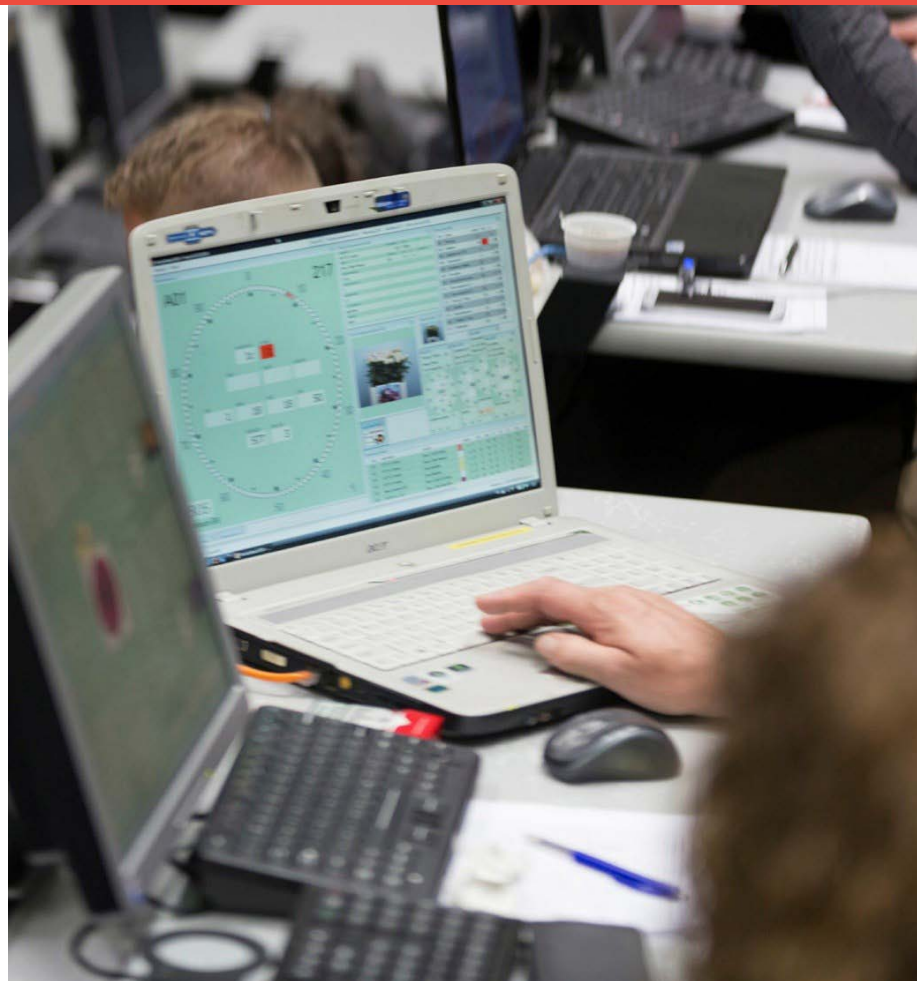Unlock data possibilities
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Reimagine forecasting:
High stakes decision making for CFOs

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How can CFOs deliver more value to their organizations?

Reimagining forecasting may seem like a gratuitous exercise in crystal ball design. But it is becoming a critical step that CFOs should take to make sure their companies are using leading indicators to maintain their positions as market-leading organizations, strive to innovate, and protect the brand – instead of lagging the pack with sub-optimal indicators.

Unlocking the power of data and analytics to think about what will happen, assessing its likelihood, and contemplating the implications mean the difference between accurate or inaccurate forecasts, with multi-million or billion dollar impacts.

It's time to reimagine forecasting:
Get started

We are always forecasting - thinking about what will happen, assessing its likelihood, and contemplating the implications. But for CFOs, the stakes are much higher – the difference between accurate versus inaccurate forecasts can be worth billions of dollars, and a job. A CFO's worst nightmare: the forecast is made, as time unravels, expected and actual revenue and profitability fail to converge. "Why" questions are asked – with no answers. Is there a fundamental problem with the appeal of our products/services? Did a competitor make a move we didn't expect? Is it due to macro factors that are out of our control? And, finally, how much does it matter to the next forecast about the future value of our business?

