Data Analytics and Visualization Tell Your Story with a Web Reporting Framework Based on SAS®

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ABSTRACT

For all business analytics projects, big or small, the results are used to support business or managerial decision-making processes, and many of them eventually lead to business actions. However, executives or decision makers are often confused and feel uninformed about contents when presented with complicated analytics steps, especially when multi-processes or environments are involved. After many years of research and experiment, a web reporting framework based on SAS® Stored Processes was developed to smooth the communication between data analysts, researches, and business decision makers. This web reporting framework uses a storytelling style to present essential analytical steps to audiences, with dynamic HTML5 content and drill-down and drill-through functions in text, graph, table, and dashboard formats. No special skills other than SAS® programming are needed for implementing a new report. The model-view-controller (MVC) structure in this framework significantly reduced the time needed for developing high-end web reports for audiences not familiar with SAS. Additionally, the report contents can be viewed by tablet or smartphone users. A business analytical example is demonstrated during this session. By using this web reporting framework based on SAS Stored Processes, many existing SAS results can be delivered more effectively and persuasively on a SAS® Enterprise BI platform.

INTRODUCTION

Visual-based data discovery and visualization, a defining feature of the modern business intelligence (BI) platform, has transformed the market to business-centric agile analytics since 2004. Traditionally, a business would have gathered information, run analytics and unearthed information that could be used for future decisions; today that business needs to identify insights for immediate decisions to adapt the fast-changing market. Frequently, analysts find new challenges that the most important analytics results are misunderstood or sidetracked by business executives. In this paper, a new reporting strategy was developed by the author to provide an interactive report on SAS web based reporting framework.

SAS Enterprise BI platform provides many easy-to-use procedures or features that support a full range of analytic workflow capabilities. However, many of the techniques are intimidating for business users. Sometimes, the reports from SAS are difficult for business users to understand. A high level summarized static report lacks of flexibility for users to pinpoint the critical information which lead to decision-making. This article is demonstrating a web reporting framework based on SAS Stored Processes to overcome these common frustrations for senior analysts, executives and business users across all data driven industries.

To leverage the presentation of business data, analysts need to construct the analytics workflow in a storytelling style, from finding business opportunities or issues, to engaging audiences to visualize and interact with the methodologies and results. If an actionable business decision is made based on the analysis, the similar analytics workflow can be reused to track the effectiveness of business actions.

The benefits of SAS web based reporting framework solution include:

- Visualize the analytical results directly without statistics or math jargons.
- Link all analytical steps into a memorable story flow.
- Signify the key points in frame by frame structure.
- Expand the depth of the report with drill-down and drill-through functions.
- Achieve the highest return on investment with existing SAS EBI or Grid platforms.

EVERY ANALYTICS PROJECT CAN BE AN INTRIGUING STORY

The objective of most analytics projects is to describe a situation, predict the outcomes, and/or research the feasibility of a better business solution. The basic steps in the analytic process consist of: 1) determining the availability of suitable data, 2) identifying issues, 3) deciding on which methods are appropriate for answering the questions of interest, 4) applying the methods and evaluating, 5) summarizing and communicating the results. Ideally, the results lead to answers to specific questions and actions. The following example details the techniques to present the analytics result with a well-prepared story. With this goal-oriented reporting style, many complicated business research cases can be simplified to a matter of story flow, in which critical information can be easily read and understood by business leaders. The dynamic content and interactive features provide great flexibility for users to navigate through all clickable links. The story-chain feature can always bring users back to the main story flow in an intuitive way.

In web-based reporting framework, drilldown or drill-through features are essential in current technology environment with smart phones, tablets, or any other web browser-installed computers. A drill-through report allows users to go from summary to detail by any clickable links on a summary report. A drill-down report lets users examine the aggregated data in different levels in the same dimension or category. For example, a report displays information on region level in US. Then users can drill down the report to display information at state level, at county level, and even at postal code level. All these functions can be developed by using SAS stored processes in SAS web reporting framework.

