Case 1

Nabisco Biscuit Company is the largest domestic operating company within Nabisco, a Fortune 500 company with $9 billion in annual sales. Nabisco Biscuit Company is the largest cookie and cracker manufacturing company in the United States, with annual sales of $3.5 billion. More than 30 company-owned and contract bakeries produce hundreds of different cookie, cracker, and snack products, including Oreo, Chips Ahoy!, Ritz, and Snack-Wells. These products are shipped from the bakeries to more than 100 distribution center warehouses throughout the United States, and then from these distribution centers, Nabisco delivers orders to more than 100,000 final destinations, mostly retail grocery and convenience stores. Orders placed with a distribution center are delivered to a store within a short lead-time period, typically 24 to 48 hours. An accurate weekly forecast of product demand from the distribution centers is particularly critical to Nabisco because of the short lead time for orders, the wide geographic dispersion of the distribution centers, the large number of Nabisco products, and the limited product shelf life of bakery products. The forecasting process is complicated by product promotional events at the stores and the continuous introduction of new products.

Nabisco uses what is referred to as a top-down approach to forecasting. It starts with a national production forecast for each product for a 4-week sales period. This national forecast considers information from finance and marketing and from a national product promotional schedule. It is provided to the distribution centers on a weekly basis to help create weekly forecasts of product demand, using statistical forecasting methods based on sales history. One of the forecast techniques it uses is a moving average. This demand forecast is combined with a statistical forecast based on individual account (e.g., store) promotional events and activities. Nabisco then uses this combined set of forecasts to determine the appropriate shipments from the bakeries to the distribution centers.

Forecasts for new products present Nabisco with a different challenge. Most of the forecasting techniques used for existing products are developed using several years of historical data, which are not available for new products. At Nabisco a planning forecast is used to develop initial production planning and scheduling and to set initial inventory levels for a new product. However, when the product is introduced, which is generally a gradual process across different geographic regions, actual sales can be different than planned, depending on consumer acceptance of the product. If consumer acceptance is greater than planned, the company can expect shortages and lost sales. If consumer demand is lower than planned and the new product fails, the company can be stuck with excess inventory that must be destroyed. Thus, it is important that Nabisco be able to adjust its forecasts quickly during the product introductory period so that they will be as accurate as possible. Nabisco uses a forecast model for new products developed using the exponential smoothing technique, with adjustments for trend and seasonality

Case 2

Taco Bell is an international fast-food business with 6,500 locations worldwide, with annual sales of approximately $4.6 billion.

Labor costs at Taco Bell are approximately 30% of every sales dollar, and these costs are very difficult to manage because labor is so closely linked to sales demand. It is not possible for Taco Bell to produce its food products in advance and store them in inventory like a manufacturing company; instead, it must prepare its food products on demandthat is, when they are ordered. Demand is highly variable during both the day and the week, with 52% of sales occurring during the 3-hour lunch period from 11:00 A.M. to 2:00 P.M. Determining how many employees to schedule at given times during the day is very difficult. This problem is exacerbated by the fact that quality service is determined by the speed of service.

To develop an effective labor-management system, Taco Bell needed an accurate forecasting model to predict customer demandthat is, arrivals and sales. Taco Bell determined that the best forecasting method was a 6-week moving average for each 15-minute interval of every day of the week. For example, customer demand at a particular restaurant for all Thursdays from 11:00 A.M. to 11:15 A.M. for a 6-week period constitutes the time series database to forecast customer transactions for the next Thursday in the future. On a weekly basis, the forecasts are compared to statistical forecasting control limits that are continuously updated, and the length of the moving average is adjusted when the forecasts move out of control. Taco Bell achieved labor savings of over $40 million from 1993 to 1996 by using the new labor-management system, of which this forecasting model is an integral part.

Case 3

Dell is the largest computer company in the world. Its founder, Michael Dell, formed the company based on the idea of selling personal computers directly to customers and bypassing retailers; Dell Inc. sells computer systems directly to customers via phone and Internet orders. Once an order is received and processed, it is sent to an assembly plant in Austin, Texas, where Dell builds, tests, and packages a product within 8 hours.