The signals in the noise

It can be very difficult to find the signal in the noise, and it is becoming more important than ever. Short-termism and fast news cycles exacerbate the effects of missing a forecast on company value. Activist investors may see it as a signal that management doesn't have a firm hand on the business. The cost of being off the mark can also be huge, not just in perception but also in dollars. A company's cost of capital (debt or equity) can be impacted by their assumptions and forecasts related to GDP growth, currency exchange rates and interest rates. Failure to accurately forecast demand fluctuations can result in too much, or not enough, inventory – either

increasing cost or ceding revenue to competitors with close substitutes. In services industries, the inability to accurately forecast demand for specific offerings requiring specific skill sets to deliver may result in having too much talent with the wrong skills – rippling into brand-crippling layoffs – or being short in areas where a war for talent is being waged. In each of these situations, the cost of being wrong today can become extremely costly in the future.

Now, there is the potential to reimagine forecasting in a way that allows CFOs and their counterparts in the C-Suite to tease out signals that matter and deliver more value to their organizations in the short and long term.

1st Companies need to make better use of the (sometimes massive) data sources available to them and apply different types of analytical techniques in their forecasting approach. Our Five Factor Forecasting Model (page 2) takes a 'top down' and 'bottom up' approach to data.

2nd Look within and across strategic, managerial and operational domains through better integrating forecasts of leading macro-economic and industry trends, with micro 'feet on the street' indicators regarding what customers are thinking, feeling and doing – all of which impact financial results.

3rd Bringing the 'reimagined forecast' to life, and capturing the value, requires effectively changing the organization's mindset using novel visual and analytical approaches to embed it into macro and micro decision making.

A guide to Five Factor Forecasting Model:
Use data and analytics to broaden aperture, create leading indicators and sharpen response

Many forecasts are built on relatively thin, high-level historical time-series data using inefficient or, in some cases, questionable modeling techniques. Reimagining forecasting starts with designing a "Five Factor Forecasting Model" that uses a more comprehensive cross-section and timeseries of "top down" and "bottom up" data. It includes knowledge of macro-economic drivers, potential policy and regulatory changes, industry supply and demand, environmental impact on resources and consumer behavior – the ultimate drivers of business performance. Combining these data and accumulating it over time makes it possible to apply an array of modeling techniques to broaden the forecast aperture, establish leading indicators that inform macro and micro changes and sharpen management's response. The figure to the right illustrates the types of data that can be applied, and value that can be generated, with this more comprehensive approach.

Five Factor Forecasting Model: Data you can use for better forecasting

With the proliferation of 'big data', many entertainment and media CFOs' FP&A process is subject to unexplainable outliers, such that simply determining if they should keep the outlier, normalize it, or disregard it is becoming increasingly difficult, and a topic of debate. In some cases, this leads to a disbelief in a financial organization's ability to set the appropriate KPIs to achieve a company's growth strategy. Robust Regression is one technique that helps deal with outliers while building forecasting models, thus tightening the confidence intervals from which planning decisions can be made. This technique assigns a weight to each data point automatically and iteratively throughout the modeling process, assigning lower weights to those data points with the least amount of contribution to an accurate prediction.

Techniques to try

- Real-time data crowdsourcing

- Robust Regression

- Time-Series

Macro-economic data

Rather than wait for lagging, *macro-economic* indicators, it is becoming possible, using new data collection approaches, to establish near real-time or leading indicators that are proxies for measures of economic activity including GDP, labor supply, liquidity, and emerging market risks. For example, "nowcasting" is an approach using internet search data combined with other sources of industry and consumer data to provide alternative and more timely GDP indicators that companies can use to make adjustments to their forecasts. Companies are using real-time crowd-sourcing techniques to capture more granular, real-time data about price volatility of similar goods in markets around the world, which can be used to inform hedging strategies involving currencies and commodities. Companies are using satellite imagery to evaluate the expansion rate of populations and residences in emerging markets and create proxies for electricity demand or bandwidth usage. Lastly, more granular data of regional and local traffic patterns can be analyzed over time to improve supply chain configuration and logistics services, as well as retail expansion strategies. Using these new techniques, companies can do a better job of anticipating economic headwinds and insulating the business from what previously seemed like random or unpredictable events.

