

UCSD Extension

Dashboards and Data Visualization

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Module 1: Dashboards

Background and basic concepts

Relationship to business intelligence (BI)

Business intelligence

Business intelligence, or BI, is a decision support system. Its aim is to help make business decisions, strategic as well as operational/tactical. It uses an assortment of resources and techniques for gathering, transforming, storing, and analyzing data including:

- Processes
- Technologies
- Applications
- Quality
- Skills
- Practices
- Risks

The technologies utilized include data warehousing, OLAP (multi-dimensional analysis), data mining, analytical and statistical tools, querying and reporting tools, data visualization, dashboards, scorecards, etc. Together, various BI technologies enable various tasks, relevant to data and information, to be performed including

- Collection
- Integration
- Analysis
- Interpretation
- Presentation

Business intelligence is viewed differently by the two groups that use it—business and IT. While IT usually views it as a tool, business views it as information.

Defining business intelligence

There is no single universally used definition of business intelligence. In 1989, Howard Dresner defined “business intelligence” as encompassing "concepts and methods to improve business decision making by using fact-based support systems" In 1996, Gartner defined it as:

“By 2000, Information Democracy will emerge in forward-thinking enterprises, with Business Intelligence information and applications available broadly to employees, consultants, customers, suppliers, and the public. The key to thriving in a competitive marketplace is staying ahead of the competition. Making sound business decisions based on accurate and current information takes more than intuition. Data analysis, reporting, and query tools can help business users wade through a sea of data to

synthesize valuable information from it - today these tools collectively fall into a category called "Business Intelligence."

Business intelligence tools

BI tools are software applications used to retrieve, analyze, and present data. They have traditionally worked on stored data. They can include a number of components which provide users with capabilities for analysis and visualization. Tool categories include:

- Reporting and querying
- OLAP
- **Advanced visualization (dashboards and scorecards)**
- Advanced analytics
- Data warehousing
- Data mining
- Business performance management
- Spreadsheets

Convergence of disciplines

Performance management and business intelligence are two disciplines that need each other, as they meet specific needs of organizations. Independently, they have struggled to provide business value and find acceptance within organizations. The shortcoming has been met through dashboards and scorecards, which represent their convergence. Together, these two disciplines, offer a combination where the value is greater than the sum of the individual components.

Relating DSS and BI solutions

Decision support systems as well as BI aim to provide information to decision makers so that it enables them to identify problems and make sound business decisions. The presentation of results can be through:

- Reports
- Dashboard
- Scorecard
- Other presentation techniques

Background

Business dashboard predecessor

The history of Decision Support Systems can be traced back to the 1960s. In the 1980s, they were represented by the Executive Information Systems (EIS) systems. They served a useful purpose and had limitations that led to the development of the modern business dashboard.

Change in user needs over time

Since the past couple of decades, user needs and requirements have changed significantly. However, the basic requirement, ability to analyze performance, has not changed over time. Users have become far more demanding due to:

- Technological changes
- Availability of powerful software tools combined with superior infrastructure and processing

User expectations, all of which dashboards have been able to provide, include:

- Real-time analysis
- Ability to work with large data volumes
- Flexibility and multi-dimensional analysis
- Ability to make changes on the fly
- Advanced visualization access via the internet
- Drill-down, as well as ability to slice and dice
- Access via the internet

Major changes in the 1990s

Major technological innovations took place in the 1990s. They encompassed both hardware and software. Data proliferated and, consequently, storage requirements also increased in step. Since cost of storage and processing decreased simultaneously, they did not become a constraint. The development of enabling technologies, which included data warehousing and tools supporting reporting and analytics, enabled dashboards to leverage them extensively. And the Balanced Scorecard rapidly became popular.

Data consolidation driver

Data consolidation is an important driver for dashboard use. Many organizations use a dashboard, an effective tool for managing enterprise metrics, to consolidate and integrate information from disparate sources and then present it to the users.

Meeting performance management needs with dashboards

Modern dashboards have been quite successful in meeting business performance management needs. They are capable of quickly providing an overview as well as details, when needed. Some issues and limitations exist, especially challenges in handling data that is dependent on disparate data sources (which can be inconsistent and unreliable).

Dashboards

Car dashboard

The automobile dashboard is a monitoring tool which monitors an auto's most important performance indicators, such as speed and fuel level. It displays the current state information at a glance. All indicators present current information, based on which the driver can take appropriate action if required. The objective is to monitor performance:

- Ensure that it is on target:
- Identify any deviations or problems
- Analyze the causes of issues
- Take corrective action without delay

Business dashboard

Is a monitoring tool derived from the car dashboard, which enables the health of an organization to be monitored quickly. It visually displays the most important information needed to monitor the health of the business on a single screen.

The dashboard is another new face of business intelligence, which provides a summarized view of the performance of an organization, business unit, department, group, or an individual. It displays KPIs relevant to the corporate objectives or business processes (such as finance, manufacturing, sales, marketing, etc.). It enables an interactive and flexible environment, which can be easily updated when required by the business.

A dashboard provides valuable insight into large volumes of performance data through:

- Advanced visualization
- Summaries
- Trends
- Deviations

Dashboards are a powerful tool for business users due to their ability to:

- Identify opportunities and threats
- Present results at both summary and detailed levels
- Analyze historical data

Defining a dashboard

Stephen Few's definition:

A dashboard is a visual display of the most important information needed to achieve one or more objectives that has been consolidated on a single computer screen so it can be monitored at a glance

Dashboard goal

A dashboard displays information used to make sound business decisions, which are less focused on strategic objectives and more tied to operational goals. An operational goal may contribute directly to one or more higher level strategic objectives. Within a dashboard, focus is on executing the operational goal itself—not the higher level strategy to which it contributes.

A dashboard's objective is to provide users with actionable information that can be digested at a glance and is in a format that is both intuitive and insightful. Dashboards leverage operational data primarily in the form of metrics and KPIs. They are optimized so that users can quickly evaluate and react to the current situation and, also, communicate and share the issues and results with colleagues and partners.

Well-designed dashboard

A well-designed dashboard fits on a single screen, eliminating the need to scroll for viewing displayed information. It displays limited number of KPIs—typically 7 or so is considered an optimal number. The top level dashboard will:

- Display the “bubble up” KPIs
- Enable links to the underlying dashboards, which can be supporting lower levels like regions or departments
- Support the ability to drill-down to the underlying data

A well-designed dashboard delivers information that is:

- Exceptionally well organized
- Condensed, primarily in the form of summaries
- Specific to the task at hand and customized to communicate clearly to its users
- Displayed using concise and often small media that communicate the information in the clearest and most direct way possible

Dashboard's core characteristics

- Are customizable
- Besides displaying the information, enable flexible analysis that static reporting tools cannot provide
- Can also provide links to other applications
- Is a type of display, a form of presentation, not a specific type of information or technology
- Designed to communicate

Core characteristics that define a well-designed and successful dashboard are that it:

- Focuses on the objectives and, hence, displays the most appropriate and relevant metrics
- Provides a visual display
- Is interactive
- Presents data that is accurate and current
- Is easy to access and use

Process that dashboards are designed to support

Dashboards support the 4 stages for monitoring information:

1. Update high-level situation awareness
2. Identify and focus on particular items that need attention:
 - Update awareness of this item in greater detail
 - Determine whether action is required
3. If action is required, access additional information that is needed, if any, to determine an appropriate response
4. Respond

Dashboards must be designed to support this process.

Characteristics of dashboard displays

Dashboard displays are characterized by a visual display that:

- Enables performance information to be displayed on a single screen
- Can be scanned quickly
- Is easy to understand
- Has a real-time interface

Dashboards provide current status or snapshot and historical performance indicator trends. These characteristics enable quick, but informed, decisions that are based on facts.

Dashboards can be built on a simple technical infrastructure or tightly integrated with other components like analytical front-end tools. The level of interaction provided can also vary significantly. Some dashboards just present static data graphically, while others can be very interactive and support drilldown analysis.

How dashboards display data

Data, which is primarily in the form of metrics and KPIs, is presented using:

- Charts
- Gauges
- Traffic lights, etc.

Individual preferences of the dashboard users are often reflected in the method and type of KPIs being displayed.

Impact of user experience

Dashboard usage extends beyond the executive suite. All types of users can access the dashboard content. The tool popularity can be attributed to:

- Ease of use
- Visibility that it provides into the business

User experience can have a significant impact on the level of adoption and engagement.

Examples of dashboard visualization diversity



Figure 1a: Example of dashboard visualization

Source: www.dundas.com



Figure 1b: Example of dashboard visualization

Source: www.dundas.com

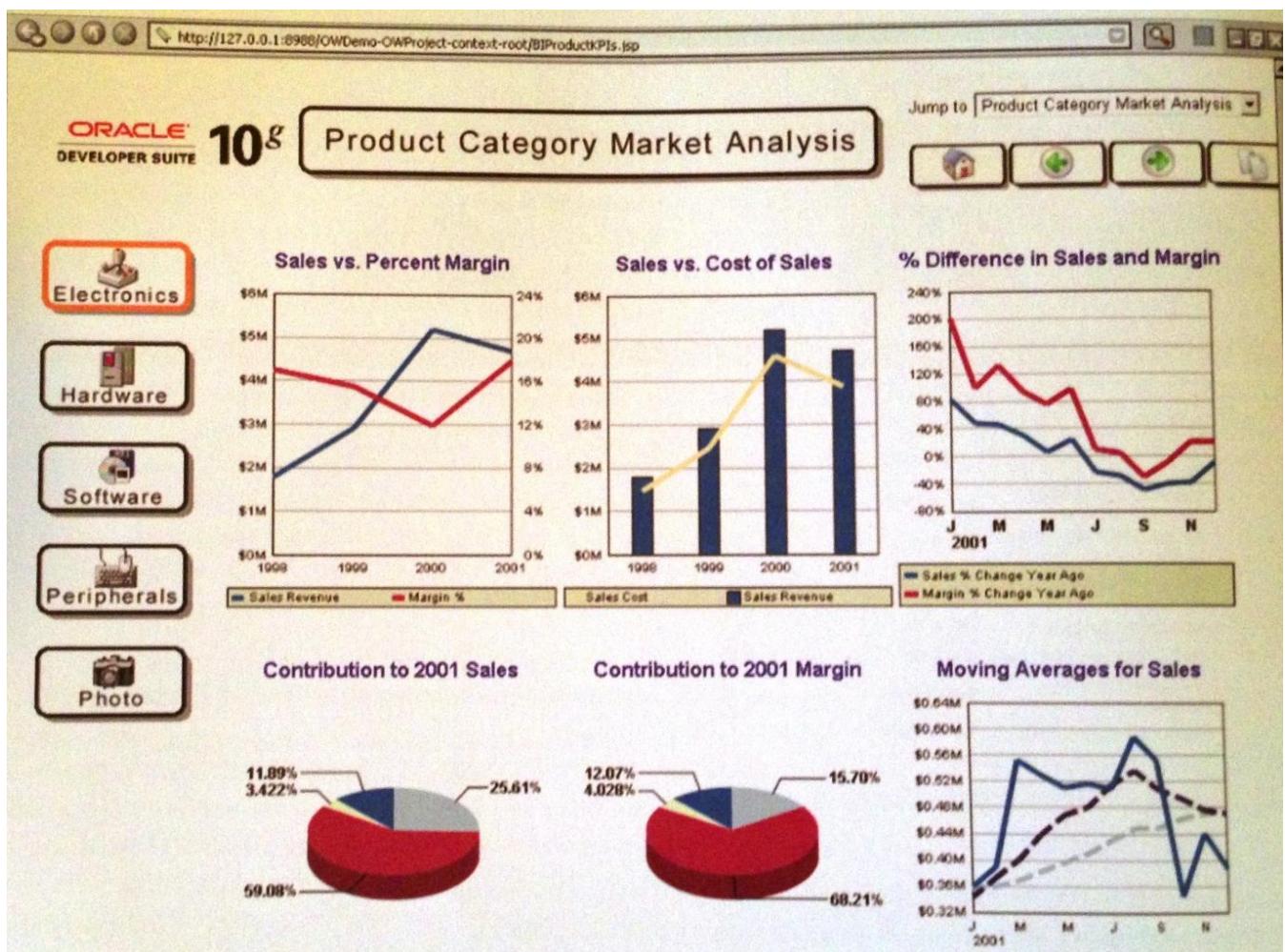


Figure 1c: Example of dashboard visualization
Source: Information Dashboard Design, Few



Figure 1d: Example of dashboard visualization
Source: Information Dashboard Design, Few

