

# Six Strategies for Modernizing Data Visualization with Dashboards and Reports

How to Balance Enterprise and Self-Service Visual Reporting and Analytics to Drive Full Business Value from Data



By David Stodder

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## TDWI CHECKLIST REPORT

# Six Strategies for Modernizing Data Visualization with Dashboards and Reports

How to Balance Enterprise and Self-Service Visual Reporting and Analytics to Drive Full Business Value from Data

By David Stodder



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## FOREWORD

Innovations in data visualization are driving better user experiences through intuitive, easier-to-use capabilities for quantitative analysis and communication. Good data visualization can open interaction with data to a broader range of users. Rather than rely on data experts to explain the significance of a tabular report or to interpret the results of statistical or mathematical analysis, visualization enables less-technical business users to apply innate powers of human perception to spot patterns, outliers, structures, and more so they can quickly grasp what's important.

Data visualization can surface data relationships and changes over time that are difficult to see in a table or spreadsheet. Solutions continue to evolve toward more self-service capabilities for users working on desktops, laptops, mobile devices, and large-display monitors, opening up opportunities for in-context data interaction with less IT intervention.

However, expansion in self-service data visualization presents challenges that did not exist when users were limited to traditional, highly controlled and managed enterprise reporting. With self-service tools, users can take extracts or samples of corporate data, blend it with their own data sets as well as external data, and develop and share visualizations. As a result, organizations become dotted with data silos that feature inconsistent data quality and nonstandard definitions; users become dissatisfied with slow query performance and incomplete results. Risks of lapses in data security and privacy regulatory exposure rise. These issues are driving many organizations to seek a better balance between self-service tool use and enterprise reporting—a topic that will be discussed in this TDWI Checklist.

Dashboards, whether generated by developers using enterprise business intelligence (BI)

platforms or self-service tools, have become the most ubiquitous form of data visualization. Many dashboards today combine multiple types of visualizations within a single presentation interface, including charts, histograms, scatterplots, text feeds, and other information. Some dashboard visualizations track historical trends; others provide real-time notifications and updates. Dashboards can consolidate key performance indicators (KPIs), scorecards, and other metrics into a single screen, enabling personnel to monitor business performance against goals, analyze the influence of changing market conditions, or examine the consequences of a change in strategy.

TDWI research finds that dashboard development continues to be a high priority in most organizations. However, the growth in dashboard development has frequently led to the problem of too many dashboards. To monitor conditions or gather information to make a decision, personnel often have to consult multiple dashboards, each one associated with a different process, project, business application, or BI platform. As a result, organizations are interested in how they can use enterprise platforms to consolidate dashboards so they can address the proliferation problem as well as lower development and maintenance costs. Enterprise consolidation can also help organizations apply governance and quality standards effectively.

Thus, as this TDWI Checklist discusses, modernizing data visualization with dashboards and reports involves more than just improving visualization itself (as important as that is). Modernization involves using the powers of self-service capabilities, data architecture resources (such as metadata), and enterprise reporting platforms to improve overall user productivity, efficiency, and satisfaction. This is how organizations can reach goals for increasing data-informed decision making and actions to drive better business outcomes.

1

**USE VISUALIZATION TO MAKE IT EASIER FOR USERS TO GAIN ACTIONABLE INSIGHTS**

From executives to analysts to frontline personnel, business users want to increase the role of data and analytics in their decisions and actions. This means that organizations need to address barriers to the development and delivery of actionable data insights and seize opportunities to apply new methods and technologies.

Traditional reporting has proven frustrating to many users because reports often swamp them with too many data points, leaving it up to each user to decipher what is relevant and what is not. Large organizations often produce not only voluminous reports but many of them; without close monitoring, it can be hard to tell which ones are delivering value and which are mostly ignored. Considering the time and expense involved in building and maintaining

reports, organizations need to ensure that they are relevant to users' current needs and deliver information in ways that have the most impact.

Fortunately, the revolution in data visualization and graphical user interfaces has opened up new ways for organizations to deliver reports and provide access to data and related contextual information. Rather than provide static tabular reports, data visualization enables organizations to focus on what's most important to users and enable them to explore data further. Ongoing technology advances build on psychological and scientific understanding of how to harness human capabilities for perceiving meaningful patterns, structures, and outliers in visual data representations.