Utilizing Rare Event Modeling in the Airline industry to better predict the likelihood of a delay or cancellation not only helps operations but also improves customer satisfaction. By collecting structured sensor data from the airframe and combining that data with unstructured data coming from maintenance logs, analytical models can be built to help pinpoint which aircraft parts are likely to fail, with sufficient lead time to allow the airline to re-route the aircraft accordingly, and minimize the likelihood of an unplanned maintenance delay or cancellation.

Techniques to try

- Simulation Models (System Dynamics, Agent Based)
- Rare Event Models
- Hierarchical Forecasting
- Anomaly Detection
- Example Application

Industry data

Aggregating **industry** level data about supply capacity and demand potential for products and services can help companies better manage short-, medium- and long-term demand/supply imbalances, thereby helping them to time investments and cut-backs more effectively. To do this requires CFOs to collect and integrate new types of data to provide a more complete picture of the value chain, including raw material availability, labor supply, production/delivery capacity, and productivity and demand estimates at each stage of the supply chain. For example, companies in asset intensive industries such as Energy, Travel and Transportation, and Semi-Conductors make billion dollar supply bets years in advance. Companies in these industries are starting to use sensor and unstructured work log data to build models that inform timing of investments to replace equipment, anticipate major maintenance needs, and identify safety and operational disruption risks – all of which help create better supply forecasts. These models can then be further improved by including proxies for total industry capacity and cost of production, to help guide improvements in capacity utilization, pricing and profitability. Maintaining time-series data about aggregate industry demand and market share changes, based on feature/functionality, volume and price changes, can be used to assess the impact of different demand scenarios on supply and maximize revenue, profit or market share accordingly.

In Services industries, companies also need to include data about industry supply and demand of skills in their forecasting models. Doing so helps them understand substitution effects between labor and automation, reduce the risk of large scale, brand-deteriorating layoffs, and avoids them being caught without the right expertise as talent wars wage. Better forecasting of skills required across large, globally diverse pools of labor helps them anticipate hiring needs, inform sourcing strategies, design talent development programs and establish competitive compensation programs. To achieve this, they need to collect and codify data about the skills required and monitor data that will indicate the future supply of skills, such as demographics, third-party job postings, and volume/types of degrees, to assess future imbalances and forecast needs. For both capital and labor intensive industries, advanced techniques such as simulation models and rare event models can be used to complement econometric models, to forecast needs for investment in capacity. It's about building a comprehensive data set that includes the drivers of change, as opposed to precision accuracy.

Example application:
Bayesian Games to combat anti-money laundering

Leveraging regulatory, transactional, employee, social media, and other third-party data sources, Bayesian* games can be built to better inform a financial institution's leadership around anti-money laundering and help refine strategies for combating AML. Moreover, using a Bayesian approach, strategies can be adjusted based upon new information about player types, updating the game, and refining expectations and strategies accordingly.

Techniques to try
- Game Theory
- Panel Regression
- Natural Language Processing

A method in probability and statistics

Policy and regulatory data

The potential for *policy/regulatory* change can be a forecasting wild card, but it is worth anticipating the ways and degree to which it can impact industry economics and company performance. Financial services companies are still extrapolating the impact of the Dodd-Frank Act on short-, medium- and long-term capital planning, trying to strike the right balance of managing risk and generating profit. Simultaneously, they are assessing the impact of customer and consumer protection regulations that will impact product design, pricing and profitability. In Healthcare, as more targeted therapies are uncovered with associated high price tags, more scrutiny from providers, insurers, governments and public perception may dramatically alter the forecasts of R&D pipeline value. In these cases, unstructured data from regulatory documents, constituency maps, organization network analysis and behavioral economics studies can inform game-theoretic models and decision trees to anticipate the likelihood of policy or regulatory outcomes and the key conditions upon which the outcomes depend.