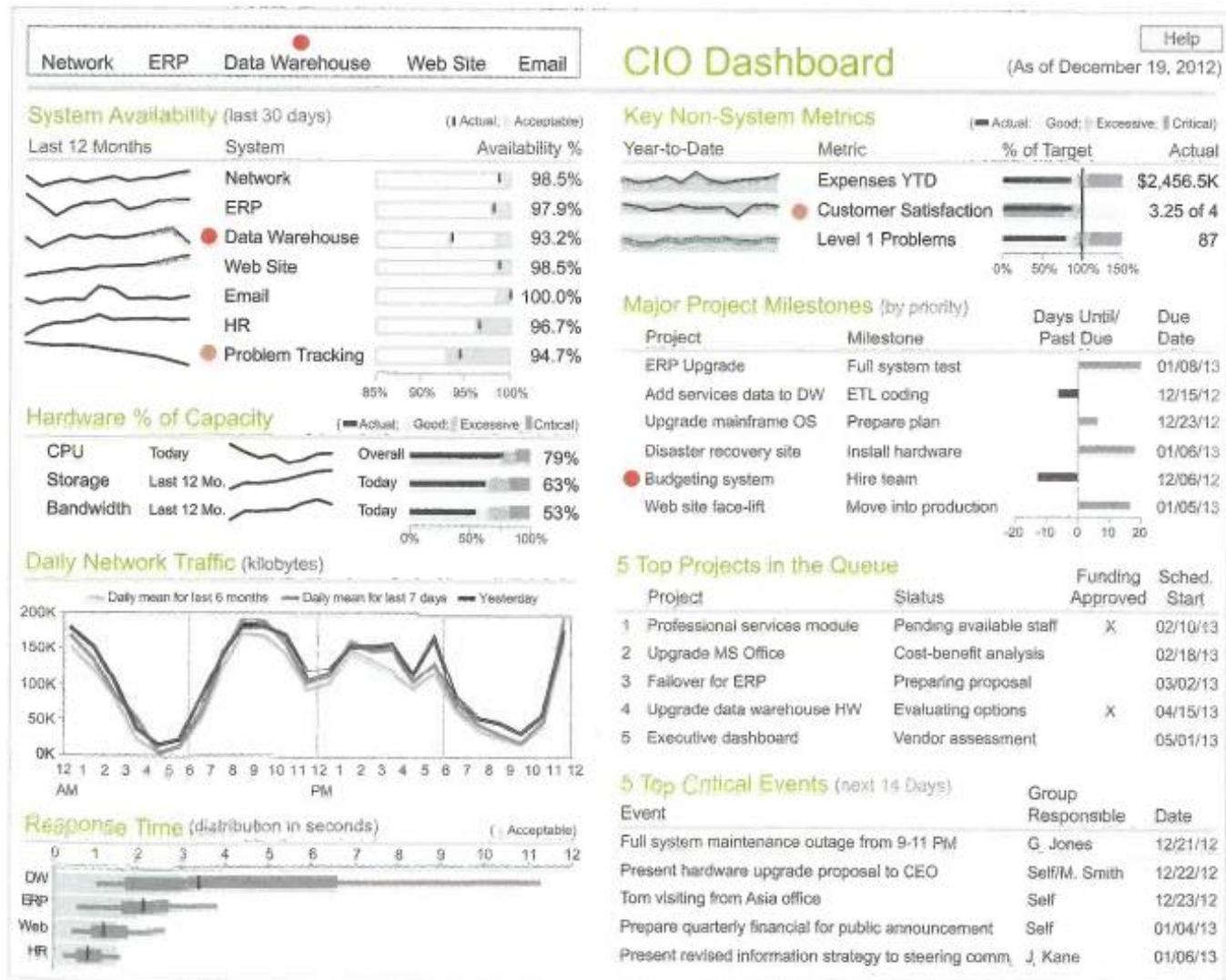


Figure 1e: Example of dashboard visualization

Source: Information Dashboard Design, Few

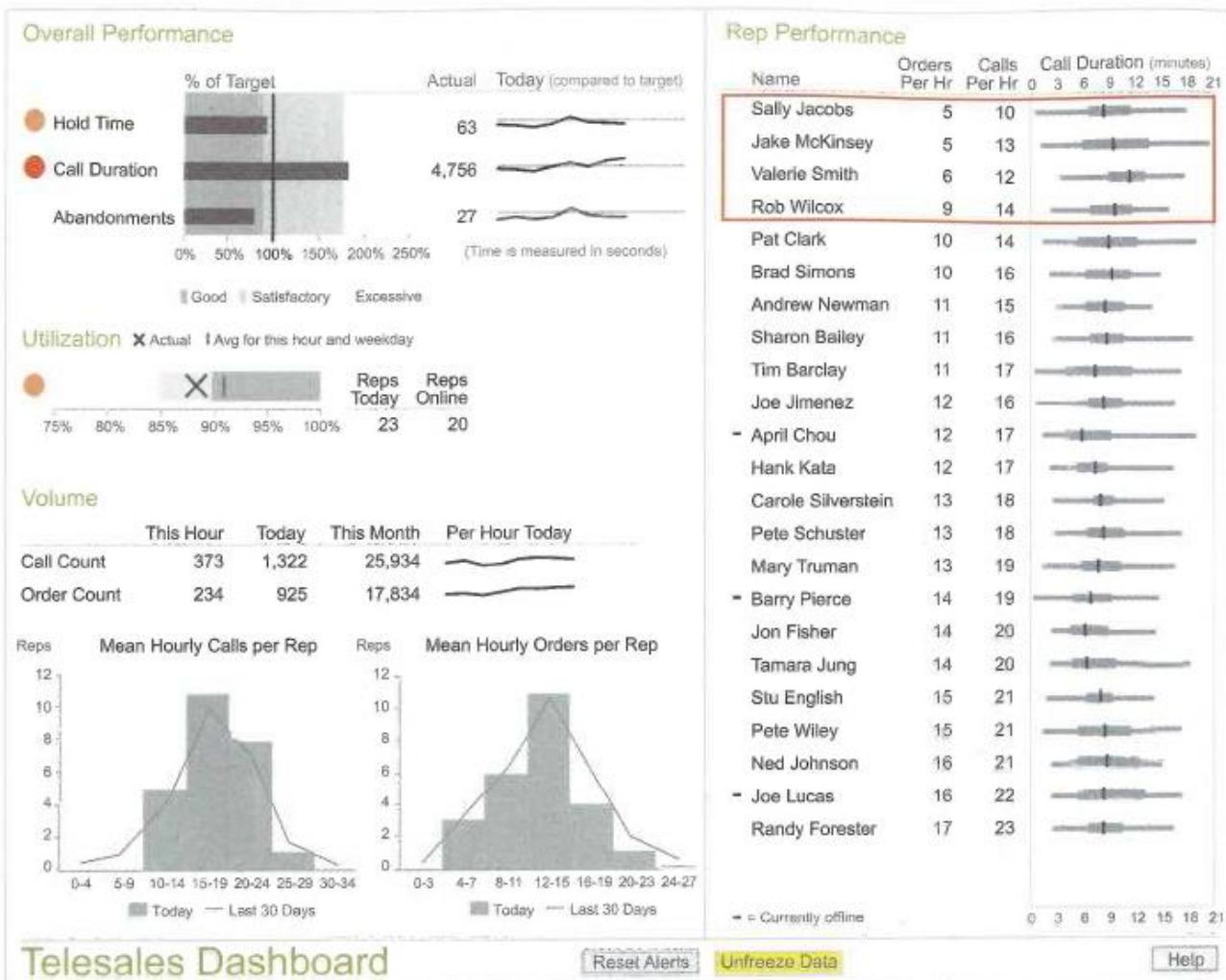


Figure 1f: Example of dashboard visualization
Source: Information Dashboard Design, Few

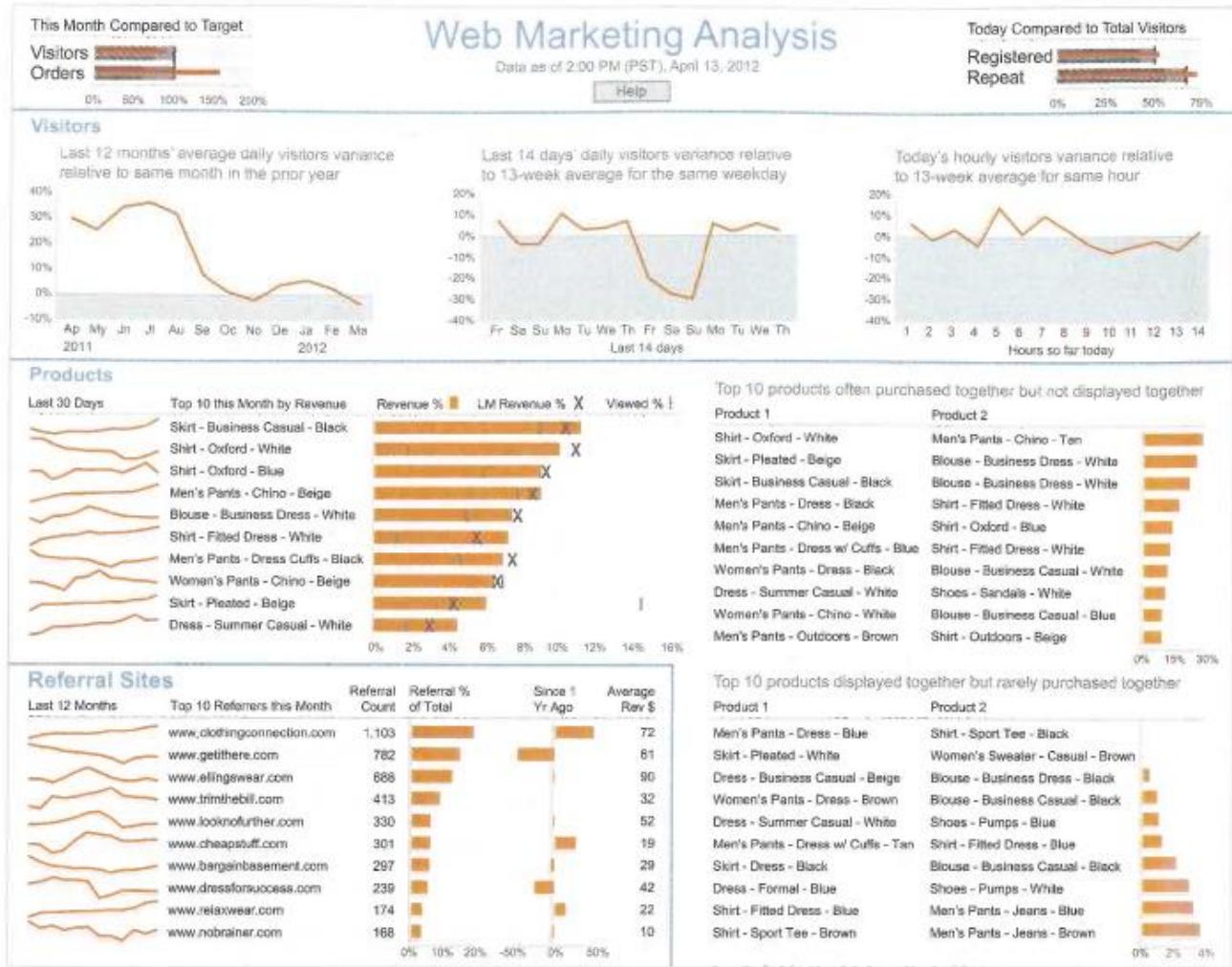


Figure 1g: Example of dashboard visualization
Source: Information Dashboard Design, Few

The versatility of dashboards allows any type of business to identify and manage key initiatives, whether they require weekly or intra-daily data updates.

Types of dashboards

Implementation levels

Dashboards are implemented at various levels in organizations as well as business functions. The implementation can occur at the:

- Corporate
- Regional
- Business unit
- Department
- Group levels

Types of dashboards

There are three dashboard classifications, which are defined by their role:

- Strategic
- Analytical
- Operational

Strategic dashboard

The strategic dashboard focuses on the high-level strategic performance objectives and KPIs of the enterprise. It provides a quick overview of the health of the organization, which can include:

- Static data snapshots for various periods
- Trends

The objective is to enable decision making by the executives. The information provided on a strategic dashboard can, also, be used by managers at lower levels.

Analytical dashboard

The analytical dashboard has an analysis focus. It attempts to gain insights from data collected over time – often the past month or quarter or year. It uses such data to determine:

- What happened
- Why it happened
- What changes should be implemented to improve future performance

For example, by comparing trends over time, analysis can reveal why a certain product is underperforming in a specific region compared to other products.