**FIGURE 1.** This dashboard uses a variety of visualizations, from a simple table to multicolor bar charts.

## USE VISUALIZATION TO MAKE IT EASIER FOR USERS TO GAIN ACTIONABLE INSIGHTS CONTINUED

Visualization, however, must always be a work in progress. Organizations need to continuously observe how well data visualization technologies are enabling users to quickly home in on actionable insights so that they are truly realizing advantages over traditional reporting. The use of color, shape, movement, and other visual design elements can direct users' attention to what's important, such as changes from expected data patterns or situations that demand immediate action. Builders of dashboards and other visual presentations should be careful to employ visual elements to increase clarity rather than distract or confuse users with misrepresentations and visual clutter.

People typically collaborate on information to make decisions. Large-screen, high-resolution displays used in command centers or other group operational settings should present visual information and analytics clearly. Dashboards on such screens can employ design elements that show the significance of a change in the data or an important trend. Real-time alerts and notifications must be easy to spot and presented within a context that makes it clear why the data point is actionable.

Displays of news or other text feeds must be curated to enhance contextual understanding. On mobile devices, laptops, and desktops, dashboards with KPIs and other metrics should enable users to drill down into the data to examine issues more deeply and share insights with colleagues through annotations on displays or via email, text, or social media.



## 2

**BALANCE SELF-SERVICE CAPABILITIES WITH THE VALUE OF ENTERPRISE SOLUTIONS**

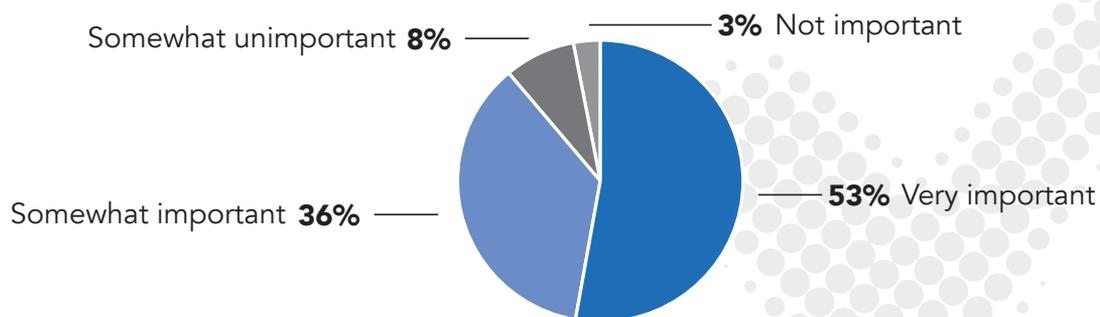
TDWI research finds that adoption of self-service technologies for BI, reporting, and analytics continues to be a high priority for most organizations (see Figure 2). Yet, as self-service technology adoption advances, many users are confronting a range of problems that include lack of standardization, inconsistent data quality, difficulty getting a single view of the truth, and unsatisfactory query performance.

These difficulties highlight the need for a better balance between self-service technologies and enterprise platforms for BI reporting and analytics. Enterprise platforms have the advantage of offering a perspective across the organization that departmental self-service technology systems cannot provide. At the enterprise level, organizations can establish data governance and security rules and data quality processes to be followed by all personnel. IT can make common metadata definitions available to all users, developers, and applications. Organizations can use enterprise platforms to resolve disputes about which data sources are most trusted, which calculated values and aggregations to use, and the accepted definitions for higher-level entities such as Customers.

If enterprise platforms can iron out these and other quality and consistency issues—and IT can effectively communicate and integrate these standards with departments employing self-service technologies—users will have greater confidence and trust in their dashboards and other visualizations. It will be easier to gain a single view of the truth where it is necessary for reports or specific performance metrics. Similar or related performance metrics developed at the departmental or operational level could be better integrated with those used at the enterprise level.

The key, however, is balance. Users want—and expect—greater freedom and empowerment. Traditional enterprise BI reporting systems have a reputation for inflexibility and “one size fits all” sets of features and functionality. They may give users the benefits of standardization but at the cost of a lack of freedom in how they can visualize and interact with data. Modern enterprise systems must be less intrusive; they must fill the gaps in terms of standardization and governance but not overtake users’ freedom to use self-service technologies to personalize visualizations, filters, and other parameters, and even to explore different types of data that they might want to incorporate.