Environmental data

Example application: Support Vector Machine Model to help determine best strategy for land management

By leveraging geo-satellite data, drone imagery, and spectroscopy data, analysts can build models to determine the fertility of soil and the proper functioning of an ecosystem, to better determine strategies for socio-economic development; i.e., crop rotation and fertilization. These models often play a critical role in city and urban planning and land management as it relates to the health of water supplies, soil for crop production, and the overall viability of a region's natural resources.

Techniques to try
- Simulation Models (System Dynamics)
- Machine Learning
- Sensor Data Analysis
- Satellite & Drone Imagery

Environmental factors related to geographic proximity have major impacts on businesses, including which markets they select for growth; diversification of suppliers; where they locate production and distribution facilities; preferred transportation routes; and choices to use physical versus digital channels to sell products and services. In large growth markets such as India and China, the prospect of water shortages may dramatically alter the geographic positioning of populations, factories, and infrastructure. Weather volatility is creating more seemingly random events impacting supply chains, capital pools, and food sources. Companies are starting to expand data sets around the environments they operate within, including weather data, geo-satellite and drone imagery, on street/in store cameras as well as sensor networks to evaluate conditions in the air and on the ground to improve forecasts. These data are being used in simulation models to optimize global supply chain configurations, rare event models to plan for catastrophe responses, machine learning image analysis to count commodity assets such as lumber or crops, and to inform intra-week retail workforce planning.

Example application: Agent Based Model to understand marketing performance versus traditional market mix models

Traditional market mix models attempt to estimate the weights or coefficients between actual and modeled sales while minimizing error. These models work best in a static market when trying to understand which stimuli contributed to overall sales or marketing performance. Moreover, traditional market mix models will often struggle with new product launches or a major shift in some external factor such as technology or climate (political or weather). ABMs can dynamically model the consumer or household while providing clear insights into the complex relationships (or feedback loops) that exist between individuals or households. These models often leverage a combination of business rules, past purchase behaviors and marketing strategies, third-party data, unstructured data, and other non-traditional data sources such as social media data or sensor data, to develop their solutions.

Techniques to try

- Simulation Models (Agent Based)
- Machine Learning (Image and Voice Analysis)
- Sensor Data Analysis
- Collaborative Filtering
- Adaptive Conjoint

Consumer data

Lastly, it is becoming more possible to use new data sources to understand how the ultimate demand generator – **the consumer** – impacts your business. For example, consumer sentiment related to specific companies, products and services can be picked up from websites and social media forums and analyzed to identify likely market adoption of new business models, product categories or services. Some companies are using social networks of individuals with smartphones to capture granular consumer behavior data to better inform marketing messaging and pricing offers. Image data is being used to understand customer reactions to new product designs. Physical movements of consumers and an understanding of their behaviors and traffic patterns, can be determined through video and image analysis, to inform retail expansion strategies and create more effective marketing campaigns that traverse digital and physical worlds. In short, B2B and B2C companies have the opportunity to analyze a much richer set of end consumer data that better informs the forecasting variables that are used to estimate demand.

Value capture using the Five Factor Forecasting Model across strategic, managerial and operations domains

Without the Five Factor Forecasting Model, the search for better data to inform forecasts may feel to some CFOs like a costly exercise, wandering through endless data wastelands that don't provide the bang-for-the-buck. The Five Factor Forecasting Model provides a guided, cost-effective approach to data discovery that allows CFOs to build a more comprehensive cross-section and time-series of data over time that, in turn, improves forecasting models and business performance.

The next step is using a systematic test and learn approach to seek out and evaluate the ways data and analytical techniques in the Five Factor Forecasting Model can be reimagined in each domain of forecasting – strategic, managerial and operational – to deliver new value.

Forecasting Domains to Deliver New Value

Strategic

Objectives:

Focus on assessing the impact of mid-long term trends on the economics related to the positioning, strategy, assets and business model

Forecasting examples:

- New business model evaluation
- Global market expansion

Reimagine with Five Factors

- Understand the likelihood and magnitude of impact of scenarios on the strategy
- Identify drivers and timing of non-linear growth or decline
- Isolate and monitor critical "factors" that influence strategic choices

Value

- Long term shareholder value generation
- Business diversification
- Revenue/profit stability