Analytical dashboards use sophisticated models, what-if analysis and pivots to:

- Identify patterns and opportunities
- Help align strategic goals with performance management initiatives

They are popular with business analysts and experts, who are responsible for outputting reports for general consumption. Characteristics associated with such dashboards include:

- More comprehensive dashboard
- Provides historical views and comparisons
- Includes more contextual information
- Includes more KPIs
- Supports more interaction with the underlying data through drill-down analysis

Operational dashboard

An operational dashboard monitors business processes and frequently changing performance metrics or KPIs. It focuses on different KPIs compared to strategic or

analytical dashboards. It monitors day to day activities which change frequently and typically require immediate corrective action.

The objective is to help an organization check, in real-time, if its performance is:

- On or off target, and
- By how much

Such dashboards:

- Eliminate or reduce the need to distribute reports
- Are common in environments where it is required to act on opportunities and issues quickly such as sales, marketing, help-desk, supply-chain, etc.

Operational dashboards may also help identify trends over time or provide context around the KPI. What sets operational dashboards apart from analytical dashboards is their ability to:

- Drill through to current information
- Generate alerts
- Identify operational problems without delay

Personalized dashboard

Dashboards are usually classified by the three roles: strategic, analytical and operational. In practice, there exists another type of dashboard—a personalized dashboard.

A personalized dashboard is:

- Customized for a specific individual or group
- Provides a unique perspective
- Can enable collaboration among groups
- Provides customized viewing, interaction, and analysis

Elements, characteristics and product features

Elements and characteristics

Why dashboard designs are unique

Dashboard requirements are driven by businesses. The environments, needs, and mode of operations differ considerably. What works for one organization may not work for others. Also, even within organizations, it may not meet the needs of a diverse group of users

Key dashboard elements

Despite differences, some common elements characterize a good dashboard. It should:

- Provide useful and actionable data that supports the business

- Is simple
- Communicate easily and effectively
- Provide essential information without being accompanied by distracting information or graphics
- Make effective use of visualization to present data
- Provide information that enables users to quickly turn insight into action

Desired dashboard characteristics

The basic requirements of a dashboard are that it:

- Provide the right level of information to users
- Provide information in the format that users prefer
- Be accessible any time users need it

A dashboard should be:

- Integrated with other applications
- Able to support all management processes
- Able to support decision making for performance management, via appropriately selected KPIs
- Reliable and consistent
- Considered the single source of truth

When other dashboards exist, they should:

- Be interconnected at different hierarchical levels
- Support upstream and downstream operations.

Dashboards should:

- Be integrated with other management tools
- Be interactive and support drill-down analysis
- Enable users to quickly prioritize actions needed to improve business performance, thus enabling them to respond quickly to changing business needs
- Be available through various applications and devices, including mobile

Other commonly available features

- Support the ability to make decisions quickly when a problem is identified
- Provide a familiar interface for users
- Role-based access and delivery
- Variety of visualizations
- Personalized views and information delivery
- Interaction with the content
- User ability to change views and make updates quickly
- Features that enable significantly reduced IT support
- Support users who want to access via multiple devices and in multiple formats

Incorporating context

Dashboards can be provided with the flexibility for users to easily add context, which can provide new insight.

- Users should be able to:
 - Add new data, such as market data
 - Customize views relevant to a specific group or department
 - Add new visualizations
 - Access information through their preferred applications or interfaces such as the web or mobile devices
- The benefit of such flexibility is that:
 - IT can avoid routine management tasks that can be handled on their own by users
 - After rollout, when views are developed and scheduled for display, users can work directly with the application, if authorized to do so

Dashboard challenges

The development and maintenance of dashboards is not easy. Variables and options available are numerous. Selecting KPIs from the large number of available indicators can be a challenging task. The challenge becomes even greater when the available visualization options, for charts and other types of visuals, are considered.

Having more options and choices does not automatically lead to more effective use of visualizations. In many cases, becomes a barrier to identifying the best way to design dashboards.

Needs of novice dashboard designers

When users are designing dashboards for the first time, they need some guidelines for:

- Identifying the essential components of a dashboard
- Highlighting KPIs and other relevant information on the dashboard

Besides help with metrics identification and development, users need guidance for:

- Selecting the appropriate visualization
- Managing the dashboard

Dashboard software product features

Key software feature categories

Dashboard software products are provided with a wide variety of features. Features can, at a high level, be categorized into:

- User experience
- Visualization
- Reporting
- Drill-down

- User management and authorization
- Collaboration

Other features relating to the back end include data connectivity and system requirements.

Common dashboard software tool features

- Drilling:
 - Enables drilldown so that detailed data can be exposed and analyzed
 - For example, a sales achievement report may be drilled down to determine the sales by region. Subsequently, another drilldown can reveal the product breakdown
 - Drilling can also be horizontal
- Filtering:
 - Limits the data displayed to the screening criteria
 - For example, filters can be specified to display all products with profit margin greater than 15% in Northern Region stores with weekly sales greater than \$250,000
- Sorting:
 - Enables sorts to be performed so that the best/worst performers can be easily identified by displaying them in ascending or descending alphabetical lists
- Pivoting:
 - Splits data into groups
 - For example, the annual sales report may have pivots that provide quarterly figures with summary year-to-date totals
- Calculating:
 - Enables calculations to be performed, such as average selling price (ASP)
- Charting:
 - Visually displays data on the dashboard
- Each function can be used independently or in combination with other; for example, a user may:
 - Drill-down from the initial display
 - Apply a filter
 - Perform a calculation
 - Sort the new result
 - Display the results graphically
 - Publish and distribute the results as a PDF via e-mail

User interface requirement

Computer expertise and software learning ability of users vary across an enterprise. Since dashboards are used by such users, they need to be provided with an intuitive user-friendly visual interface. Visual graphical style of dashboards enables large volumes of performance data to be quickly viewed and analyzed.

Access and performance requirements

A dashboard must be accessible through the web, intranet or extranet, as well as mobile devices. Authorized users should be able to access it through any standard web browser. A dashboard should perform efficiently and be able to quickly display requested reports/views, especially during peak traffic.

Obtaining value from dashboards

Prerequisites

Determine the dashboard objective

- Type of dashboard and its content will depend on:
 - Overall objectives of the proposed dashboard
 - Business challenges it is trying to meet
- The first step in any proposed implementation is to identify:
 - Objective
 - How dashboard will be used

Determine the expected value

- Before attempting to find a solution that meets the needs of the organization, determine benefits of implementing a dashboard
- Value is derived from monitoring:
 - How the enterprise is performing
 - How goals and expectations are met, exceeded, or fall short
- When organizations are provided insight into their performance, they can:
 - Dig deeper into their data
 - Identify issues proactively
- Organizations can, for example:
 - Identify successful products or services,
 - Learn how to drive sales
 - Relate different variables
 - Cut costs efficiently
 - All these can provide value to the organization
- After benefits have been determined, optimal solution can be identified

Identify users whose needs are to be met

- Dashboards should meet the needs of a wide range of users including executives, business users at different levels, as well as IT
- Executives need:
 - To view, at a glance, the performance of the organization.
 - The ability to drilldown to lower level data for further analysis and decision making
- Business users typically need data at the operational level

- IT needs a system that:
 - Can be administered easily
 - Is efficient from the IT resource utilization perspective
 - Enables content to be created and then handed over to users for continuing enhancements

Leverage advantage over conventional reporting

Report limitations

- Reporting and analysis tools are used to:
 - Monitor business performance
 - Identify problems that need to be addressed
- Reports are limited in their analysis:
 - In many cases, they cannot identify problems at the summary levels (on which most reports are based)
- Detailed reports are inefficient as they do not support rapid analysis
- Reporting is the foundation of BI:
 - It is designed for questions posed on a regular basis for monitoring performance in areas such as sales, supply chain etc.
- For performing analysis, most web-based reporting supports:
 - Interactive drilldown
 - Use of filters to refine the data set

Advanced reporting tools versus data visualization

- Advanced reporting tools:
 - Use ad hoc query and OLAP analysis
 - Are designed to support random questions
 - Major limitation: Require user to make a reasonable guess regarding where the answers to questions may reside
- Data visualization is better at exposing hidden problems:
 - When used on dashboards, provides a distinct advantage over conventional reporting
 - It can provide, on a single page of graphics, information distilled from thousands or millions of data rows aggregated at many dimensional levels

Balance conflicting dashboard display requirements

- Information displayed must be carefully selected, useful, and actionable
- If too little information is displayed:
 - It will make the dashboard practically useless
- If too much information is displayed, it can make it:
 - Confusing
 - Inefficient
 - Cumbersome to use

- Practically useless in many cases
- Dashboard should:
 - Display only a few but important items so that it maximizes efficiency
 - Contain more leading than lagging indicators
- Numbers should be complemented by context, such as current versus previous quarter
- Dashboard should also highlight:
 - Positive and negative performance deviations
 - Change in KPIs from negative to positive or vice versa
 - Trends as well as factors impacting trends
 - Alerts, associated comments, and notes that provide additional context, etc.

Selection and implementation

Cost components

Cost as a selection variable

- Cost is an important selection variable
- Selection is not based only on pricing, as it is influenced by a number of variables
- Fees are often based on usage levels
- Pricing structures can be broken out by user, department, developer, or server
- Other costs that come into play include:
 - Training
 - Value-added services
 - Ongoing support
 - These are usually calculated as a percentage of the base cost

General costs and licensing fees

- Depending on the solution, pricing structures and license options can differ considerably
- Many on-demand or software-as-a-service providers offer their solutions:
 - On a subscription base, or
 - On a yearly or monthly basis by individual user or group
- Alternative solution usually involves a structure based on per user and per CPU licensing structure.
- License fees broken out by users may be limited to a handful of super users or developers
- Alternatively, user fees can be divided into two categories:
 - Super users (or developers)
 - Data consumers
- When these two categories are used:
 - Only a small number of users develop the dashboards and/or reports

- However, a large number of end users access the information, share it with colleagues, and make decisions based on the information they receive
- In the CPU or server license models, focus shifts from end users to data volumes and maintenance
- Organizations can use CPU licenses to:
 - Distribute information to various users
 - Avoid worrying about individual licensing fees

Added value costs

- Value added costs typically include training, services and support
- Support alone can annually cost 20-30% of the overall software cost:
 - Support is essentially required for troubleshooting, upgrading, changing platforms, encountering general issues, etc., especially when in-house expertise is lacking
 - Options may be included within an initial package though, in general, it is an additional expense
- Consulting services can help with identifying important metrics and designing customized solutions:
 - Although initially expensive, consulting can lay the groundwork for subsequent self-reliance
- When starting a project, there should be a clear vision for identifying and implementing key metrics, developing the solution, and training

Costs for smaller organizations

- Many small and mid-sized companies:
 - Require the same type of metrics management as large organizations
 - Realize that analytics can provide visibility into their operations
- For such companies, dashboards provide a BI solution that:
 - Provides a low cost entry point
 - Is cheaper to deploy and maintain compared to full BI suites
 - Enables easy access to data and ability to monitor KPIs without developing an internal IT infrastructure or data warehouse

Balancing costs and benefits

- Real value of dashboards, which can be expensive to implement and maintain, comes from assessing the costs and benefits associated with each solution
- Cost/benefit analysis is necessary for evaluating solutions against an organization's overall business requirements
- Pricing and software costs cover just one aspect for evaluating dashboard implementations
- Analyzing cost breakdowns and evaluating various software component costs can help short list solutions based on the allocated budget

- For more cost conscious organizations, using trial versions and general free versions of solutions before commitment is a good option

ROI for dashboards

ROI for making decisions

- Traditionally, ROI is measured by analyzing savings versus costs, including software, hardware, and time saved
- Survey by WiseAnalytics, Klipfolio Inc. and Dashboard Insight considered additional factors contributing to ROI, using dashboards, such as:
 - Implementation time
 - If solution actually met expectations
- Earlier poll run by Klipfolio indicated that only 56% of decision makers actually evaluate ROI when making BI/Dashboarding decisions

Variables evaluated for calculating ROI

- When calculating ROI achieved through the use of dashboards, organizations evaluate:
 - Time to implement
 - Increased data management
 - Ease of use
- In some cases, this means using one solution provider across the organization
- In other cases, organizations look at the needs of each business separately and implement multiple vendor solutions
- Expected ROI for IT applications is often the subject of heated debates
- ROI can be difficult to estimate:
 - At least initially
 - Even more so for dashboards than for other more operational IT applications

Key considerations for selecting the best solution

- Many cost-conscious managers tend to see expenses, rather than the return, when asked to do something new
- To select the best solution, organizations should consider:
 - Overall costs of implementing multiple solutions
 - Support and maintenance costs
 - Long-term software and hardware requirements

ROI calculations

- Calculating the return on a dashboard investment can be tricky, as no one-size-fits-all calculation can do this with mathematical certainty
- ROI will never be correct the first time
- Should be recalculated on a regular basis before, during, and after the dashboard implementation

- When done regularly, ROI calculation can ensure that dashboards provide lasting value

Difficulties in calculating ROI

- Dashboard solutions are unique and whereas operational systems are standardized, BI lacks implementation standards:
 - There do not exist any widely used methods for calculating ROI
 - Same ROI model cannot be used universally
- Other issues include:
 - Lack of data required to calculate costs and benefits
 - Failure to develop a business case
 - Focus on implementation costs rather than benefits (which are more difficult to calculate and quantify)
- ROI calculations should be considered more of a guideline, rather than the results derived from an exact science

Selection

Selecting the dashboard type

- To choose the best dashboard for any given business problem, ask questions regarding the objectives and goals
- Responses to the questions will help identify:
 - Business metrics that need to be monitored
 - Measurement frequency
- Based on the results of this exercise, appropriate type of dashboard can be selected for implementation

How the business view drives selection

Four basic questions help determine which type of dashboard to use:

- Q1: Which business problem needs to be solved?
 - Helps determine the driver for the dashboard solution as well as the project scope
 - If trend analysis is desired, an analytical dashboard will be appropriate
 - Operational dashboard will meet the day-to-day operational analysis requirement
- Q2: Who will use the dashboard?
 - Users' roles will impact the dashboard features and design
 - Analytical dashboard will meet the requirements of executives
 - Operational dashboard will meet the needs of line managers and lower level workers
- Q3: What are the existing performance gaps?