**Q. How important is it to your organization to increase users’ self-reliance with BI, search, data exploration, and analytics and to reduce their dependence on IT?**



**FIGURE 2.** From the 2020 *TDWI Best Practices Report: Faster Insights from Faster Data*. Based on answers from 135 respondents, online at [tdwi.org/bpreports](https://tdwi.org/bpreports).

## BALANCE SELF-SERVICE CAPABILITIES WITH THE VALUE OF ENTERPRISE SOLUTIONS CONTINUED

Along with addressing data quality, consistency, and governance concerns, two other issues enterprise systems are able to address are:

- **PROMOTING REUSE AND PREDEFINITION FOR EFFICIENCY AND PERFORMANCE.** A common byproduct of increased self-service is that users create their own dashboards and ad hoc queries, which may be the same or similar to those used by others. Data systems are then swamped by nearly redundant and poorly composed queries. Quality standards weaken as best practices are insufficiently shared.

Organizations can reduce quality and consistency problems by employing enterprise systems. They can focus on eliminating redundancy and applying best practices for increasing reuse. At the enterprise level, IT can define common needs and create and execute predefined queries to optimize overall performance.

- **ENABLING EASIER DEVELOPMENT AND EMBEDDING IN APPLICATIONS.** Today's applications need to be more data-driven, which means that BI reporting and analytics systems need to be better integrated within them. Then, data insights can inform application processes so that operational users or automated systems make faster and better decisions.

Enterprise systems are a good place to formalize integration with applications across the organization. Organizations should evaluate opportunities to embed interactive dashboards and visualizations. These must be supported by enterprise governance and the use of standard integration technologies and application programming interfaces (APIs).

By using enterprise systems effectively to solve common challenges, organizations will make it easier for users to focus on resolving business questions and improving performance rather than on how to query and access data. With a good balance between self-service capabilities and enterprise governance and quality, organizations can gain the benefits of both types of platforms. A good balance will enable organizations to keep total cost of ownership (TCO) in check by reducing inefficiency and redundancy while giving users the flexibility and personalization they need.



## 3

**MANAGE METADATA TO ENABLE USERS TO INTEGRATE COMPLETE, TRUSTED DATA**

Good metadata is critical to building users' trust in dashboards and reports. This "data about the data" offers organizations fundamental knowledge with which they can build a broader and deeper understanding of data's lineage—its origins, how it came into the organization, how it may have been transformed, and who is using and sharing it. Usually stored in a central data catalog, metadata management system, or the enterprise data warehouse itself, metadata helps organizations resolve inconsistencies about how users define similar data sets from different sources.

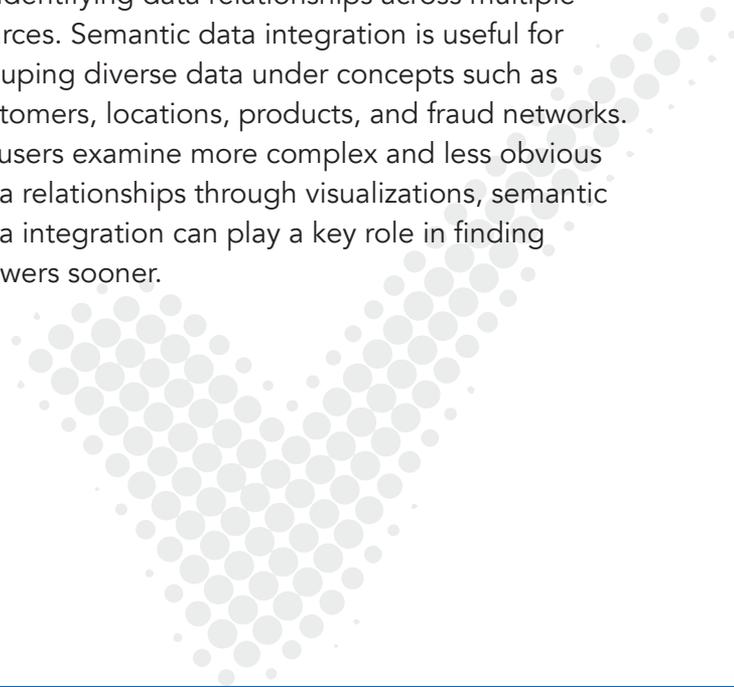
Most databases and applications have some metadata about their data; in fact, one of the biggest challenges with metadata is integrating it from multiple sources and learning how metadata is related. Yet, as users explore, visualize, and analyze more diverse data, metadata integration and management will grow in importance. Illustrating this point, TDWI's latest research finds that more than twice as many organizations surveyed are currently using or are planning to use data catalogs, glossaries, and metadata repositories compared to four years ago when we asked the same question (36% compared to 17%).