In four steps below, the paper provides a typical example on how to formulate a story-chain in SAS web reporting framework. A major apparel company started an analytics project to capture the opportunities or issues on its marketing strategy. The goal is to launch a marketing campaign to boost its revenue and profit margin in this highly competitive industry. This analytics story-chain consists of trend analysis, competitive analysis, channel effective analysis, and demographic analysis. Only critical results are included into the main story-chain for management review.

STEP1: IDENTIFY OPPORTUNITIES OR ISSUES WITH DESCRIPTIVE REPORT

Defining problems in data analytics world usually involves identifying the emerging issues. In data visualization process, the items listed below are commonly used to show emerging issues.

- A disrupted trend
- An outlier in cross-sectional metrics
- A change in correlations
- A change in ratio

The drilldown, drill-through, and filtering functions in web reporting framework can identify specific causes of problems.

On the other hand, opportunities can also be found by discovering the new markets, uncharted capacities, and potential demands. In this study, cross sectional and longitudinal data were combined together to show a company's market position while performing the trend analysis.


In Figure 1, the first graph provides the three years' trend overview of profit and revenue for this company adjusted by seasonal weight. This visualization is to let audience identify the emerging issues. The slow growth can be observed in 2016.

The second graph and third graph show the competitive analysis on profit and revenue respectively with industry average growth rate in the market sector comparable to the company. This analysis identifies the market position for this company. The blue bars represent the industry average growth rate and red bars for the company's growth rate. The bars with line pattern indicate that the company's growth rates were lower than the industry average rates at the same periods. The increasing number of bars with line pattern led reviewers to define emerging issues appeared in the second half of 2016.
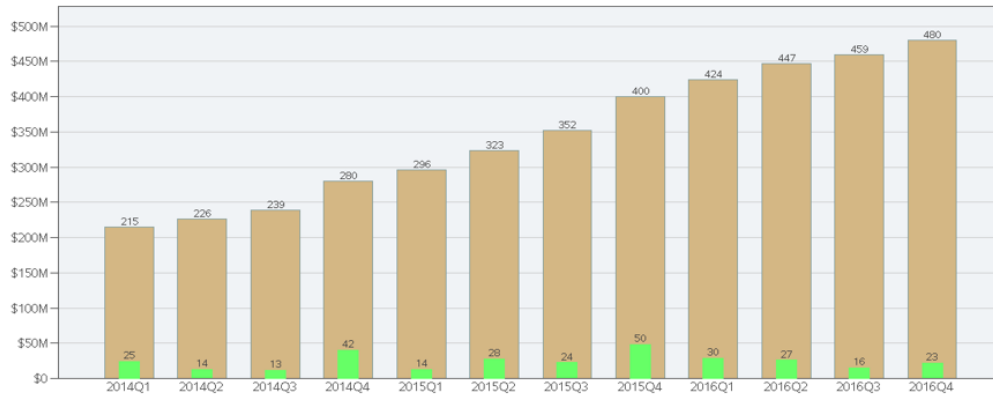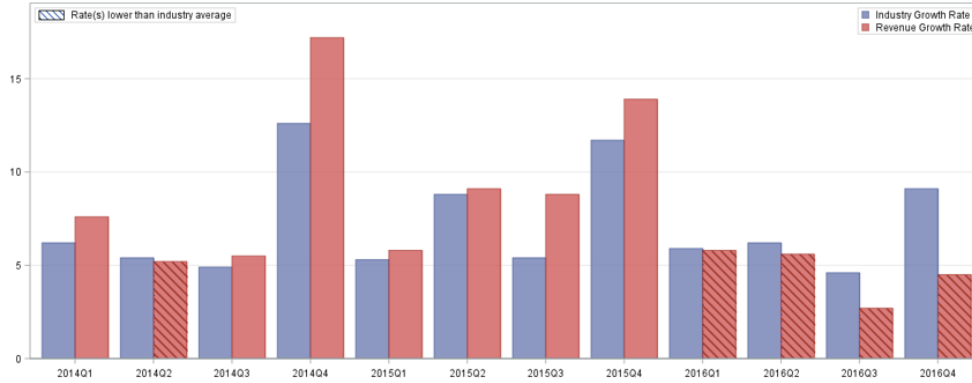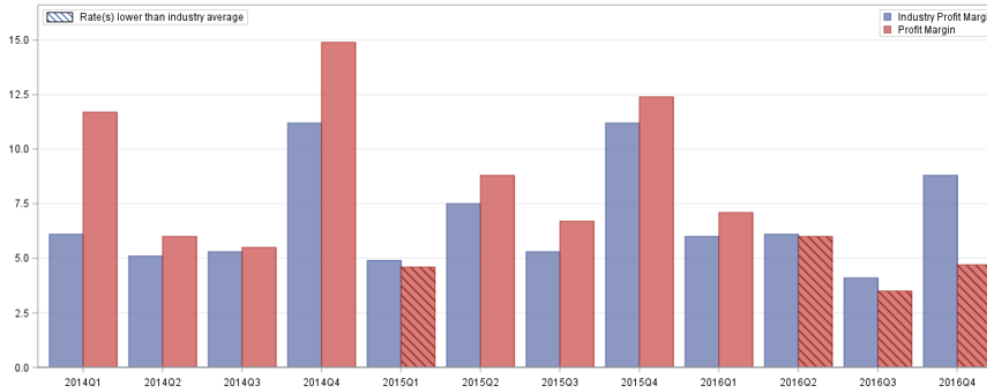
Figure 1. Profit and revenue from top 5 market players in the same industry