Strategic forecasting

Strategic forecasting helps companies assess the impact of mid- to long-term trends on the economics, given the positioning, strategy, assets and business model. Traditional strategic forecasting is predominantly based on trend analysis: extrapolating past performance to the future and assessing the impact. It often relies heavily on personal intuition and judgement as opposed to rigorous data-driven analysis. Using data sets spanning the Five Factors, it becomes possible to create a more cohesive model to evaluate the likelihood and magnitude of impact of a range of scenarios on the strategy and business model. Drivers of non-linear growth or decline can be better understood and monitored to avoid unrecoverable losses. This type of approach is becoming more critical in a business environment where the speed of technological change is enabling new business models that put at risk incumbents' ability to generate long-term shareholder value.

Managerial

Objectives:

Focus on managing key financial metrics and the associated market drivers and operational metrics

Forecasting examples:

- Demand management
- Risk management

Reimagine with Five Factors

- Understand "cause and effect" drivers of financial performance
- Create better informed annual/quarterly plans that optimize short and long term capital allocation and ROI

Value

- Revenue increase
- Profit increase
- Productivity improvement

Managerial forecasting

Managerial forecasting is focused on managing key financial metrics and evaluating the impact of market trends and operational metrics. Frequently, it involves setting stretch targets, which are needed to satisfy expectations for financial results, with little attention paid to the "stars in the market" that need to align or the demands on operational resources needed to deliver the results. It is becoming possible to model the "cause and effect" relationships that need to be managed to increase the probability of achieving financial targets. This allows management to create better informed annual plans that optimize capital allocation to drive revenue increase, profit increase and productivity improvement.

Operational

Objectives:

Focus on managing key operational metrics and the impact on financial metrics

Forecasting examples:

- Safe planning
- Production & operations target

Reimagine with Five Factors

- Understand the impact of "cause and effect" drivers on financial performance
- Adjust operations plans based on changes to financial forecasts
- Optimize associated price, quantity and cost metrics

Value

- Effectiveness/efficiency increase
- Service level improvement

Operational forecasting

Operational forecasting is about managing the key operational metrics that are expected to drive financial metrics. Frequently, operational plans are not adequately adjusted to the degree needed to achieve managerial forecasts. If growth is forecasted, inventory levels need to be adjusted. If market pressures are expected, pricing needs to be evaluated to make sure it's competitive, which in turn will impact profitability forecasts. With more data available, it becomes possible to run optimization models that tell you how numerous operational metrics such as price, quantity and cost need to be managed.