- Identifying gaps will enable metrics to be identified and developed, which can be used at different hierarchical levels
- Depending on the performance being monitored, either an operational or analytical dashboard might be appropriate
- Q4: What is the objective(s)?
 - Dashboard's goal must be aligned to the department's goals and the corporate strategy before metrics are identified, developed, and implemented
 - If goals are strategic, an analytical dashboard is appropriate
 - Operational dashboard is appropriate when constant monitoring is required

How the technical view drives selection

Three basic questions help determine which type of dashboard to use:

- Q1: What is the data infrastructure status?
 - If there exists a robust data warehoused based infrastructure, leveraging available data becomes easy for either type of dashboard
 - If transaction based data is the primary consideration, then an operational dashboard is required
- Q2: What are the data latency requirements?
 - If frequent data updates are required, and data requirements are time-dependent or real time, operational dashboards are the logical choice
- Q3: Where is the source data located?
 - Analytical dashboards generally require more breadth of data and, hence, data sources
 - Operational dashboards are relatively narrower in focus and leverage one data source

How to use guidelines

- Business and technical view highlights should only be used as a guide for selecting the type of dashboard most suitable for the organization
- Using these questions will help bring decision makers one step closer to choosing the most appropriate dashboard for their environment
- In many cases, organizations will require both analytical and operational dashboards in different parts of the company (for long-term performance monitoring and for day-to-day business decision making)

Implementation

Factors considered for dashboard implementation

- Selecting a dashboard solution can be stressful or overwhelming as many factors need to be considered including:
 - Purpose
 - Scope of the deployment

- Integration criteria
- Features and functionality
- Additional factors to be considered include:
 - Initial cost of deployment
 - Implementation period
 - Project cost
 - Solution cost over time

Additional evaluation to be performed

- Analyze other implementations via study of white papers, site visits, etc.
- Study vendor provided cost figures for their products, which can include:
 - Component costs
 - Solution cost
 - Average deployment cost based on number of users or various licensing fees/structures
- Such numbers can provide additional insight into what to expect when implementing the dashboard solution

Implementation period

- Implementation period can vary significantly:
 - Most organizations want to implement it quickly once they have made a decision to proceed
- TDWI survey revealed that many respondents' solutions took over 6 months to deploy which, in many cases, could be attributed to the solution choice:
 - For instance, IBM and Microsoft typically require more integration and infrastructure requirements in order to get the solution up and running
 - Other dashboards, especially those from pure-play vendors, can be implemented within 4 to 6 weeks, depending on the type of solution
- To select the right solution, organizations need to balance their requirements with the reputation and viability of the solution providers

Ability to deploy quickly

- Ability to implement a solution quickly is becoming a key requirement when organizations are evaluating potential dashboard options for different cases:
 - Company has a strong BI infrastructure already in place, or
 - Is considering a dashboard for the first time
- Dashboards provide a more user-friendly alternative to traditional BI solutions due to:
 - Technological advancements
 - More interactivity
 - Self-service models
- As dashboards become more popular and more mature within organizations, ability to deploy solutions more quickly will become possible and expected

Module 2: Scorecards

Objectives and integration

Understanding scorecard objectives

What is a scorecard

- It is one level above a dashboard in the business decision making process
- It is primarily used to align operational execution with business strategy
- Displays the performance of an organization, at a point in time, for enabling decision making
- It provides periodic snapshots of performance associated with the organization's strategic objectives and plans
- Its objective is to focus the business on strategic objectives by monitoring execution and, subsequently, mapping the results back to a specific strategic objective
- Scorecard aligns strategic goals:
 - It enables implementation of the strategy through monitoring and measurement against targets
- Using a scorecard, users can observe how their goals and activities are aligned and correlated with the organization's goals
- While a scorecard basically measures against goals, a dashboard does not typically compare against goals
- Scorecard:
 - Is a tabular display of KPIs, which reflects different perspectives and the organization's strategic objectives, along with their respective targets
 - Blends the concept of metrics management with visualization
 - Communicates the corporate strategy across the organization
 - Visually presents indicators
 - Shows how each measure is performing against its specified target
- Monitoring key indicators helps management to monitor and achieve the company's strategic goals

Comparing a dashboard against a scorecard

- Dashboards and scorecards can contain similar information
- Key difference is that a scorecard displays information at the highest, strategic, level of decision making
- Compared to a dashboard, a scorecard's view is more static and just provides a performance snapshot
- Scorecards are useful for reporting, assessing, as well as driving performance

What dashboards and scorecards enable

- Dashboards and scorecards:
 - Are sophisticated information systems
 - Are based on a BI foundation and data integration infrastructure
 - Are used by businesses to help them achieve their strategic objectives through measurement, monitoring, and management of business performance
 - Use measures that include both financial and non-financial
- These tools can:
 - Measure the past
 - Monitor the present
 - Provide forecasts
 - Enable organizations to adjust their strategy in real-time, as needed, so that performance is optimized
- Terms dashboards and scorecards are frequently used interchangeably; however:
 - They differ in how they are used and how they achieve their objectives
 - While scorecards measure against goals, dashboards need not do so
- When a dashboard or scorecard displays an alert:
 - Majority of users drilldown into the application to determine what action to take
 - Most users also export to Excel, open a predefined report or analytical tool (i.e., OLAP tool), or contact a business analyst

Scorecard alignment

- Scorecard should be aligned to corporate objectives, which define how the organization will achieve its strategy
- Everything an organization does should be aligned to one or more corporate objectives
- Each objective should have 1-3 KPI's that indicate progress in meeting that goal

Three key elements relating to objectives

- Activities and measures relating to objectives generally involve three elements:
 - People: Who will perform the action
 - Process: How the action will be completed
 - Technology: Tools that will be used to perform the action and capture relevant data

Maintaining alignment to corporate objectives

- To maintain alignment to corporate objectives which is a constant process, insight into performance data is required
- Scorecard is a powerful tool used to facilitate this capability
- Scorecard, just like a dashboard, displays information in a compact easy to use format

- Many organizations design a hierarchy of dashboards and scorecards, which:
 - Enable metrics to roll up from the bottom to the top, and
 - Drilldown from the top to the bottom
- In contrast to dashboards, which are reviewed regularly (usually daily), scorecards are reviewed with lower frequency (typically monthly)

Integrating dashboards and scorecards into the total BI solution

Integrating into BI

- Scorecards and dashboards are only part of a total BI solution
- When they are integrated into the BI solution, users can:
 - Gain more insight into the business
 - Convert insight into action
 - Improve ability to execute strategic and tactical plans
- Access to historical information alongside current data as well as trends means that users can quickly move from insight to action—all in one place
- BI software:
 - Can include scorecard solutions that automate the strategy management process
 - Enables users to:
 - Monitor, measure, and manage business metrics
 - Compare them to the organization's strategic and operational objectives
- Benefits include:
 - Alignment of strategy with operations
 - Communication of strategy
 - Monitor of progress
 - Ensure performance accountability
 - Broad distribution to the user community

Aligning strategy with operation

- With scorecards:
 - Corporate strategy can be linked to operational tactics
 - Performance can be tracked based on KPIs
 - Setting of quantifiable goals for any time period can be enabled
 - Progress can be monitored for specific projects and activities

Monitoring and communicating strategy

- Based on their size, organizations differ in the way they monitor performance and communicate strategy:
 - Small- to medium-size organizations use software applications to monitor performance, as well as support the project management and performance monitoring processes

- Large organizations spend considerable time communicating strategy and aligning corporate vision
- Scorecards visually capture organizational strategy, which enables departments and employees to set priorities
- Status indicators and plan-versus-actual data enable progress to be monitored
- Specific users can define threshold ranges and values

Enabling accountability using scorecards

- Scorecards:
 - Ensure that employees are accountable for their performance
 - Highlight high priority objectives
 - Assign owners to each metric
- Metrics are organized and displayed by status, which enables:
 - Problem areas to be quickly identified
 - Corrective action to be taken in a timely manner
- To enable awareness of any change in metrics status:
 - Alerts can be set
 - Corrective actions can be assigned to specific individual(s) or business area

Enabling sharing

- Metrics can be shared and tracked across different geographies
- Can be populated in one language and then displayed in the user's language, which enables more efficient monitoring of performance across geographic regions

Building and using a scorecard

Facts and issues to be aware of when building a scorecard

Scorecard implementation realities

- Scorecard implementations:
 - Benefit larger organizations more than smaller ones
 - Take about 3-6 months
 - Longer it takes, more successful the implementations tend to be
- For success to be achieved, it is critical that there is "C-level" sponsorship and employee buy-in
- Leaving employees out of the process tends to isolate them and produces a less useful scorecard
- Probability of success increases with pilot projects

Key implementation issues

- Five key issues need to be considered when building a scorecard:
 1. Metrics
 2. Format
 3. Standards
 4. Collection
 5. Use

1. Metrics issue

- Scorecard's effectiveness depends on the type and quality of the information it tracks
- Common mistake is to:
 - Measure too many items
 - Losing focus on the key metrics
- Another mistake is to collect the most easily accessible data
- Only the right data must be collected, as managers need to focus only on the data that helps decision making; for example:
 - Measures for managing product costs will be different compared to those used to improve quality
 - Hence, it is to be expected that product and quality managers will need to monitor different measures and KPIs
- Another issue is collecting too much data:
 - Causes information overload
 - Data should not be collected for the sake of data
 - Only actionable data should be collected

2. Format issue

- Scorecards range from:
 - Simple spreadsheets to sophisticated software embedded in a company's ERP system
 - Simple table in a Word document to a complex display in an ERP system
- For use in a scorecard, ERP system can track:
 - Each vendor transaction (such as sales orders, purchase orders, invoices and shipments)
 - Quality of products delivered
 - Quality bug fix time

3. Standards issue

- Common mistake of novice scorecard designers is to use standard measures
- Businesses operate uniquely and what may be right for one organization may not be right for another
- When building a scorecard, it should be tailored to deliver the specific information that is needed

4. Collection issue

- Various methods can be used to collect data required for creating a scorecard
- Some data can be easily collected
- Some data might not be easy to collect and, hence, the tendency is to avoid such data
- Collect the most relevant and important data, even if it is difficult to collect, store, and analyze such data

5. Use issue

- Objective of collecting information for a scorecard is to use it
- Just displaying a lot of metrics and KPIs is not beneficial if that data is not used
- What is done with the results is what will determine if the scorecard is successful

Using the scorecard

Sustaining a scorecard

- Scorecard should be a sustainable initiative which is easy to implement and deploy
- Should be able to leverage technology to provide automated links to measures, texts, and initiative
- Ultimately, scorecard should become part of the organization's culture and employees' work experience

Cascading a scorecard into the organization

- After a scorecard is developed, it should be cascaded into the organization
- In bigger organizations:
 - Scorecard is first implemented at the top as commitment at the highest levels in the corporate hierarchy is critical for ensuring success
 - Subsequently, it is cascaded throughout the organization, to align departmental goals with the overall company goals:
 - For smaller companies, this step might be unnecessary
- Linking is important because it enables employees to understand the cause-and-effect linkage—how they connect to the organization's overall performance
- Linkage analysis can help:
 - Link groups and individuals to the strategy
 - Point to potential improvements
- Goal should be to:
 - Translate strategy into the staff's routine daily work
 - Identify success measures that link to the overall strategic direction
- As users connect and link, the culture of the organization changes to be strategy focused