STEP2: PINPOINT THE CRITICAL METRICS TO DESCRIBE THE ROOT CAUSE

This step gave a cross-sectional review on the company's current market status across continental US. Graphs in Figure 2 reveal the market share in each state across with geographic information. The market size is measured by the radius of the pies on the map. The slides on each pie chart represent the combined measure for the top 4 competitors or the company. The states with light-gray background color show the opportunities or issues with less than average market shares within the company in the same industry.

The second graph shows two key measures (ratio for store and target population, and brand awareness) on market performance in each of the states. In the same state, the left bar represents the ratio of store/population and the right bar indicates the average brand awareness from the survey results in the same sample collection period. When reviewing in web browser through SAS stored process web applications, the report can be drilled down to zip code level for the same measures. The significant lower outlet/population ratio or brand awareness can be observed and identified with the light gray or light green bars.

From this report, most states in the second graph with lower values on the ratio of store/population or average brand awareness are coincidently matched with the states with the light gray background color on the first graph. The metrics presented on this report reveal the weakness about the company's current marketing strategy. There might be an opportunity to increase the company's market recognition in these identified areas.

Based on the information from this visualization, the management team in the company started to discuss the marketing strategy on resources. The advertisement campaign and distribution channel expansion are on the top list to increase the market potential in those underperforming markets.

