Google Cloud

Smart Analytics Reference Patterns

How to build a demand forecasting system so you can take anticipatory action and plan ahead

What is demand forecasting?

Demand forecasting systems help organizations optimize their supply chain logistics, and is broadly applicable in many industries. Under-allocating resources to meet demand can result in loss of potential revenue, while over-allocating resources can be costly, demand forecasting helps businesses anticipate and plan their resources accordingly to meet demand. For example, demand forecasting can help retail companies anticipate the amount of inventory needed to stock right before the holiday season, while gaming or telecommunications companies benefit from planning extra resources in anticipation of higher traffic and save costs when demand is expected to be lower. When future demand can be forecasted through such models, organizations can take anticipatory action and plan ahead, which can lead to strategic optimizations of return on investment of time or money.

What are the benefits of demand forecasting?

Organizations need to anticipate demand earlier and more effectively than ever before to stay competitive in a digitally transforming society. Demand forecasting allows these organizations to:

- Plan ahead by predicting demand as early as possible and keep on top of changing demand, regardless of day, month, season, or even holiday peaks

- Prepare just the right amount of inventory to meet demand, while reducing unnecessary costs for low-demand products

- Continuously and automatically keep up-to-date with market demand and capitalize on new opportunities as consumer behavior and trends change over time

Underallocation = revenue loss

Overallocation = revenue waste

Supply

Actual demand
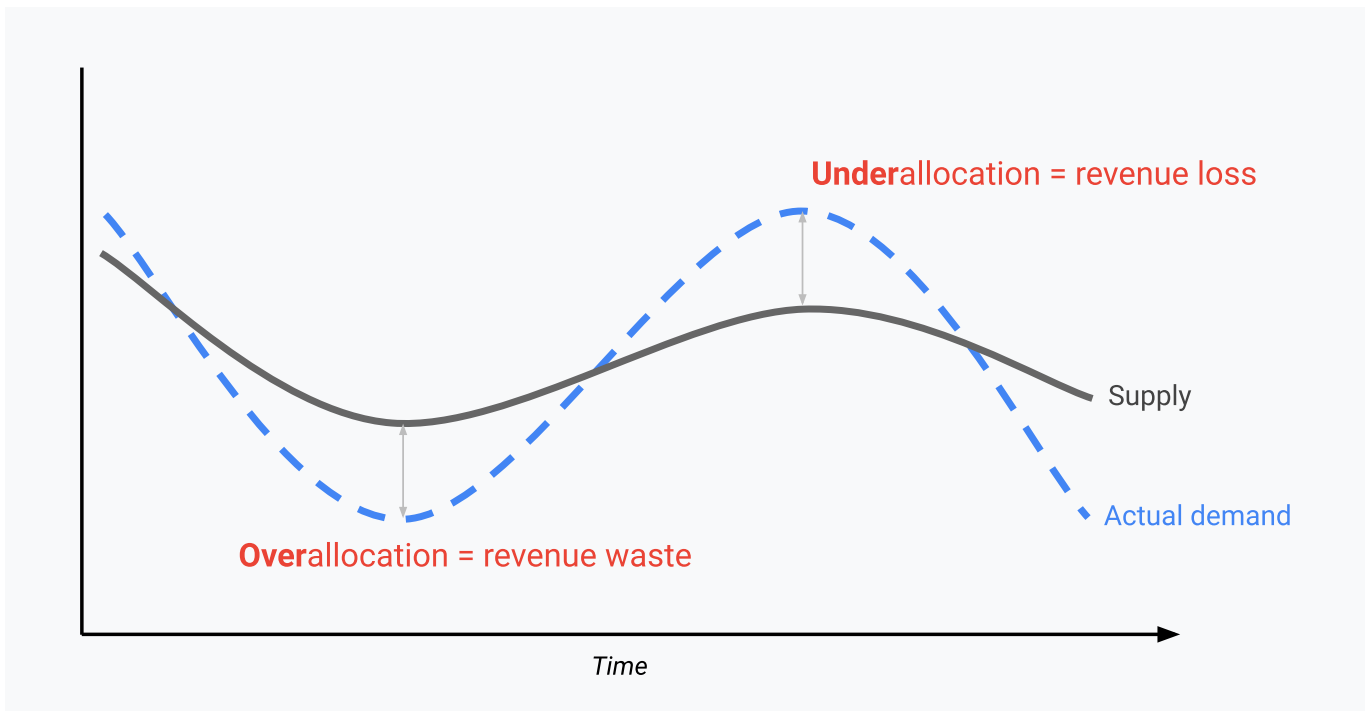
Time

A mismatch between demand and supply (overallocation or underallocation of supply) can lead to potential revenue loss/waste.

## How does demand forecasting work?

Demand forecasting models are built on historical time series data and then used to predict demand on future dates. Demand forecasting models often start with autoregressive integrated moving average (ARIMA) as a basis. However, advanced demand forecasting models will also account for seasonality and trends, regional holidays, and spikes or other irregularities in the data. As new data comes in, the models can be regularly re-trained to keep up-to-date with emerging changes in the world.

