and manufacturing methods, the processing speed for finding a solve would become unacceptably long. This issue, partially explains why many of the SCP solvers take a long time to run. To avoid the latter, they form abstraction of the problem leading to misleading and inaccurate plans.

To conclude, attributes are properties of demand, customer, processes, products, equipment, skill set, suppliers, and even factory conditions, use of child labor, politically unstable regions, low quality suppliers, late suppliers or bad weather locations amongst others.

How attributes are used

Not every time we use attributes, implies that we are doing Attribute-Based Planning. Attribute-Based Planning means *use of attributes as constraints in the search algorithms for finding an optimal plan*. You can appreciate that, it is easy to allocate a field to each attribute and keep track of them in a database. Many systems do that at the *finished goods level only* to match the demand to what they have in inventory.

In fact, this is what happens when you go to a store and they look up your specific need to what they have in inventory. In true Attribute-Based Planning, the attributes are used at every level of production starting from supplies, WIP, production, and finished goods, methods of transportation and so on, in order to decide how it is built and where it is stored and which demands it is pegged to, right from the very start.

Attributed are therefore used as dynamic constraints that guide the search process from the very beginning to match the desired demand for delivery at the end.

What makes it very interesting is that the users can define any kind of attributes and a range of values as they desire and the system would automatically use Boolean expressions, as constraints.

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Couple of examples of Boolean expressions are given below:
"Made in Mexico OR Taiwan AND 0.001<Speed<0.01 AND Light Blue AND Memory Unit from XYZ OR ABC Vendors"

"Surface Tension <0.25 AND High Elasticity AND Packaged in NA Region OR Europe AND NO Components from Region X"

Such "business rules" are actually used by ABP in order to peg the right product to the end customer from the very beginning to the end. You can imagine that as the supply chain changes or new customers and vendors are acquired, new specification are given and new rules may be needed. Users can simply add and delete additional attributes and rules as needed.

Thus, we can have a very flexible supply chain planning engine that keeps changing with its environment. In the absence of ABP, every change has to be coded and re-programmed by armies of programmers and developers and it is impossible to define every combination of rules and end-user requirements by hard-coding.

It should also be evident that ABP significantly reduces the cost of ownership since it makes it very easy to reconfigure the system to the specific need of each customer with the same core planning engine. Thus, the system keeps adapting to its environment.

At Adexa, we have already started to use Attributes for the system to automatically adapt to its environment using machine learning techniques.

For example, the system can detect hidden patterns or repeated issues such as supplier late deliveries or early deliveries in order to re-adjust the model so that much more accurate results can be obtained.

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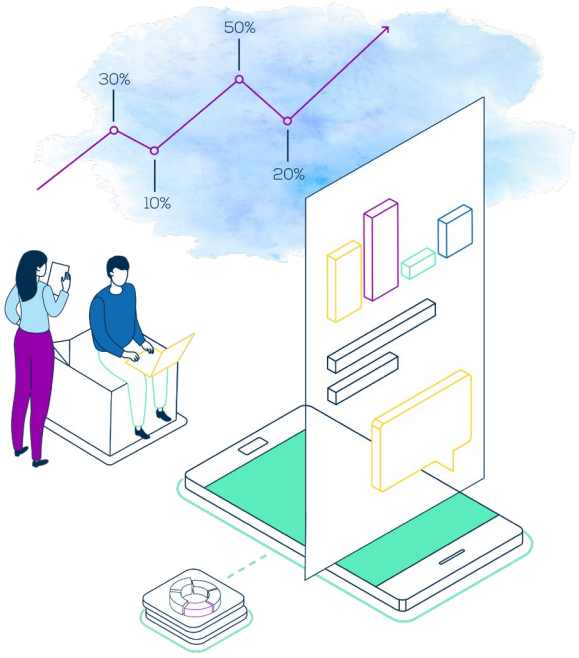
To learn more about this topic or Attribute-Based Planning, the reader may click the following link to our innovation page:

Attribute Based Planning

Self-correcting and self-improving supply chains

ABP video

Let's make **accurate** plans together!



"Your supply chain is a living and changing entity with millions of variables. ABP allows detecting the change patterns and constantly adapts to the environment"

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