Integrating strategic, managerial and operational forecasting

The true power of using a Five Factor Forecasting Model, with rich cross-sectional and time-series data, is that it enables integrated strategic, managerial and operations forecasting in a way that has only recently become possible and cost effective. Collecting data is cheaper today. There are more types of data that can be collected (text, audio, image). The data can be integrated and managed. There is now the processing power to enable the use of different types of techniques and models to draw better insights and inform actions. The net result is that companies can create a more holistic forecast of short-, medium- and long-term business performance that is linked to internal and external drivers. They can systematically assess the likelihood and timing of scenarios and tradeoffs between value drivers that are sometimes at odds, such as short-term revenue growth versus long-term shareholder value, or immediate effeciency improvements versus sustained productivity improvement. Most importantly, companies can set forecasts with a better understanding of the factors most likely to impact it, either positively or negatively, and make more timely adjustments to strategy, management plans and operations as needed. Following are examples of how companies are creating value across strategic, managerial and operational forecasting domains with a Five Factor Forecasting Model.
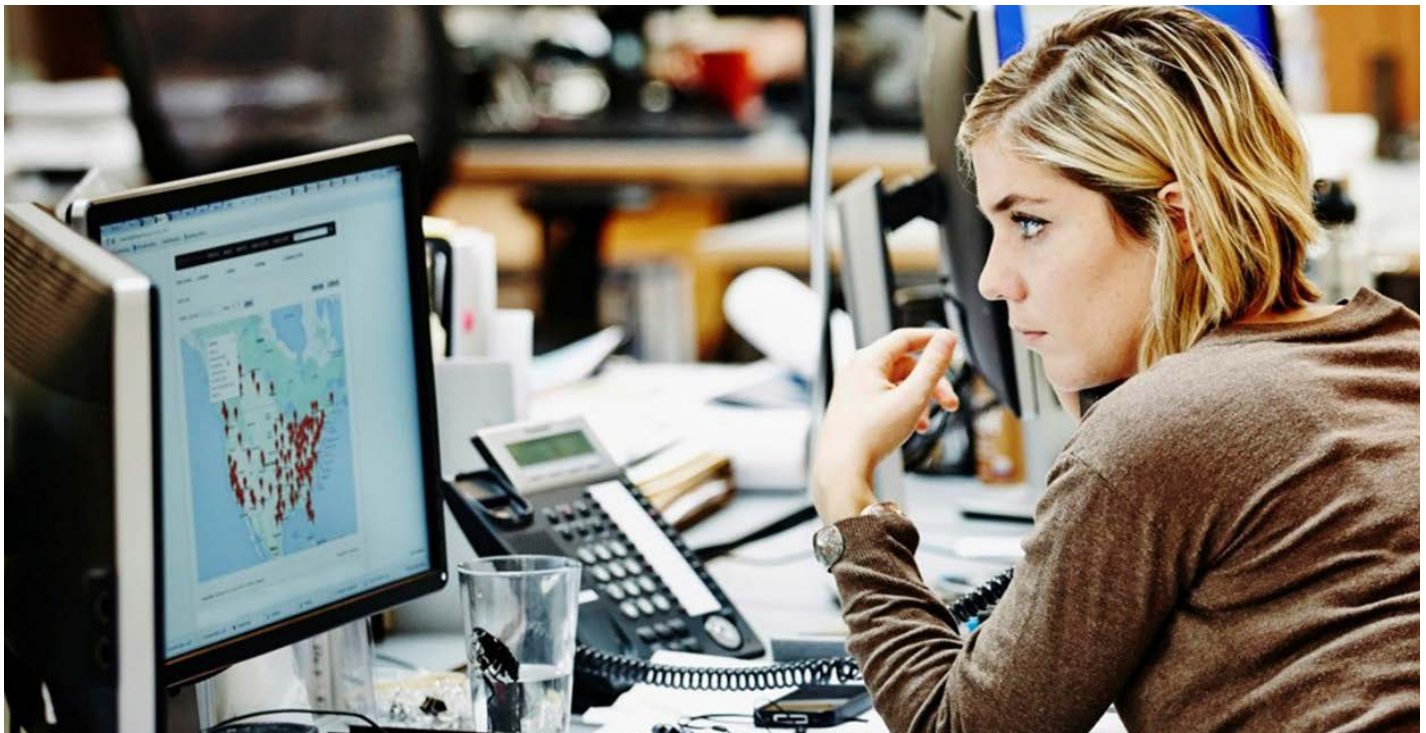
Forecasting value capture:
Why do it?

To bring to life how CFOs can deliver more value to their organizations, we offer these examples.

Avoid wasted short-term investment based on unwillingness to commit to the sustained investment needed to win

Forecasting the short- and long-term investment, market adoption and revenue impact of new business models

Companies that are considering new business models can improve growth and investment forecasts by collecting more data about drivers of consumer switching behaviors, and alternative competitive offerings. For example, a large Financial Services institution was looking to create a new business model in the mobile wallet space. Linear forecasting models assumed rapid adoption and revenue which justified more short-term investment, for a shorter period of time. They also included an untested assumption that mobile wallet customers would use their branded credit cards – creating an ancillary revenue stream. More careful examination of multiple scenarios over a 10-year time horizon – assessing the impact on the industry's point-of-sale infrastructure, policies related to security, the relevant geo-specific bandwidth needs, consumer preference for alternative payment vehicles and consumer behaviors governing switching – helped pinpoint a likely timeframe for adoption, which was many years beyond what they had initially forecasted. The net effect of the linear forecasting was an ROI that was some $200MM lower than anticipated. The Five Factor Forecast demonstrated the need for a more sustained investment, with lower levels of profitability. In addition, a critical determinant of early adoption success was the wallet being "open" to other companies' credit cards – a conflict with the business model of the core cards business. This forecasting model incorporated cross-sectional and time-series data to identify strategic, managerial and operations factors that most impacted mobile wallet business model success, and ultimately better informed a "big decision".