Many steps had been involved in this marketing research project. However, the information covered on this report is the most relevant one to support the story of this report. All other less important information was put in the sidelines to reduce the possible distraction to senior management team in this report. If preferring, users can always see the additional information interactively through dynamic links. The is the power of interactive reporting techniques.
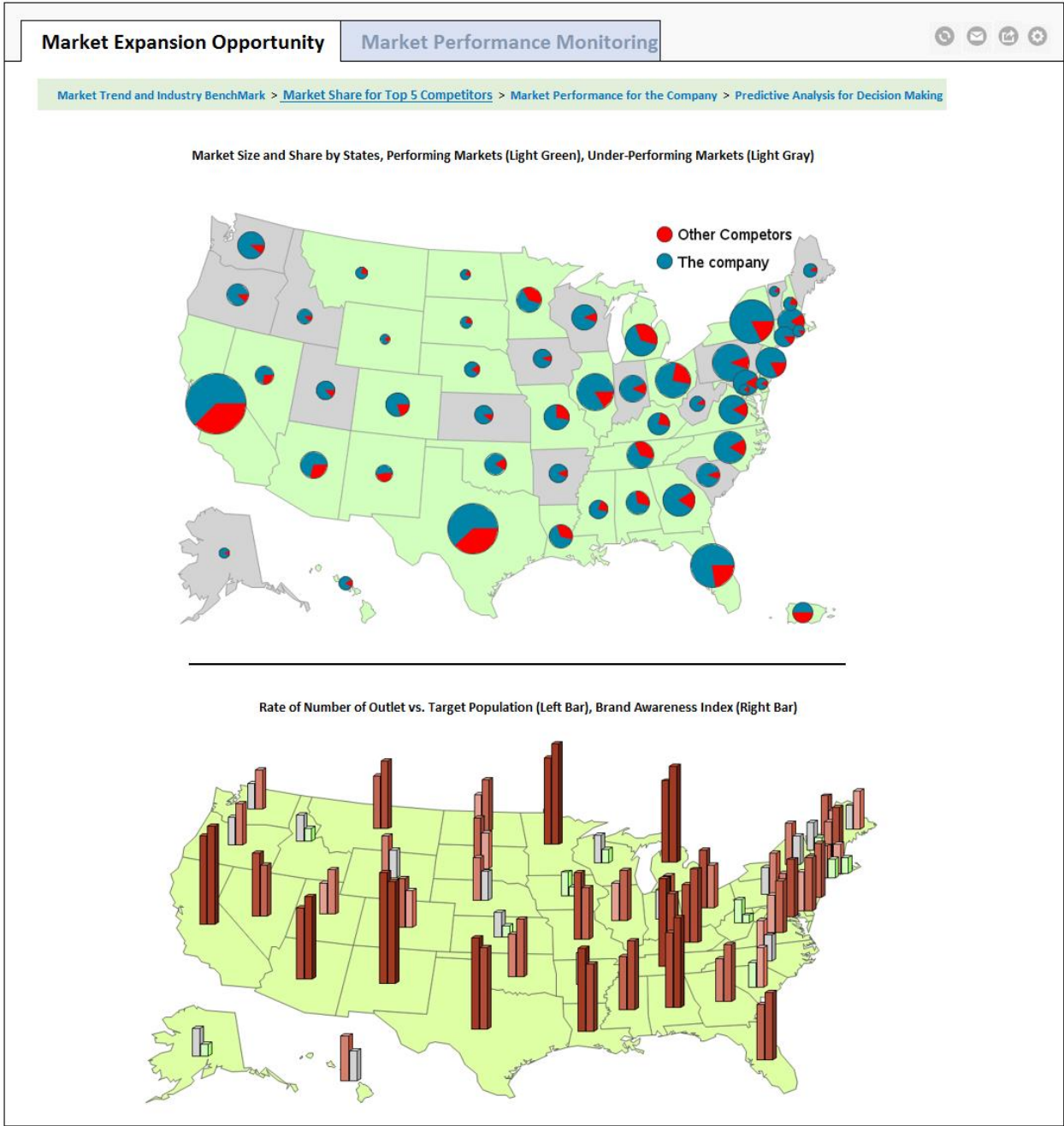
Market Trend and Industry BenchMark > Market Share for Top 5 Competitors > Market Performance for the Company > Predictive Analysis for Decision Making

Market Size and Share by States, Performing Markets (Light Green), Under-Performing Markets (Light Gray)

Other Competors
The company

Rate of Number of Outlet vs. Target Population (Left Bar), Brand Awareness Index (Right Bar)

Figure 2. Market share and outlet/store to target population rate and brand awareness

Naturally, the next step will be needed to focus on the researching and modeling processes to estimate how much the market share can be improved from current company benchmark.