Making a scorecard more useful

- Potential users should be encouraged to use the scorecard as a routine matter-- making it part of the culture
- After it has been developed, the scorecard should:
 - Become incorporated into the business routine
 - Be embedded into the company's operations as a standard decision-making tool
- Scorecard:
 - Makes the results of changes measurable
 - Indicates what works and what does not work
- If updated regularly, a scorecard can:
 - Provide warnings of future problems
 - Signal opportunities
 - Be used as the focus of continuous improvement

Making an actionable scorecard

Basic characteristics of an actionable scorecard

- Focused
- Comprehensive
- Proactive
- Analytical
- Actionable

How to make a scorecard focused

- Scorecards are aligned to the strategic business plan and driven by objectives and targets
- For example, if objective is “Maximize the sale of low-risk products,” it should present:
 - Overall sales numbers and, also, enable drilldown to the sales numbers of low risk products
 - Proportion of low-risk sales to overall sales and other relevant metrics
 - Apply the 80-20 rule and identify the top 5 items which make the biggest difference and drive performance
- Avoid too many graphs, tables, interpretations:
 - Affluence leads to confusion or information glut, leading to rejection
- Scorecard should cover and provide emphasis in sync with the importance of the objective
- Space and effort should be determined by the importance of measures
- Focus on exceptions:
 - Place more effort and space in reporting, highlighting and root-cause analysis of items that are performing too well or too poorly

How to make a scorecard comprehensive

- High level information in enterprise level scorecard should be linked with lower level scorecards:
 - For example, if enterprise scorecard is displayed on the home page due to its weight, drilldown to the “Operations Scorecard” should be enabled
 - If enterprise scorecard color is red, and drilldown reveals amber at the operations level:
 - It indicates its high importance at the enterprise level compared to less importance at the operations level
- Wherever possible, standards should be firmed up (cost/unit, tolerances, etc.)
- Maximize comparison of actual vs. standard

How to make a scorecard proactive and analytical

- Scorecard can be enabled to support analysis and forecasting, by using:
 - Associated tools like data warehouses//OLAP
 - Leading as well as lagging indicators
- Provide trend analysis:
 - Scorecard, while showing where the needle is (as in dashboard) , also indicates where and how much the needle is moving
- Provide forecasts:
 - Using the leading indicator and state of the initiatives linked to the objective, a scorecard should categorize:
 - Current state, i.e., what has happened, into 'good/fine/poor'
 - Future readiness into 'Red/Amber/Green', i.e., what is expected to happen
- Supporting analytics that answer the question “Why is it happening?”
- Reporting exceptions as well as their reasons, which can make them actionable

What is included in an actionable scorecard

- Status commentary:
 - For example, if 99.9% adherence to SLA has been delivered, whereas the standard is 100%, how bad it is?
 - In case of an air traffic control, difference may cause many air crashes
 - For a CRM system, criticality is limited
 - State of performance should be spelled out: For example: “Measure is bad as we are able to meet only 75% of the SLA”
 - Place a commentary regarding the reasons—i.e., answer to “why is it happening”?
 - Example: “Orders have shrunk over the last month, due to non-availability of raw material to our supplier”
- Commentary on the corrections/improvements required:
 - After reasons are provided, the next question is 'What are we going to do about it?'

- For example: “We should broad-base our vendor network, source two new vendors, and place part orders to them by end of next month” and “We should emphasize to our supplier the need to place our orders at top priority”
- Commentary on expected improvements:
 - Proposed action for improvement is valid only if it brings along the expected improvements
 - For example: “We expect to achieve SLA adherence to 85% within two months and achieve the standard of 95% within four months”
- Help items and appropriate/useful linkages

Balanced scorecard

Concept and history

What is a balanced scorecard

- Is a strategic performance management tool used by management to monitor the organization's performance compared to its strategic goals
- Helps implement and manage strategy at all enterprise levels
- Links objectives, initiatives, and measures to the organization's strategy
- Converts mission statement into a comprehensive set of objectives and performance measures that can be quantified and appraised
- Provides an enterprise view of an organization's overall performance
- Integrates financial measures with other KPIs
- Tool helps :
 - Align business activities with the organization's strategic goals
 - Enables managers to monitor how the business is being executed and, also, the impact of corrective actions
 - Improves communication internally as well as externally
- Widely used by all types of organizations including:
 - Large and small companies
 - Non-profits
 - Government
- Balanced Scorecards are considered to be “balanced” because they:
 - Provide an integrated view of an organization's performance
 - Are based on conventional financial metrics as well as strategic non-financial metrics

Balanced scorecard objectives

- An organization's vision and strategy drive the scorecard objectives and measures, which provide a view of its performance from four perspectives

- Concept was developed because traditional performance measurement systems were generally based only on financial performance indicators and inadequate for guiding the organization's performance
- Balanced scorecard:
 - Aims to be an essential decision-making tool for everyone in the organization
 - Aligns everyone around a common strategy and goals
 - Aims to link initiatives to the strategy, which makes prioritization easier
- Basic philosophy is that employees will focus on what is measured because it shows that they are important—not because of financial incentives

What a balanced scorecard can be used for

- Balanced scorecard:
 - Helps define what management means by "performance," and
 - Indicates if it is achieving the desired results
- Using a balanced scorecard:
 - Senior management can measure how the organization's business activities are helping them meet its strategic goals
 - Managers can:
 - Track how activities are executed by their subordinates
 - Monitor the results due to their actions

Four balanced scorecard perspectives

Introduction

Strategic areas covered by the four perspectives

- Four perspectives cover the main strategic focus areas of a company
- Model serves as a template for designing strategic objectives, measures, targets and initiatives within each of the 4 perspectives:
 - Financial
 - Customer
 - Internal business processes
 - Learning and growth



Figure 2: Balanced Scorecard
 Source: <http://crackmba.com/balanced-score-card/>

What the financial perspective provides

- Covers the organization's financial objectives
- Shows how the organization is viewed by its shareholders from a growth, profitability, and risk perspective
- Enables managers to track financial success and shareholder value
- Encourages identification of a few relevant high-level financial measures
- Designers are encouraged to choose measures that help answer the question "How do we look to shareholders?"

What the customer perspective provides

- Shows how the organization is viewed by its customers
- Deals with the strategy for creating:
 - Value
 - Differentiation from the customer perspective
- Covers customer objectives such as:
 - Customer satisfaction
 - Market share goals
 - Product and service attributes

- Perspective encourages identification of measures that help answer the question "How do customers see us?"

What the internal business processes perspective provides

- Shows how well the organization manages its operational processes
- Deals with the strategic priorities for various business processes, which create customer and shareholder satisfaction
- Covers internal operational goals and outlines the key processes necessary to deliver customer objectives
- Perspective encourages identification of measures that help answer the question "What must we excel at?"

What the learning and growth perspective provides

- Focuses on the organization's ability to continue improving and creating value
- Reviews how the organization learns and grows
- Focuses on the priorities for creating a climate that supports organizational change, innovation, and growth
- Also covers intangible drivers of future success such as:
 - Human capital
 - Organizational capital
 - Information capital including skills, training, organizational culture, and leadership
- Perspective encourages the identification of measures that help answer the question "How can we continue to improve and create value?"

Types of KPIs used for the different BS perspectives

- Financial perspective:
 - Revenues
 - Earnings
 - Return on capital
 - Cash flow
 - ROI
 - Project profitability
 - Sales backlog
- Customer perspective:
 - Market share
 - Customer satisfaction index
 - Customer loyalty
 - Customer ranking survey
- Internal business process perspective:
 - Productivity rates
 - Quality measures
 - Timeliness

- Safety incident index
- Project performance index
- Innovation and learning perspective:
 - Percent of revenue from new products
 - Rate of improvement index
 - Number of employee suggestions
 - Revenue per employee
 - Staff attitude survey
- Employee performance:
 - Morale
 - Knowledge
 - Turnover
 - Use of best demonstrated practices

Customizing the perspectives

- Basic principles of Kaplan and Norton's original balanced scorecard model have significantly influenced subsequent work on the subject
- Individual organizations tailor the four perspectives to suit their own needs; however, basics have not changed much over time

Connection between perspectives

Interconnection

- Strategic planning the balanced scorecard way:
 - Means looking at implementing change from different aspects of a business
 - These aspects are the balanced scorecard perspectives
- Basis for the balanced scorecard is that:
 - Perspectives are interconnected
 - Changes in one will have ramifications for the others

How perspectives are connected

- Process starts at the bottom with the “Learning and Growth” perspective
- Skills, culture, leaders and management information aligned to the organization’s strategy will create effective and efficient business processes (business process perspective)
- Effective and efficient product delivery, customer relationships, innovation, and regulatory processes, in turn, ensure that the organization’s offerings meet the customers’ needs
- Components of the organization’s offerings (products, services relationships and brand) are shown in the customer perspective
- Satisfied customers and efficient business processes combine to produce growth, lower costs and better use of the organization’s capital, with the result being increase in profits and shareholder value