Improving access to and management of metadata can be a cornerstone of modernizing data visualization with dashboards and reports to meet users' diverse data needs. TDWI finds that for most organizations, the top objective for upgrading metadata management is simply to make it easier for users to search for and find data. Without a good metadata resource, a marketing or sales manager seeking a complete view of all data about customers or market segments will be frustrated, especially as they attempt reach beyond the limited data in their self-service BI system or single CRM application. They will at the very least require IT's help. If users have access to an enterprise

metadata resource, it can shorten the path to other data sources such as data-rich applications in the organization, and make it easier and faster to integrate new, external data sources.

Governance is an additional important reason to have good centralized metadata. First, organizations can use metadata to find data faster to meet data inventory requirements in regulations such as the European Union's General Data Protection Regulation (GDPR), the California Consumer Privacy Act (CCPA), and other data privacy regulations within the U.S. and around the world. Second, organizations can use the metadata resource as part of a larger objective of ensuring that users are accessing and sharing trusted, well-governed data through their dashboards and reports.

Organizations should invest in improving metadata management to improve user data access and governance. They should also evaluate solutions that offer the ability to build from simple metadata to more complete, higher-level semantic data integration. At this higher level, the focus is on expanding definitions to build broader meaning by identifying data relationships across multiple sources. Semantic data integration is useful for grouping diverse data under concepts such as customers, locations, products, and fraud networks. As users examine more complex and less obvious data relationships through visualizations, semantic data integration can play a key role in finding answers sooner.



## 4

**REDUCE TOTAL COST OF OWNERSHIP AND ADD FLEXIBILITY THROUGH WEB-BASED AND EMBEDDED DEPLOYMENT**

Even as organizations invest in technologies that enable personnel to innovate with data and analytics, they also need to manage the total cost of ownership (TCO) involved in doing so and look for opportunities to reduce it. TDWI finds that budget limits are commonly one of the top barriers preventing organizations from expanding analytics and democratizing BI reporting and visualization. As they look to use data insights effectively to drive business processes and applications, many organizations fear that TCO could rise dramatically and budgetary limits will preclude expansion.

Fortunately, technology trends are helping organizations achieve goals without driving up TCO. Self-service and enterprise BI reporting, analytics, and visualization are more flexible and easier to embed in business applications and services. The maturation of web-based and cloud-based development and data integration standards is making it easier to enhance BI reporting and dashboards with new data feeds and functionality, whether they are embedded in applications and services or part of standalone systems.

A key enabling trend is toward robust web-based capabilities. Web-based solutions offer services through a browser. They enable transparent access from front-end dashboards on desktops, mobile devices, and large-format displays to BI applications hosted on an organization's on-premises servers behind security firewalls. Organizations can focus on using these centralized servers to manage scalability, availability, performance, governance, and security rather than having to address technology on each individual instance distributed across the enterprise. Increasingly full-featured, web-based capabilities enable organizations to overcome cost and administrative challenges that typically accompany expansion in reporting, dashboards, and analytics for more users.

If an organization needs more elastic scalability and wants to augment computation or storage with cloud-based, pay-as-you-go subscriptions instead of adding to on-premises systems, they can expand from web-based to cloud-based services. Organizations could choose private cloud computing to ensure that they have dedicated services available rather than just the shared, multitenant arrangements common with public clouds. Organizations should evaluate web-based and cloud-based solutions to determine the best fit for their anticipated growth in user workloads and TCO requirements.

Web-based and cloud-based options are having a positive impact on visualization and analytics capabilities offered in embedded dashboards and reports. Embedded BI has traditionally been limited in functionality; however, users today want more as they try to expand the role of data insights in business processes and operations. Embedded functionality is also important for organizations that want to provide monetized services to business partners, suppliers, and customers (and in some cases, employees). Organizations need to provide current, state-of-the-art dashboards and analytics to keep paying users satisfied and stay ahead of the competition. Web-based and cloud-based functionality can make it easier for organizations to upgrade embedded dashboards, reports, and analytics over time.