STEP3: CALCULATE THE POSSIBLE PROFIT RANGES FOR MARKET IMPROVEMENT

Figure 3 is to show the market expansion potential for each of the under–performing markets indicated on Figure 2. The graph 1 and 2 gave a gap analyses on current quarterly revenue and profit compared with normalized industry average. The graph 3 projects the potential room for fill up the gap in graph 1 and 2.

The total revenue gap is $32 million and net profit gap is $16 million to normalized industry averages. However, the revenue growth potential is $56.12 million for all underperforming markets by 17 states. The total growth potential can cover the total revenue gap and more. Therefore, the combination of the graphs present the new opportunities for targeted marketing campaign and new distribution channel development.
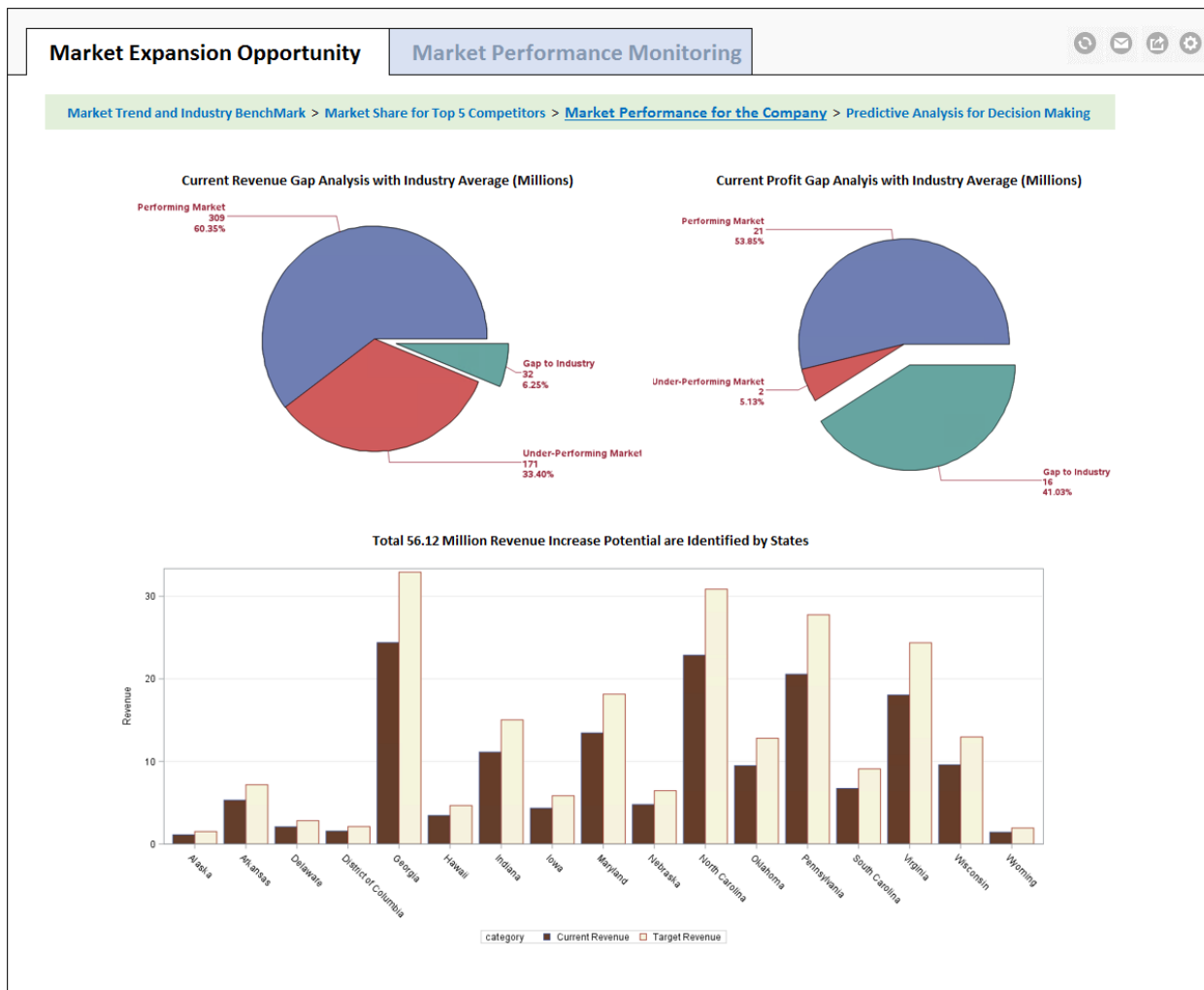