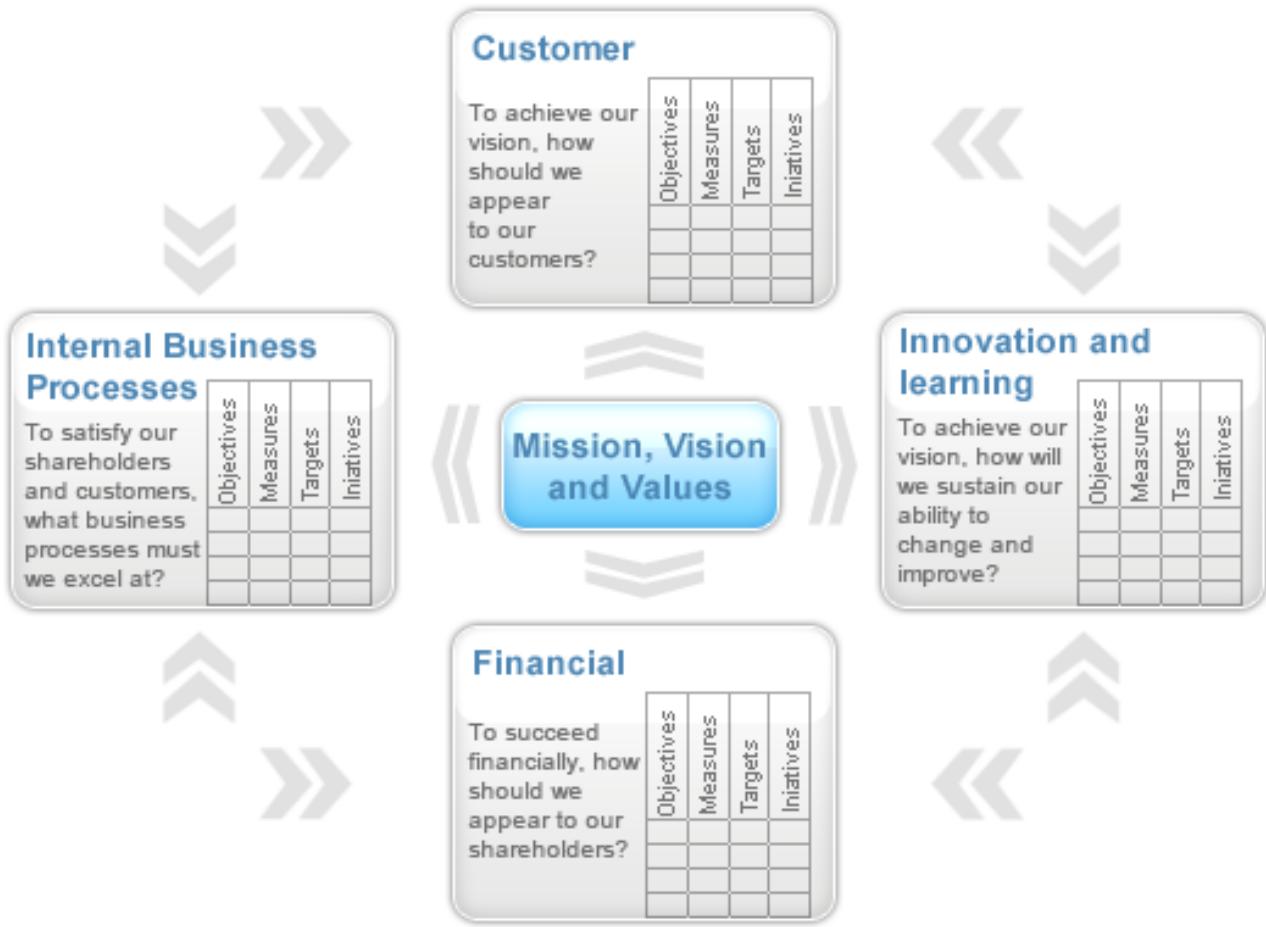


Figure 3: Balanced Scorecard flow

Source: http://www.virbusgame.eu/virbus/mediawiki/index.php/Balanced_Scorecard

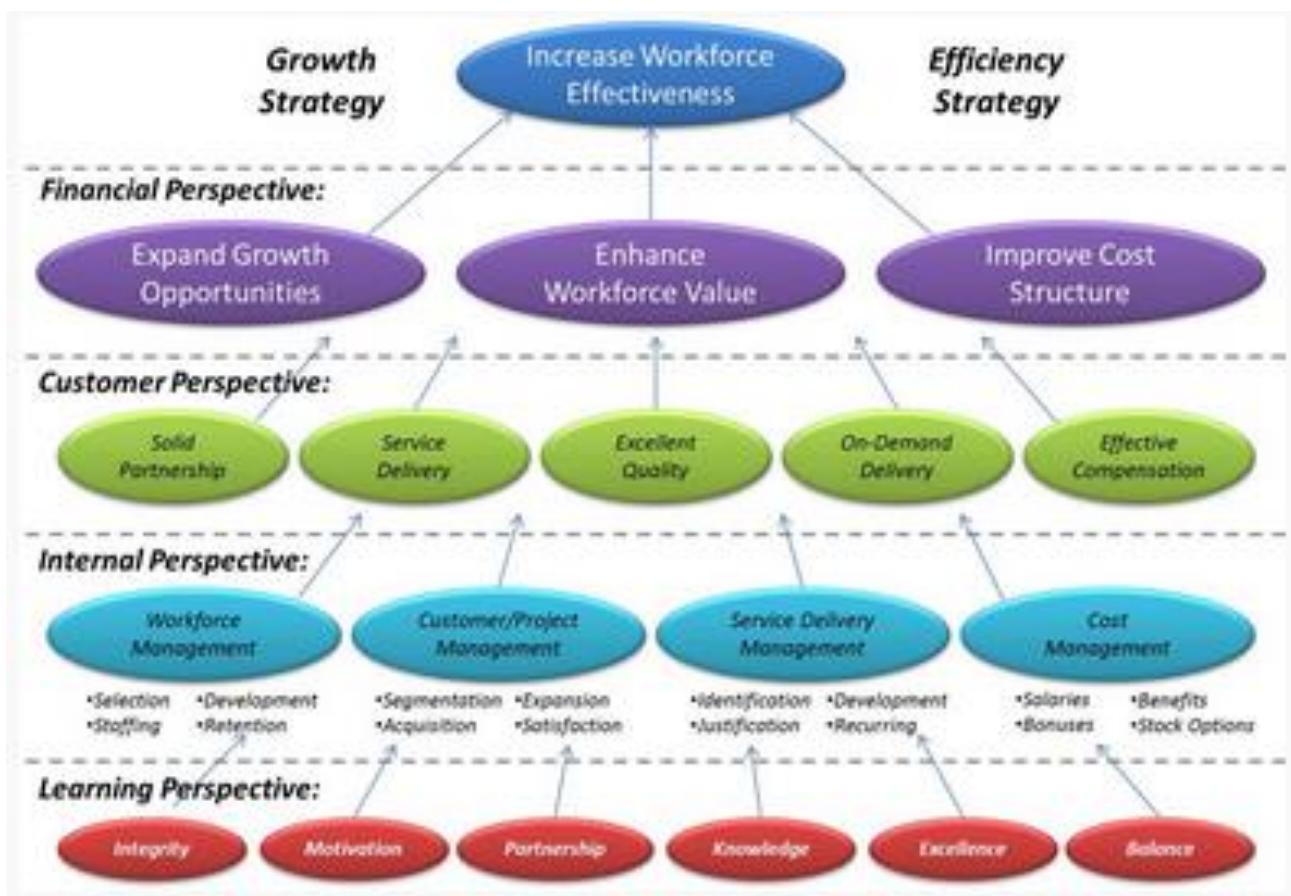


Figure 4: Balanced Scorecard

Source: <http://www.jeitosa.com/service/vision-to-value-v2v-hr-strategy/>

Module 3: Dashboards and scorecards: Characteristics and implementation

Common characteristics

Basic characteristics of dashboards and scorecards

- Many variations exist among dashboards and scorecards
- Three common characteristics define them and enable them to provide value to the organizations implementing them
- Each one has:
 - Three applications
 - Three layers
 - Three types

Three applications

What are the three common applications

- Dashboards and scorecards contain three tightly integrated applications which, when well-designed, work smoothly
- Three applications are:
 - Monitoring application
 - Analysis and reporting application
 - Management application
- These applications, which may or may not be distinct programs, provide specific functionality

Three Applications

	Monitoring	Analysis	Management
Purpose	Convey information at a glance	Analyze exception conditions	Improve coordination and collaboration
Components	<ul style="list-style-type: none">• Multi-paned screens with visual elements• Graphs (i.e., dials, gauges, thermometers)• Symbols, alerts• Charts, tables with conditional formatting• Alerts	<ul style="list-style-type: none">• Analytics (i.e., dimensional, time-series, segmentation)• Forecasting, modeling, and predictive statistics• Visual analysis• Reporting	<ul style="list-style-type: none">• Annotations• Threaded discussions• Meetings• Strategy maps• Workflows

Figure 5: Three applications
Source: Deploying dashboards and scorecards, Eckerson, TDWI

What is an application

- An application is a software program or groups of programs:
 - Designed to perform a specific function
 - Either for end users or other program(s)
 - Developed on an information infrastructure
- Objective of such programs is to help users to monitor, analyze and manage their business
- For dashboards and scorecards, they:
 - Help display information quickly and efficiently
 - Highlight exceptions
 - Improve execution through easy communication and collaboration throughout the enterprise

Three layers

What are the three common layers

- Dashboards and scorecards are characterized by three information layers:
 - Monitoring
 - Analysis
 - Action
- Monitoring view:
 - Displays data, such as charts, which monitors the key performance indicators
- Analysis view:
 - Consists of summarized dimensional data used to determine the real cause of identified problems
- Action view:
 - Displays detailed underlying data that helps determine the corrective action to be taken to solve an identified problem
- Starting at the top, users can drilldown through successive layers, so that:
 - Root cause of a problem can be identified
 - Appropriate corrective action undertaken

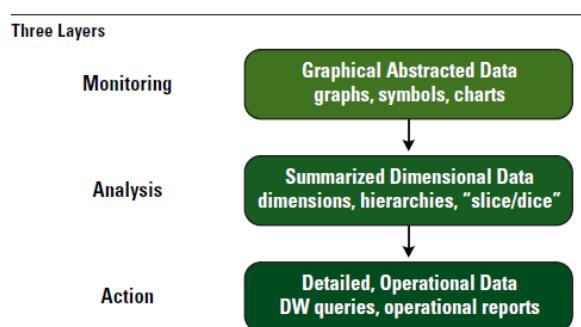


Figure 6: Three layers of data

Source: Deploying dashboards and scorecards, Eckerson, TDWI

Three types

What are the three types

- Three types are:
 - Strategic
 - Tactical
 - Operational
- For these three types, implementation of the three applications and three layers can vary somewhat
- Strategic dashboards or scorecards:
 - Are geared more towards management, rather than monitoring and analysis
 - Focus is on monitoring progress towards implementing the enterprise strategic objectives
 - Strategic dashboard implementation is often executed via the balanced scorecard
- Tactical dashboards:
 - Are at a lower level, usually departmental
 - Are geared more towards analysis, rather than monitoring
- Operational dashboards:
 - Are at the lowest level
 - Track business processes
 - Frequently extract and display real-time operational data
 - Primary objective is monitoring, rather than analysis or management

Differences and measures used

Differences between dashboards and scorecards

Why the terms dashboard and scorecard can be confusing

- Dashboards and scorecards:
 - Are performance measurement applications
 - Visually display performance indicators that can be digested quickly
 - Have their own unique characteristics which are not widely realized; hence, they are frequently used interchangeably
- Dashboards and scorecards:
 - Are linked to the strategic business objectives
 - Use visualization
 - Have some common elements
- Look and feel of dashboards and scorecards, as well as their functions:
 - Can be different
 - Depends on the organization implementing the applications

Dashboard and scorecard differences

- Dashboards and scorecards have distinct differences because they focus on different levels of the organization

- Dashboard is a performance **monitoring** system with an operational focus that measures performance
- Scorecard is a performance **management** system that focuses on the progress towards achieving strategic objectives.
- Usage:
 - Dashboard is used by managers and lower level employees
 - Scorecards are primarily used by executives and managers
 - Dashboards use real-time data and typically display charts and tables
 - Scorecards use summaries, provide periodic snapshots, and use graphical symbols and icons to highlight the KPI status and trends

	Dashboard	Scorecard
Purpose	Measures performance	Charts progress
Users	Managers, staff	Executives, managers, staff
Updates	Real-time to right-time	Periodic snapshots
Data	Events	Summaries
Top-level Display	Charts and tables	Symbols and icons

Figure 7: Dashboards versus Scorecards
Source: Deploying dashboards and scorecards, Eckerson, TDWI

Functional and design distinctions

- Dashboards:
 - Monitor performance for a shorter time horizon
 - Depending on the organization, can cover daily, weekly or even hourly time periods
- Scorecards:
 - Look at longer time spans
 - Can cover quarterly, monthly or even weekly periods
- While dashboards are operational and occasionally tactical in nature, scorecards are primarily strategic and tactical
- Scorecards generate long-term considerations and actions
- Dashboards display results which usually require immediate action

Making dashboards and scorecards effective

- Simply displaying KPIs on a dashboard or scorecard will not improve performance
- Besides measuring and monitoring KPIs, there needs to be:
 - Active management and appropriate actions, when needed, so that targeted goals are realized
 - Integration of objectives, programs, and KPIs
- Execution should be monitored and the results mapped back to the strategy

Example: Dashboard versus scorecard measures

Scenario: Manager responsible for outbound renewal collection calls at a large enterprise

Example of dashboard measures

- Dashboard can have the following measures:
 - Number of outbound call in progress vs. number FTEs
 - Number of outbound call, which have gone over 5 minutes.
 - Number of outbound calls, which have not received a response in the past one hour.
 - Number of outbound calls in last one hour, which are resulting in agreement from the customer to pay
 - Number of outbound call where customer has refused to pay

Example of scorecard measures

- Monthly scorecard can have the following measures:
 - Mean outbound call duration and weekly trend.
 - Standard deviation outbound call duration and weekly trend
 - Percentage of calls resulting in agreement from the user to pay
 - %age utilization of calling staff
 - Comparison of the above figures versus average of last three months
 - Product wise split of the call duration and call success rates

Application and implementation

Application

Popularity of dashboards and scorecards

- They merge BI and performance management, providing a powerful performance tool
- Present summarized actionable information, which significantly reduces the amount of time required to review and analyze information and, subsequently take appropriate action
- Appeal to users who find traditional reporting and analysis tools too complex:
 - Instead of learning multiple tools, users are presented data that they can easily comprehend, through a single interface
 - When required, they can drill-down to the underlying data so that the root cause of an issue can be identified and appropriate action taken in a timely way
- Dashboard and scorecards can also be customized so that they:
 - Proactively provide alerts via e-mail or smart phones
 - Act as an early warning system when there are deviations from predetermined thresholds

Scope of implementations

- Despite their existence for a long time, dashboards and scorecards usage is not as widespread as should be expected
- While many organizations develop their own customized systems, many reliable and robust commercial products are available for building these tools
- Scope of most dashboard and scorecard implementations is at the enterprise level
- Metrics are cascaded, typically to four enterprise levels
- Typical utilization is less than 50 users
- Data used is extracted from less than ten sources
- Typically less than 50 GB of data is analyzed

Implementation

Implementation prerequisites

- Before selecting a scorecard or dashboard for implementation, there needs to be clarity regarding:
 - Objective (strategic or operational goals)
 - Type of information to be displayed and monitored
- If objectives and goals are not determined first, the solution selected, dashboard or scorecard, may not be appropriate

Implementing multiple dashboards

- An organization can have multiple dashboards, with each serving a:
 - Specific objective
 - Business problem
 - Functional area
- To ensure performance consistency across the organization, implementation should be on a common data infrastructure and application platform