Increase ROA of physical assets while reducing the probability of risk associated with asset failure

Forecasting physical asset replacement timing and operational risks through creative uses of environment, industry and regulatory data

In a physical, asset-intensive industry, a major Electric and Natural Gas Utility company optimized their capital replacement planning and execution by developing a predictive analytics tool to combine asset risk data and methane emissions data to prioritize pipeline replacement projects. This enabled them to improve pipeline safety, reduce methane emissions, optimize capital investment and improve operational efficiency. First, a geo-spatial analysis was conducted by assessing internal and external data to identify high density/high risk zones of critical leaks. Previous leaks and failures were analyzed to evaluate the density of leaks across the network. The results of this analysis were used to enhance the predictive deterioration models and increase ROA. In addition, a predictive model was developed that forecasted the expected number of leaks in the next year. Finally, these results were used to predict 'leak find rate' in each geo-cluster so that replacement projects could be re-prioritized. As the Internet of Things connects sensors to physical assets, and geo-satellite imagery and drones allow cost effective visual inspection, it will become increasingly possible to integrate strategic, managerial and operational forecasts to improve asset management.

Using real-time trend analysis to quickly adjust marketing priorities, optimize inventory and capture unplanned revenue upside

Anticipating healthcare trends in near real-time and using geo-targeting to increase revenue

A maker of popular cold and flu remedies used search data from the medical website WebMD (with almost 32 million monthly visitors at that time), to track cold and flu symptoms across the US and anticipate where outbreaks were likely to occur. Then the company released targeted geography- and symptom-specific advertising and promotions (including an offer for free home delivery), in those places. Along with a strong cold and flu season, this initiative helped the company, during one four-week period, to increase its US sales of cough and cold products by 22 percent, compared with the previous year.

Investing in building proprietary data sets about consumer behavior can improve operations performance

Sense consumer behavior data and respond with better managerial and operational plans

One of the largest retailers in the world has spent decades extracting insights from customer buying trends and incorporating those insights into upstream operations. This retailer leveraged its customer loyalty card program to extract customer purchasing insights and applied them toward the redesign of its internal operational processes, most notably the supply chain. Through better scenario planning, incorporating weather forecasts and weather related buying into demand forecasts, the retailer can deliver exactly the right type and amount of inventory to the right store at the right time and reduce the risk of stock-outs. As a result, the retailer captures high operational cost savings, in addition to revenue and margin gains from knowledge of consumer behavior.

Identify better entertainment content, forecast optimal release strategy and create new advertising business models

Moneyball for movies informs content creation and release strategies

In the entertainment industry, simulation is being used to forecast and improve the revenues generated by movies across the complete spectrum of release windows. This model incorporates the real-world dynamics of the system, including marketing strategies, environmental factors (e.g., GDP, disruptive technologies) and intrinsic characteristics of the movie. Executives can use this to simulate and test various release and distribution strategies prior to launch and throughout the lifecycle. In addition, they can engage in "content discovery optimization," similar to today's search engine optimization practices, where content is continuously tuned so that it can be discovered by the broadest possible audience at the right time. Using data analytics, companies can then package the right experiences for advertisers and monetize them directly by building a model that caters to different types of viewers.

Creating living, breathing forecasts:
Where to begin?

Adopting the Five Factor Forecasting Model requires three major changes in the ways many companies operate. They involve the operating model, culture, and data and analytics technology.

### Making the mind-muscle connection

The biggest challenge for many CFOs is aligning the C-Suite on the best drivers from each business area/function to inform forecasts. From there, consensus will still be required on how to analyze results and quickly leverage those insights to drive strategic or operational adjustments across multiple areas. It is important for organizations to establish a framework for translating forecasts into actionable insight and ultimately to action – the "mind-muscle connection." To do this, the forecaster should prioritize the data to be explored and the analytical techniques to be applied, based on what generates the most timely and actionable results for senior decision makers.