Dell's direct sales model is dependent upon its arrangements with its suppliers, many of which are located in Southeast Asia, with shipping times to Austin of 7 to 30 days. To compensate for these long lead times, Dell requires its suppliers to keep specified (i.e., target) inventory levelstypically 10 days of inventoryon hand at small warehouses, called "revolvers" (short for revolving inventory). In this type of vendor-managed inventory (VMI) arrangement, Dell's suppliers determine how much inventory to order and when to order to meet Dell's target inventory levels at the revolvers.

To help its suppliers make good ordering decisions, Dell shares its demand forecast with them on a monthly basis. Dell uses a 6-month rolling forecast developed by its marketing department that is updated weekly. Buyers receive weekly forecasts from commodity teams that break down the forecasts for specific parts and components. These forecasts reflect product-specific trends and seasonality. For home computer systems, Christmas is the major sales period of the year. Other high-demand periods include the back-to-school season and the end of the year, when the government makes big purchases.

Case 4

FedEx is the world's largest express delivery company, with annual revenues of $14 billion. With a workforce of 145,000 employees, 600 planes, and 42,000 ground vehicles, it delivers more than 3 million packages per day to 210 countries. To support its global delivery network, FedEx has 51 customer service call centers, including 16 in the United States and 35 overseas. The customer service centers in the United States handle about 500,000 calls daily for requests for pickup, drop-off locations, package tracking, package rating, and so on. FedEx's service level goal is to answer 90% of all calls within 20 seconds, and it has some of the highest customer satisfaction levels in the industry.

FedEx has three major service call networks: domestic for calls related to packages sent and delivered within the United States; international for packages sent overseas from the United States; and freight for calls related to packages over 150 pounds. For each of these call networks, FedEx uses four different forecasts, encompassing different forecasting horizons: strategic plan, business plan, tactical forecast, and operational forecast. The strategic plan is for a 5-year horizon and includes forecasts for the number of calls to service representatives, average call handling time, staffing requirements, and technology calls. This plan is revised and updated once a year. The business plan includes the same forecasts as the strategic plan, except it is for a 1-year horizon, with updates and revisions as management requires. The tactical forecast is a daily forecast of the number of calls offered to service representatives, provided once per month and rolled over for 6 months. The goal for the tactical forecast is to be within a 2% error per month and within a 4% error on a daily basis. The operational forecast is a daily forecast of the number of calls offered to service representatives and the average call handle time per half hour. It is prepared on a weekly basis and forecasted 1 month in advance.

The forecasting models used include exponential smoothing, linear regression, and time series, with adjustments for trend and seasonality. For example, the tactical forecast employs a time series model based on 8 years of historical data, with adjustments for seasonalities that is, month, week, day, and day of month. Trend adjustments are also used.

Case 5

In 1993, due to large financial losses, National Car Rental was threatened with liquidation by its parent company, General Motors. The car rental industry had been in turmoil since the 1980s, when automobile manufacturers purchased almost all the major rental car companies and then flooded them with their excess auto production. The excess supply of cheap cars led to low prices, especially during periods of low demand, which eroded profits. When in the 1990s demand for cars increased, thus raising the cost of cars to the rental car companies, profits fell further.

Car rental companies rely largely on corporate clients that have large numbers of employees who travel. Rental car demand peaks at midweek, forcing car rental companies to turn away customers. They also have a large excess fleet that is idle on weekends, which, in turn, allows occasional renters, such as leisure customers, to book multiple reservations with no prepayment or cancellation or no-show penalty. This can result in no-shows that exceed 50% of reservations.

Prior to 1993, no demand forecasts had existed for National. To save itself from liquidation, National Car Rental committed over $10 million to design and build a revenue management system that would manage capacity, pricing, and reservations. The system encompasses a number of management science and analytic models. A critical component of the system was the development of a comprehensive set of demand and revenue forecasts. Demand forecasts are made for the length of the rental period and the number of cars in use on a specific date. These demand forecasts are based on a combination of long- and short-term forecasts. The long-term forecast is a time series model with seasonal factors. The system generates forecasts for all days within a 60-day booking period. The system also generates forecasts for daily non-reservation customers and for no-shows.

The complete revenue management system produced immediate results, improving revenues by $56 million in the first year alone. Rather than liquidate, General Motors sold National Car Rental in 1995 for $1.2 billion.