Web-based and cloud-based functionality plus open standards make it easier for third-party developers, ISVs, and IT developers to embed dashboards, reports, and other BI and analytics capabilities. These approaches reduce complexity for developers and enable organizations to expand functionality while keeping TCO manageable. Organizations should evaluate how web-based and cloud-based deployments can improve embedded functionality and flexibility in applications.

## 5

**MODERNIZE PERFORMANCE MANAGEMENT WITH ANALYTICS-BASED RECOMMENDATIONS**

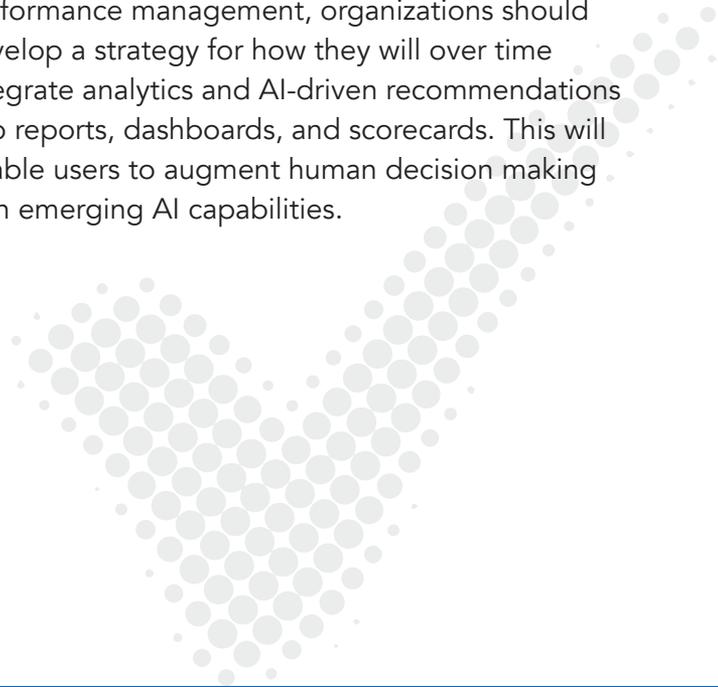
Performance management continues to be essential to how many organizations communicate goals and define and monitor metrics such as KPIs to understand whether they are meeting goals. TDWI finds that performance management remains a top driver behind the development of dashboards and particularly scorecards, which offer visualizations of metrics that are tied to use of a management method, such as Balanced Scorecard or Six Sigma.

However, performance management can fall short of delivering value if users are unable to analyze data related to metrics to determine how best to adjust behavior to meet objectives. Metrics can also become siloed; for example, organizations may have metrics for financial results, operational efficiency, customer satisfaction, and other areas that are not well-integrated, which can lead to conflicting goals and misunderstandings. Finally, because business conditions and objectives do not stay the same, organizations must be able to revise dashboards and scorecards easily so that KPIs and other metrics reflect current business conditions and are aligned with revised goals and objectives.

Enterprise BI reporting and dashboards can help organizations integrate different KPIs and metrics and provide a centralized platform for keeping them up to date and aligned. Enterprise BI reporting and dashboard platforms can support common models and mapping of hierarchies and dependencies to help users understand how definitions of metrics are related across different visualizations and analytics. The models and mapping are important to supplying the right data to business users and analysts for drill-down data exploration. Solutions with the latest functionality can enable users to work with visualizations and graphical interfaces rather than having to hand-code queries, for example, that analyze cause-and-effect issues or perform what-if forecasting analysis using simulations.

Integrating advanced analytics into performance management can help organizations bring users more sophisticated insights for interpreting data associated with metrics. Using predictive modeling to provide insights into what could happen based on certain variables, organizations can develop prescriptive analytics and provide users with actionable recommendations. These guide users to take actions that have the highest probability for achieving a desired outcome. An example would be a next-best action recommendation for use by a field salesperson or call center agent engaged with a customer. At the leading edge, BI and analytics solutions are applying artificial intelligence (AI) techniques such as machine learning to automatically crunch through large data volumes and evaluate data based on complex constraints and variables to arrive at recommendations that can be communicated to users.