A shift in mindset

The right organizational mindset is required in order to build greater accountability surrounding forecasts and responsiveness to results. Engagement and collaboration across various groups are critical to establishing accurate forecasts based on an unbiased consensus outlook. Learning from, as opposed to persecuting, failure is key. Lastly, adopting an approach that blends data-based insights with business judgment (the 'art and science' of decision making)is needed to answer "the why questions" that are at the heart of improving performance. A corollary of this, a best-in-class planning framework, requires the collaboration and unbiased consensus of different functions to establish an accurate forecast. A good place to start with the mindset shift is in the C-Suite.

Large scale visualization

Given the amount of data – and the ability to create simulation models that visualize cause and effect relationships between market and operational drivers and financial metrics, integrated strategic, managerial and operational forecasting models require large scale visualizations, so that cross-functional groups collectively looking at data from across functions are better able to assess how their part of the business impacts the whole. In this way they can also evaluate how changes to their operations impact financial performance and vice versa. Most importantly, teams can test how their assumptions made with experience and intution play out in simulations, compared to data driven assumptions, to strike the right balance between management art and science.
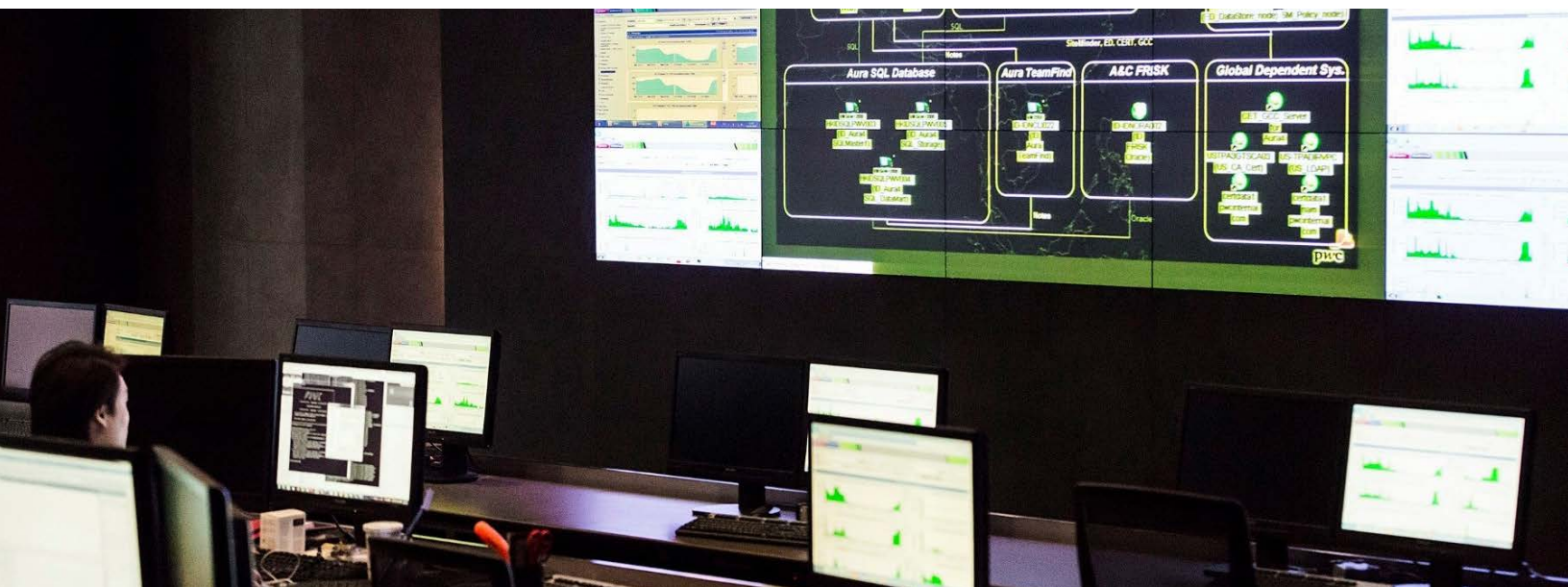
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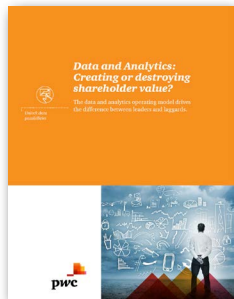
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