Therefore, a proper demand forecasting solution should ideally provide organizations with the ability to take action as quickly and easily as possible on the predictions -- this can be facilitated by using live dashboards instead of static charts, receiving automatic alerts instead of manual ad-hoc analysis. Ideally, the solution should take any series of subsequent actions automatically by triggering other processes or systems when certain conditions are met. For example, automatically reserving extra transportation to ship a higher-than-normal volume of product, or reserving less transportation if forecasted demand is lower.

For this reference pattern, you will:

- Pre-process historical time series data into the correct format to create a demand forecasting model using BigQuery ML

- Train a time-series model in BigQuery ML

- Evaluate the model

- Predict the future demand of each product over the next n days

- Take action on the forecasted predictions

- Create a dashboard to visualize the forecasted demand using Data Studio

- Setup scheduled queries to automatically re-train the model on a regular basis

Historical Data	Time-series modeling	Forecast Predictions	Dashboard
BigQuery	BigQuery ML	BigQuery	Data Studio
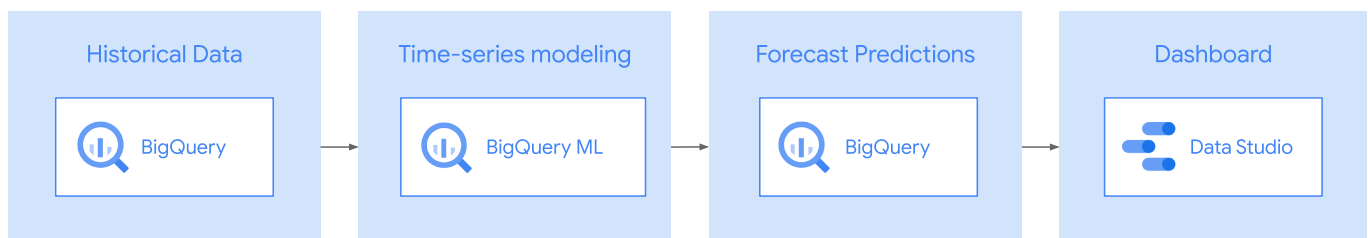
To get started with building a demand forecasting solution, check out all the code written, packaged, and ready for you to test, customize and deploy here.

We have other patterns available for time series analysis and custom models available here.

Benefits of this Google Cloud approach

- With fully managed products like Google BigQuery, you can free up developers and operators with fully managed, self-scaling infrastructure

- AI/ML approaches, including Cloud AutoML, for that meet your organization's needs and expertise

- Enterprise-grade warehousing and security to meet your scale and data protection requirements

- Solutions and tools to meet each of your data and business stakeholder's needs

- Strong support for open source technologies and partner solutions

Smart Analytics reference patterns are designed to reduce the time it takes for you to implement analytics and ML solutions so you can get up and running as quickly as possible. To get started, check out all existing reference patterns here and select the one that best fits your needs.