Organizations should test prescriptive and AI-based recommendations carefully and be able to explain the recommendations in business terms before deploying them in real-life scenarios. To take advantage of these advances for modernizing performance management, organizations should develop a strategy for how they will over time integrate analytics and AI-driven recommendations into reports, dashboards, and scorecards. This will enable users to augment human decision making with emerging AI capabilities.



6

IMPROVE OPERATIONAL EXCELLENCE WITH ACTIONABLE, REAL-TIME INSIGHTS

Increasing the efficiency and effectiveness of operations is a top priority for investing in BI and analytics, according to TDWI research (see Figure 3). Dashboards, reports, and analytics are critical to using data effectively to reduce costs and increase operational excellence. As noted earlier, analytics can be integrated with KPIs and metrics in dashboards to guide operational managers and frontline personnel in changing behavior or process execution with a clearer understanding of how the changes can measurably improve outcomes.

Dashboards are key to operationalizing analytics because they present insights in context and in a visually compelling way. Dashboards can provide a trusted, consolidated presentation of analytics insights relevant to operational roles and responsibilities. Rather than limit visualizations to static dashboards and reports, organizations can use analytics to provide proactive insights in dashboards—such as the detection of patterns or anomalies that warrant immediate attention—and recommendations for how to address them.

However, the recommendations must be provided in the language and context of operational decisions, not statistics and mathematics. Visualizations can display the importance of analytics insights to operational priorities such as addressing factors that lead to rising costs.

Operational personnel typically must make quick, tactical decisions. Thus, many organizations are focused on reducing information latency to get closer to real-time data feeds and updates. Some organizations are integrating real-time streaming data into dashboards, although it is important to inform users if this raw, unprocessed data has quality issues. Alongside data feeds based on standard BI reports drawn from historical data, real-time analytics based on streaming data can be packaged into alerts and notifications that inform operations personnel of real-time patterns of activity or anomalies discovered in the data streams. They can then use these insights for timely decision making.

**Q. What are the major business drivers behind your organization’s investment in new technologies and/or cloud-based services to improve BI, analytics, and supporting data integration and management?**



**FIGURE 3.** Source: 2018 TDWI Best Practice Report: BI and Analytics in the Age of AI and Big Data, Q4 2018, online at [tdwi.org/bpreports](http://tdwi.org/bpreports).

**IMPROVE OPERATIONAL EXCELLENCE WITH ACTIONABLE, REAL-TIME INSIGHTS  
CONTINUED**

Visualizations used for alerts and notifications must be clear and presented in a context that users grasp easily. Users may need capabilities for performing some drill-down data exploration for root-cause analysis to resolve questions before they can take action.

Operations need dashboard portability across desktop, mobile, and large-format displays, which are often used in control centers and other situation monitoring locations where personnel need to see real-time updates in the course of their work. For example, a dashboard presented on a large screen may be used to monitor resource allocation or hygiene practices at a hospital, to manage the location of freight in a warehouse for logistics, or to maintain equipment on a manufacturing floor. Portability allows organizations to form-fit visualizations to each type of device and supply consistent information across them.

Data visualization choices for operational contexts must be made carefully. Organizations will often communicate updates through changes in color, animated objects, blinking icons, or even gamification, such as the competitive accumulation of points or progress toward a finish line. Before deploying these, organizations should consider human perception factors: that is, how people react to different colors, the relative size of objects or spaces, types of animation, and so on. Organizations should err on the side of clarity to ensure the visualizations highlight what is most important.



## A FINAL WORD

Data visualization plays a critical role in enabling organizations to derive business value from investments in data management and analytics. Good data visualization can inspire personnel to develop innovative strategies and make operational decisions that elevate customer satisfaction, improve margins, align actions to achieve success with new business ventures, and provide safety from fraud or errors. The dashboard quality should, therefore, never be taken lightly; organizations need to plan for their continuous improvement to ensure that users are getting the most out of them.

This TDWI Checklist has examined six strategies for modernizing data visualization with dashboards and reports. A key point discussed in this report is getting the balance right between democratized, self-service technology adoption and enterprise platforms that are essential to governance, quality, and efficiency. With this balance, organizations can enrich data visualizations with innovative analytics, performance metrics, and actionable notifications to help personnel make decisions and take actions that benefit companywide objectives.