Implementing dashboards as part of a BI solution

- Dashboards are usually not planned and implemented as part of an overall BI solution, though they can be
- Some challenges include:
 - Variation in the needs and technical skills of a wide range of users (which can cause serious resistance)
 - Redesign encompassing many tools which can be less than cost-effective
 - Limited IT bandwidth for implementation

Selecting the dashboard functions to be implemented

- For a dashboard to provide value, it must meet the needs of its targeted users
- Users must be able to easily and quickly access information which is useful and actionable

- Unplanned implementation that is based on ad hoc requests or driven by technology, rather than user requirements, is destined to fail

Providing information to users

- Usage will be heavy if:
 - Users can access the dashboard quickly and conveniently
 - Information provided is beneficial
- Information displayed should be:
 - Personalized
 - Delivered in the format that users desire
- Users should have the flexibility to access and analyze information in the most convenient and meaningful ways
- Access should be enabled even if the users are not connected to the corporate BI infrastructure or a web browser

Benefits and shortcomings

Benefits

Dashboard benefits

- Enable users to understand their business and monitor performance
- Are an effective way of providing information in a:
 - Filtered
 - Summarized
 - Easy to understand way
- Reduces the time required to:
 - Analyze information
 - Gain insight into data and trends
 - Take corrective action
- Increase productivity:
 - Users can make faster decisions
 - Do not have to dig through irrelevant data, since it only provides data relevant to analyzing the performance
- Other benefits that a dashboard can provide include:
 - Alignment of strategy with tactics
 - Instill a goal-driven performance culture
 - Provide one version of the truth
 - Provide consistent view of the business
 - Improve coordination and save time
 - Empower users and increase motivation
 - Reduce costs and redundancy
 - Deliver actionable information
 - Provide insight into customer behavior

Benefits of a dashboard's intuitive environment

- Users at all levels can become very productive
- Even users who are not technology savvy can change the content that is displayed or delivered to them quite easily, provided they have been authorized
- For example, users can:
 - Change the filters (dashboard or reports)
 - Request delivery via smart phone at a specific time
 - Change the page layout, etc.

Benefits of a properly deployed dashboard or scorecard

- Properly deployed, they can provide three benefits:
 - Communicate the strategy across the enterprise
 - Monitor and adjust the strategy being executed
 - Deliver actionable information and insight to the users

Benefit of communicating strategy

- Dashboard enables strategy, objectives, and goals to be communicated across the enterprise
- Every employee, at different levels, can relate his/her goals and performance to those of the enterprise
- Success, deviations, and failures can be communicated easily and quickly
- As an agent of organizational change:
 - Dashboards and scorecards enable management to synchronize the effort of employees at all levels so that the organization can meet its strategic goals

Monitoring and adjusting strategy

- Management can use the tools, dashboards and scorecards, to:
 - Monitor performance
 - Ensure that the strategy is being implemented as planned
- Depending on the requirements and the metrics being tracked, monitoring can be on an hourly, daily, weekly, monthly or quarterly basis
- When issues are identified, executives and managers can:
 - Quickly take corrective action
 - Ensure that progress towards goals is maintained
- If necessary, strategy can be changed to reflect the changed business conditions

Shortcomings

Dashboard shortcomings

- Generally, they are considered nice to have, but not essential or critical
- Despite their popularity, most dashboards:
 - Live up to only a fraction of their potential
 - Fail, not due to poor technology—at least not primarily—but because of poor design
- More critical the information is for the business health, more grievous is the failure because the remedy is so readily available
- Dashboards often do not mean the same thing to different people in the organization, as there is a lack of understanding of:
 - Its objective
 - What the tool really aims to achieve or its relationship to performance
- Many dashboards are more complex and do not:
 - Follow good design principles
 - Provide good visualization, which is a critical element of any successful dashboard
- Dashboards have:
 - Confused users
 - Caused resistance in many cases

These are some of the main reasons why, despite their potential benefits, dashboards are still not as widely used as they should be

Issues with low-cost dashboards

- Many organizations implement low cost dashboards or scorecards which, typically, leverage the existing data infrastructure
- They are usually driven by an urgent business demand for implementation with limited funding
- While they can meet some short-term needs, they are usually:
 - Unable to scale, or
 - Meet the organization's long-term strategic needs
- Since they are not well-designed or well-planned, they usually have to face the problems associated with such ad-hoc software development

Module 4: Key performance indicators

Performance measurement

Reasons for measuring performance

Reasons for measuring performance

- Organizations measure performance for three main reasons:
 - Learn and improve performance
 - Provide external reporting (for shareholders and compliance requirements)
 - Monitor and control internally within the organization
- It is widely believed in many organizations that:
 - Only what gets measured gets done
 - Unless something is measured, it cannot be managed and controlled

Benefit of performance management analytics tools

- In many organizations, performance data is collected and distributed across the organization without any meaningful analysis
- To provide real value, data needs to be interpreted and analyzed so that improvements can be made in meeting the strategic goals of the enterprise
- For this purpose, performance management analytics tools and techniques can be used so that collected data can be converted into information and used to improve performance

Measurement requirements

Measuring for learning and improving performance

- KPIs:
 - Are used extensively, especially to learn and improve
 - Provide information to users for making informed and, hence, better decisions so that performance can be improved
- Monitoring KPIs:
 - Enables management to remain informed
 - Assumptions to be challenged
 - Provide ongoing learning and improvement

External and compliance reporting requirements

- KPIs are also measured to ensure that reporting requirements, generated by external requirements, can be provided easily and accurately
- Requirements are generated due to:
 - Need to inform external stakeholders and shareholders
 - Compliance with external reporting requirements
 - Special requests for information or data

- Some of this information can be requested on an ad hoc basis
- Many reports and associated indicators, such as quarterly financial reports, need to be provided on a regular basis as they are mandatory

Measurements for controlling and monitoring

- KPIs are routinely used to monitor and control performance and behavior of employees at all levels of the corporate hierarchy
- KPIs are used to set performance goals and monitored to ensure that they have been met:
 - Whenever variance exists between the goal and its achievement, appropriate corrective action is initiated
- Measurements aim to eliminate variances and improve conformity:
 - To achieve this objective, measures are linked to financial and associated rewards
 - Such reward structures need to be implemented carefully
- Poorly designed system can be self-defeating when it causes employees to focus:
 - On meeting the measure targets
 - Not on performance improvement
- Organizations that follow best practices:
 - Know which KPIs are necessary for learning and improvement
 - Focus on them, rather than use indicators for controlling employees

How best practice organizations drive performance

- Such organizations identify and focus on the indicators that are required for learning and improvement
- They separate indicators required for external reporting if they are not internally relevant; this is
 - Beneficial as it makes monitoring more focused and targeted
 - Screens out data that is not required
 - Helps improve performance

Metrics and KPIs

Measures and metrics

Measure

- Is a unit or standard of measurement, which consists of a number and a unit
- Example:
 - Speed is expressed in miles per hour (mph)
 - Temperature in degrees (°F)
- Measure is the raw data that is collected, such as revenue or sales
- To be useful, measures should be defined and used consistently across the organization, which enables easy sharing, aggregation, and comparison

Metric

- Measure and metric are basically the same
- Metric:
 - Is used in business performance and has a goal or performance associated with it
 - Is a measurement standard, which provides a target value that must be achieved for success
- Measurement represents a piece of business data that is related to a dimension, such as revenue by month; for example:
 - Revenue is the measure (dollars)
 - Time is the dimension (month)
- Business metric:
 - Is a measurement used to gauge a company's performance
 - Provides a raw measurement of a quantifiable component of an organization's performance such as revenue per customer, gross margin, and average cost per customer

Objective of metrics

- Objective of metrics and related targets is to monitor:
 - Progress towards the achievement of strategic goals and, ultimately, implementation of the organization's strategy
- Metrics are:
 - Ultimately the key to the success of any dashboard or scorecard
 - The linchpin between business and technical architectures
- Many techniques and guidelines exist for developing effective metrics; the most important ones will now be discussed

Differences between strategic and operational measures

- Strategic and operational measures have different objectives
- Operational measures:
 - Monitor measures in a shorter time frame, which can be daily or even more frequently
- Strategic measures:
 - Monitor indicators that indicate long-term performance
 - Can typically cover monthly, quarterly or annual periods

Selecting the right metrics

- Indicators that can be measured in an organization are numerous—in reality anything can be measured
- Challenge exists to identify and pick the appropriate metrics that should be measured
- Key is to measure items that can help an organization to monitor and improve its performance

- Metrics:
 - Should be actionable and enable performance improvement
 - That are nice to know but do not provide any value should be avoided
- Metrics selected should be relevant to:
 - Improving the organization's performance
 - Achieving the strategic goals
- Selected metrics should enable the performance of the enterprise to be evaluated
- Metrics should include:
 - Financial and non-financial measures
 - Existing metrics and custom metrics
 - Leading and lagging indicators

Qualitative and quantitative metrics

- Analytics can be a very effective tool when both qualitative and quantitative metrics are utilized
- Tendency of most organizations is to only use quantitative metrics, or numbers, as they are:
 - Available
 - Easy to extract
 - Can be converted into meaningful metrics that the business can use for performance management
- Quantitative metrics should be balanced with qualitative, i.e., non-numeric, metrics as they can:
 - Provide additional insight
 - Highlight issues with customers and stakeholders

Key performance indicators (KPIs)

What is a key performance indicator

- KPI is a:
 - Type of measurement used to gauge or compare performance
 - Metric that is tied to a target
- Metric is not necessarily a KPI
- KPIs:
 - Reflect critical success factors and organizational goals
 - Are evaluated over a specific time period
 - Are compared against acceptable values, historical performance, or targets
 - Are used to determine how far, above or below, a metric is compared to a pre-determined target
- Objective of using KPIs is to reduce uncertainty
- KPIs reduce the complex nature of organizational performance to a few key indicators that can be easily monitored
- Just like doctors use only a few key health indicators:

- Like blood pressure and cholesterol levels
- Organizations also need to measure and monitor the most important and relevant ones
- When KPIs are not easily available, proxy indicators can be used

KPI characteristics

- Strategic
- Relevant
- Quantifiable
- Reflect strategic goals of the organization
- Based on corporate standards
- Based on valid data
- Defined by management
- Do not change frequently
- Easily understood across the organization
- Measured frequently
- Trigger action at appropriate levels
- Provide context
- Empowers users
- Have a significant impact on the organization
- Can be used to assign responsibility

Which KPIs should be used

- KPIs go beyond counting
- Selected KPIs should enable the organization to:
 - Monitor its performance
 - Provide a true picture of how it is progressing towards achieving its goals
- No universally accepted set of KPIs exist for any business or function because they depend on the organization's business strategy and priorities, which vary across different organizations

KPIs commonly used

- Objective of using a KPI is to determine if the performance is on or off target
- Since there exist a variety of organization types, which run different businesses:
 - Performance criteria cannot be expected to be the same
 - KPIs, or their relative importance, can vary significantly across organizations
- Range of KPIs that can be used varies significantly, such as:
 - Top revenue products
 - Sales growth year-to-date
 - Percentage of on time deliveries
 - Number of complaints received
 - Number of defects for new products

- Percentage of late payments
- Return on equity
- Profit margin
- Customers lost in previous quarter

KPI management

- KPIs highlight an organization's performance in the quest to achieve its strategic goals
- KPI management basically involves:
 - Defining what the organization needs to do, such as grow revenues at a certain rate
 - Prioritization for achieving the objectives
- Next step is to create indicators that measure the progress towards achievement of those goals
- Finally, progress is analyzed to identify:
 - What works
 - Changes that need to be implemented to ensure that the objectives are achieved

Benefits of KPIs

- Metrics and KPIs are the building blocks of many dashboard visualizations
- They are very effective in informing users:
 - Of the performance status, compared to their goals
 - Helping them make better informed decisions
- Help organizations track how well they are performing relative to their strategic goals and objectives

Problems with KPIs

- Can be difficult to implement and use
- May have limitations regarding accuracy
- Can be difficult to change without causing disruption
- Can impact comparison with historical data
- Are backward looking
- Can involve many measurements
- Targets can be unrealistic and distort perception of performance

Using metrics on dashboards

Metrics should correlate with an organization's success

- If dashboards are well designed, they can enable organizations to:
 - Track their strengths and weaknesses
 - Monitor performance
 - Help with planning

- When dashboards are based on irrelevant metrics, they:
 - Waste resources
 - Do not help in making the organization profitable and successful
- It is imperative that metrics used on a dashboard should correlate with the organization's success
- Dashboard can be a critical decision making tool when it contains metrics that are the best predictors of success; when such metrics are used, they enable valuable insight that management can use and act upon