Figure 3. Under-performing market dashboard

This step greatly increased the feasibility of revenue or profit gap filling compared with industry benchmark. Logically, with all information gathered, the result from this market analytics project can lead to a conclusive action. The coming step is prepared to call for an action by providing proposed and alternative options. The predicted results for each option are provided to senior management team for a reference.

STEP4: PROPOSE ALTERNATIVE OPTIONS USING PREDICTIVE ANALYTICS

This is a dynamic world. If opportunities or problems were found and no action has been taken, the lukewarm profit or a loss will be predictable. Therefore, call for action is the ultimate goal for any business analytics. The valuable analytics projects usually provide senior management with solutions and alternative options. The measured predictive analysis for each of the options will be more persuasive for management to take actions sooner.

Figure 4 is calling for an action by comparing two predictive analyses. The upper graph shows if the company stays with the current strategy what the outcome will be in next 12 months with 95% of confidence. The lower graph used historical data from marketing campaign results to predict the potential market share redistribution in next 12 months. By indicating the cost and benefit measures, this step provides information for senior management team to make decisions on actionable options. The differences between predicted revenue growth rates can be 5-10% with different actions.
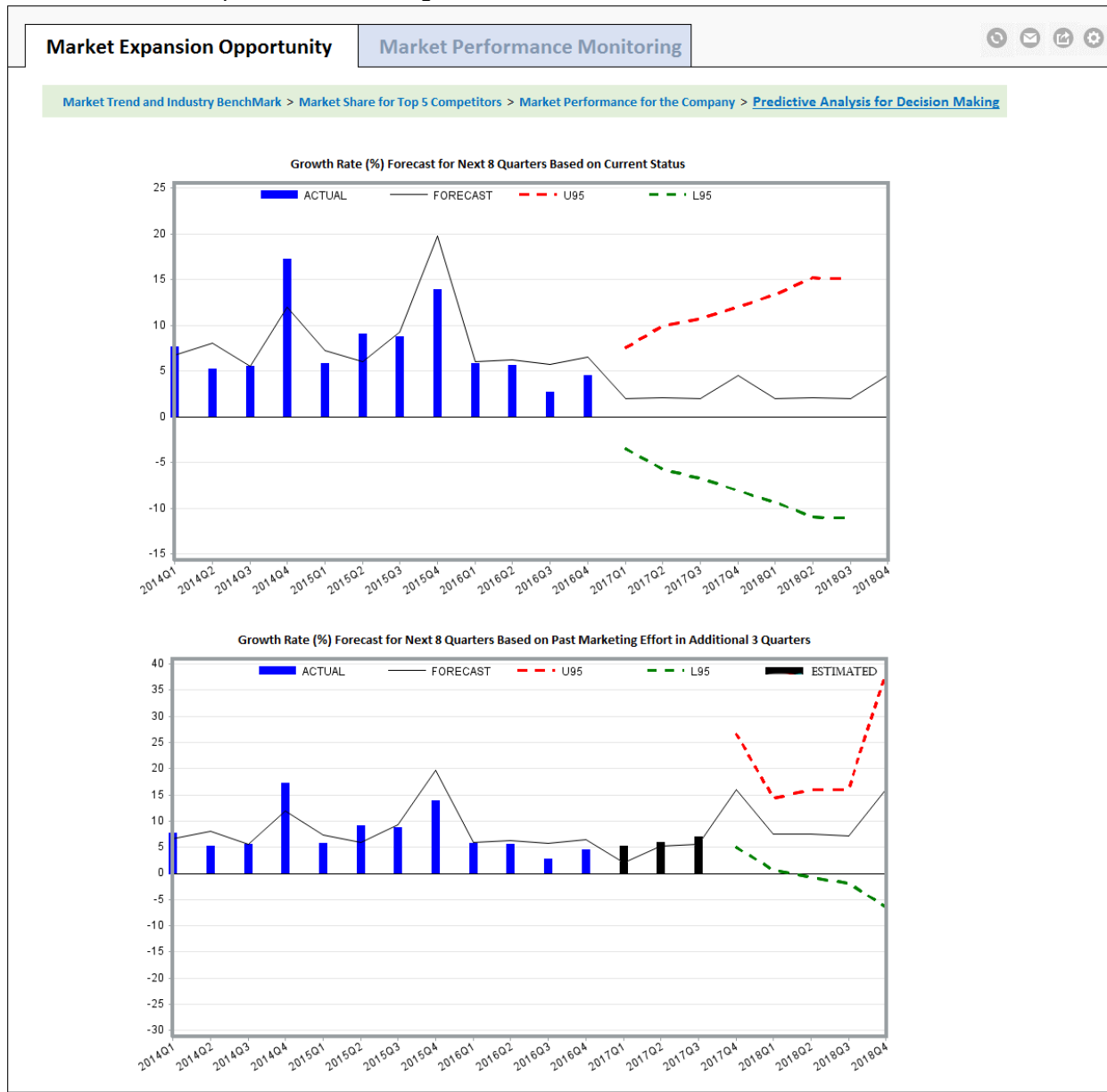