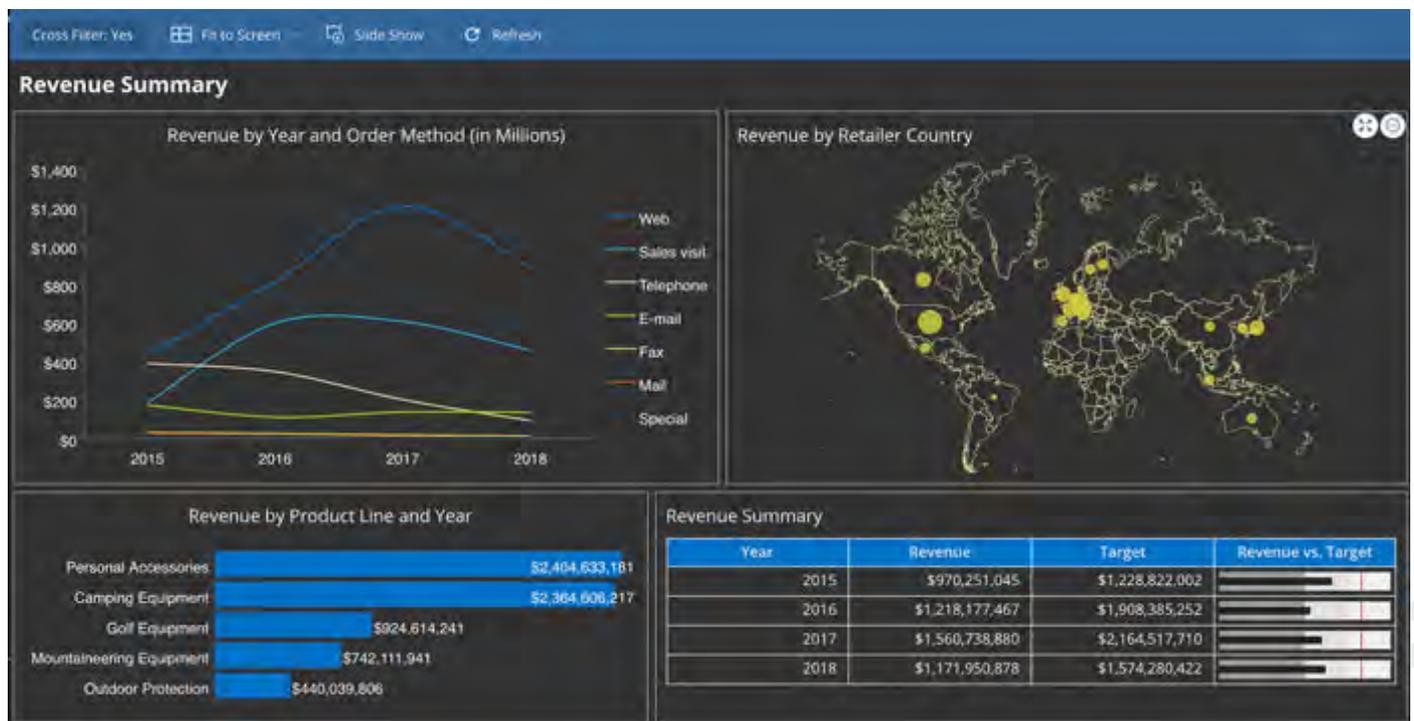


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The lightweight server architecture of Wyn Enterprise offers ad hoc reporting, embedded analytics, and interactive dashboarding. Industries such as finance, insurance, healthcare, manufacturing, retail, and technology utilize WynDashboards to visualize data to identify data trends. Enterprise end users as well as nontechnical and technical users can easily design personalized, ad hoc dashboards and reports based on secured data. They can also use existing documents as a starting point to slice and dice business information on their own. With the ability to combine data from various sources into one cohesive document, users can easily visualize the big picture to drive strategic, data-driven business outcomes.

## ABOUT THE AUTHOR



**David Stodder**, is senior director of TDWI Research for business intelligence. He focuses on providing research-based insights and best practices for organizations implementing BI, analytics, data

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TDWI Checklist Reports provide an overview of success factors for a specific project in business intelligence, data warehousing, analytics, or a related data management discipline. Companies may use this overview to get organized before beginning a project or to identify goals and areas of improvement for current projects.