Figure 4. Predictive analysis on marketing effort

FOLLOW THROUGH THE ACTION AFTER DECISION

After the marketing-campaign decision had been made as the result of reports in previous section, a practical dashboard was implemented to monitor the market performance with the most recent data. The purpose of the market performance dashboard is to communicate strategic objectives and enables business users to measure, monitor, and manage the key activities and processes needed to achieve their goals. With the SAS web-based reporting framework, the dashboards deliver the right information to the right users at the right time to optimize decisions, enhance efficiency, and accelerate bottom-line results.

In this case study, the same report can be rerun in a defined time interval to track the market performance change. The analytical result will be used as baseline to all longitudinal or cross-sectional analyses.

CONCLUSION

With the increasing demand on big data and business-centric agile analytics, visual-based data discovery, analysis, and reporting tools are the defining features of the modern business intelligence (BI) platform. SAS has been the leader in advanced analytics. Its unique capabilities span a wide set of analytics offerings. The SAS Web Based Reporting Framework is a web application package to expand SAS usage beyond experienced programmer group.

SAS Web Based Reporting Framework allows analysts to create modern interactive reports in storytelling style. The reports are arranged with a main story plots flow, letting users to re-examine varies details with drillable clicks, leading to decision making for specific actions, and tracking the progress of actions. By using this methodology, the tedious data processes and analysis processes are transformed into visual processes. The colorful, clickable, and drillable graphs give users better experiences that make them engaged with complicated data analytics steps. Additionally, the reports can be shared enterprise wide with web browsers, smart phones, or tablets. All reports can also be printed as PDF format. This Web Based Reporting Framework bridges the communication gaps between senior analysts, executives and business users across all data driven industries.

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Website: Robert Allison. "Robert Allison's SAS/Graph Samples #58." Accessed January 7, 2017. http://robslink.com/SAS/democd58/aaaindex.htm.

RECOMMENDED READING

- *SAS(R) 9.4 Stored Processes: Developer's Guide, Third Edition at* http://support.sas.com/documentation/cdl/en/stpug/68399/HTML/default/viewer.htm#titlepage.htm

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