Align metrics with the strategic goals

- Enables key information to be shared with different departments and groups
- Ensures alignment with the company's objectives and goals
- Provides a common location where anyone in the organization can observe how the company is performing
- Users can also understand how they and their department or group:
 - Contributes to the overall company goals
 - Is performing compared to others

What the right metrics indicate

- They pinpoint the organization's strengths and areas where its performance is superior compared to the industry and competitors
- They can also:
 - Point out weaknesses
 - Identify areas where performance is lagging compared to the competition or the industry in which it operates
- Using limited and the correct metrics:
 - Screens out unnecessary data
 - Presents only the data needed to make well informed decisions
 - Helps managers avoid sifting through a lot of distracting information
- Ability to drill-down to detailed data enables managers to analyze areas of interest and weakness

Include unique measures

- Dashboards need to be unique for the specific organizations implementing them
- Content should be customized for the organization and only include metrics that can help the organization be successful
- Only metrics unique to the organization should be included
- Performance metrics should support strategic objectives
- Performance metrics are unique for each organization, though there may be similarities with other organizations
- Using existing repackaged measures are risky as they may not meet the organization's needs

- It is common to find that over half of the required strategic indicators are unique; hence:
 - They have to be designed
 - Such unique indicators tend to be among the most relevant and useful metrics

Effect of selecting random metrics

- Many dashboards are based on flawed measurement techniques and metrics, which are selected randomly or without any evaluation
- Many metrics are randomly chosen that are self-serving for the executives; such metrics are useless from a performance monitoring perspective
- Some dashboards only:
 - Focus on one area such as marketing, with a narrow set of metrics
 - Monitor short term results
- Such dashboards are not beneficial from a strategic perspective
- Only metrics that are predictors of success should be selected

Metrics to include on a dashboard

- Dashboard should:
 - Display metrics that make it useful
 - Avoid complicated and artistic presentations consisting of elaborate graphics and animation
- Dashboard should be able to communicate its information to users easily without any distraction.
- Users should be easily able to understand the few metrics that are displayed, so that they can quickly analyze and take appropriate action

Basic indicator rules

- Indicators
 - Must trace back to the source data
 - Be a representation of the underlying detailed data
 - Must also be actionable, which helps limit the number of indicators
- Data status, complete or incomplete, should be displayed:
 - Ensures that there is no confusion
 - Any action taken by the users is based on that knowledge
 - Avoids decision making based on incomplete or missing data
- Data displayed on a dashboard must also indicate the relevant time, such as refresh date and time.

Developing and keeping metrics effective

Obtain buy-in

- Metrics won't propel an organization in the right direction unless the users, whose performance is being measured:
 - Understand
 - Accept
 - Endorse the metrics
- To gain buy-in, involve users in the process of defining metrics, targets, and thresholds
- Since users are closer to the business processes, they will better understand whether:
 - Metrics accurately capture the nuances of a process
 - Targets are realistic or not
- When requirements are gathered, obtain user feedback on proposed metrics and targets
- Individuals who have a vested interest in making them work can develop more accurate metrics, which:
 - Have a greater impact on the business
 - Are less likely to be manipulated

Benefit of simplicity

- Humans can only absorb limited information at any one time
- To avoid cluttering a dashboard or scorecard:
 - Display only a handful of metrics on a single screen
 - 4-7 is a good number
- If there are more metrics:
 - Which is reasonable if measuring an end-to-end business activity:
 - Create hierarchies of metrics, using folders, tables, and drilldowns, which will preserve the clarity and simplicity of the dashboard display

Empower users

- When designing metrics:
 - Examine the context in which they are used
 - Give users authority to make decisions, even unconventional ones, that will improve performance:
 - May require reengineering business processes, and
 - Delegating responsibility to those closest to the customer or the process being measured
- Organizations need to hold users accountable for the outcome of the measures:
 - If no one is accountable, metrics won't have any impact on the organization
 - Better to hold an individual accountable, even if a team manages the process or task being measured

Avoid perfectionism

- Difficult to design new metrics in a vacuum
- Important to gather comprehensive requirements and map business processes and information flows:
 - However, one can never be sure how well a metric will work, in practice, until it is deployed
- To avoid analysis paralysis, adhere to the 80% rule:
 - Develop metric to a point where there is 80% confidence that it will have the desired effect
 - Deploy it, track the results, and refine it, as needed

Review selected metrics periodically

- All metrics have a natural lifecycle and over time:
 - Lose their impact as processes are streamlined to the point where additional gains are not worth the effort
 - Business usually changes, forcing organizations to add new metrics that cause users to expend their energies elsewhere
- To ensure the effectiveness of the metrics and performance management system as a whole, continuously monitor the usage of metrics
- Dashboard and scorecard teams should:
 - Aggressively prune underused metrics (after consulting with the business)
 - Monitor newly deployed metrics to quickly identify problems that users may be having with the metrics or views

Pitfalls of incentives

- Do not attach incentives, in the form of bonuses or compensation, to metrics that have not been fully vetted and accepted by the organization
- Deploy metrics for a while to:
 - Identify and close potential loopholes
 - Change calculations to more accurately reflect reality
 - Provide training so users understand how to impact outcomes

Check data quality periodically

- Users should have complete confidence about the data displayed on a dashboard
- Imperative that the dashboard data be periodically reviewed and validated, which can be done through a regular auditing process in which key indicators are reviewed and subsequently:
 - Traced back from the results to the source data
 - Calculations and formulas are checked
 - Data quality is validated
 - Verifying that correct triggers are used to indicate stop lights (red, green and yellow)

Module 5: Designing KPIs

Designing KPIs

Creating and selecting metrics

KPI design process

- Users need to study the organization's strategic goals from a new perspective, which can bring into the open many parked issues
- After the review, the tasks required to create new measures can be started
- If the organization has already identified short- and long-term goals, defining new metrics becomes easier
- To start designing a KPI:
 - Determine the questions for which answers are sought
 - Identify one or two key performance questions (KPQs) for each strategic objective
 - These KPQs will lead to the KPIs

Creating new metrics

- Corporate strategy:
 - Determines what needs to be measured
 - Does not specify how that should be done
- Custom metrics need to be developed:
 - When users want to measure something that has not been previously measured, such as a new process, and
 - Off-the shelf or traditional indicators are not suitable
- New metrics can be easy or difficult to create, depending on the complexity
- Usually, creating a metric is easy if it involves customizing an existing metric
- Creating a new metric entirely from scratch can be laborious
- Some areas:
 - Are relatively easy to quantify
 - Others present a challenge in the selection and design of appropriate KPIs
- For example:
 - Sales achievement or number of defects encountered can be easily designed as they are quantifiable
 - Others like customer satisfaction are not so easy to measure and design
- For selecting KPIs:
 - Broad view needs to be considered
 - Balance needs to be provided between qualitative and quantitative measures

Time to create a metric

- According to some experts, it should take about three days to create ten metrics
- Depending on the complexity, creating a new metric(s) can take weeks and even years before an agreement is reached on:
 - What exactly should be measured
 - How it should be measured
- Scorecards, which are more strategic in nature, tend to create more unique metrics in new areas of the business than dashboards, which tend to measure established processes

IT involvement in design and development

- Functional and content requirements should be determined by the users, as they understand the business and how to analyze performance
- IT should be involved in the design and development as it provides an important role
- IT is needed to provide valuable input regarding:
 - Data sources to be used
 - Loading data
 - Roles and authorizations
 - Communication via alerts and e-mails
 - Other technical issues
- IT is responsible for:
 - Installing and maintaining the infrastructure required to support the dashboard
 - Maintaining data integrity
 - Keeping the application operational

Why technical resources should be involved

- Common mistake is to create metrics for which data does not exist
- To avoid this situation, ensure technical folks are assigned to the team that gathers requirements and designs the metrics
- During discussions, they can evaluate the existence, and condition, of data needed to calculate the proposed metrics

Organizational levels

Effect of organizational levels

- Metrics should:
 - Define the organizational levels to which they apply
 - Cascade from the top down to the bottom, while data should roll up in the reverse direction—bottom to the top
- Application:
 - In some cases, is simple to implement

- In many cases, can be fairly complex
- Average levels to which dashboards and scorecards rollup is four

Benefits of a universal metric

- If a single metric is deployed across the organization, it:
 - Enables a comprehensive view of the organization's performance
 - Enables detailed data to be aggregated easily
 - Permits drilldown from the summary data to the detailed data
 - Provides transparency and visibility

Gathering requirements

Process

Why requirements gathering is a prerequisite for success

- Importance of requirements gathering is either not understood or fully appreciated by many business users and executives
- It is considered additional and unnecessary work, which interferes with their schedule and takes them away from more important work
- No one can make the correct decisions regarding data except users who need the data
- Users need to realize that:
 - Current decisions, about data and metrics, can have a significantly future impact
 - Better they make the decisions now, rather than at a future stage (when development will be in progress or have been completed)
 - At a later stage, changes will be difficult and costly to implement, as the cost of change rises exponentially along the development life cycle

Strategy map

- Is the most important component of a performance management system
- It describes, on a single sheet, the cause and effect linkages between strategic objectives
- Metrics should only be designed after senior management approves its content

<http://www.thepalladiumgroup.com/KnowledgeObjectRepository/Sample%20Strategy%20Maps.pdf>

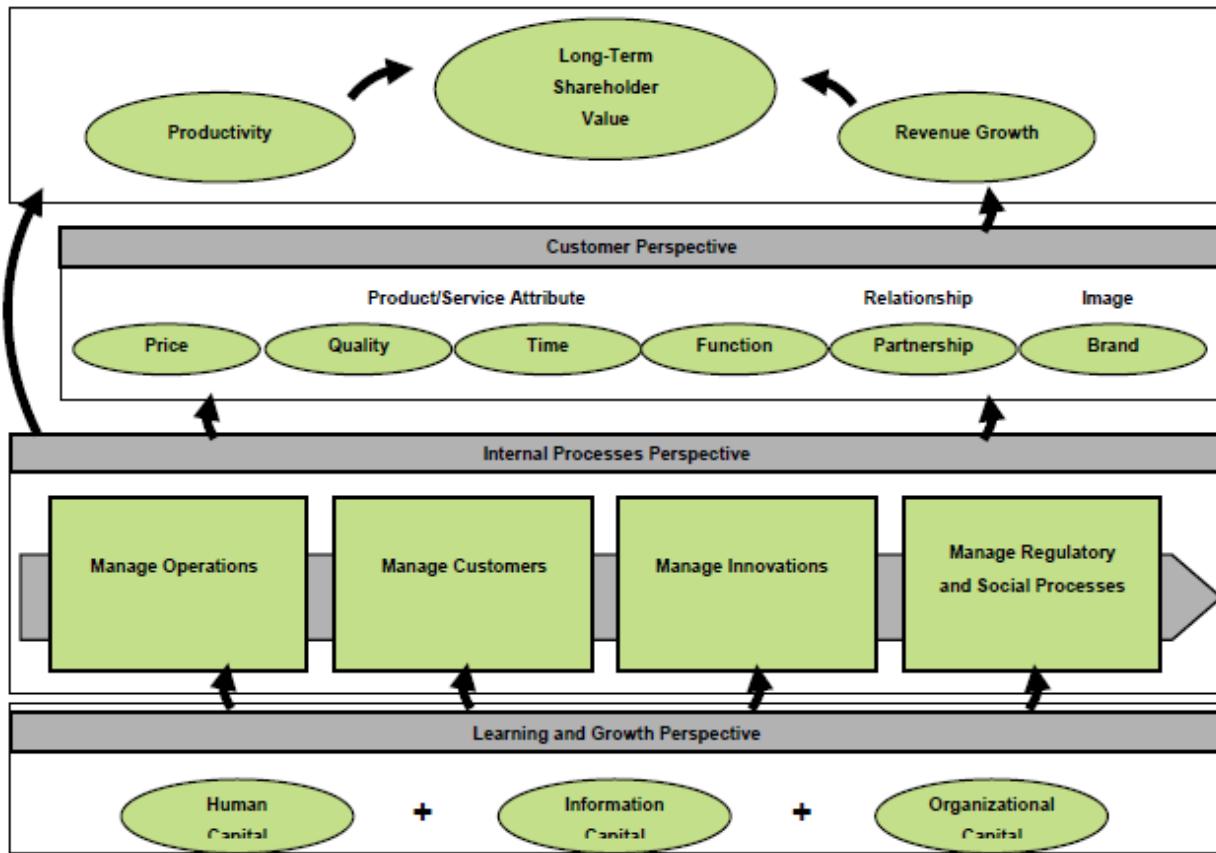


Figure 8: Strategy map template (Source: Kaplan & Norton, 2004)

"Maximize the Quality of Life and Dignity of Older Adults"

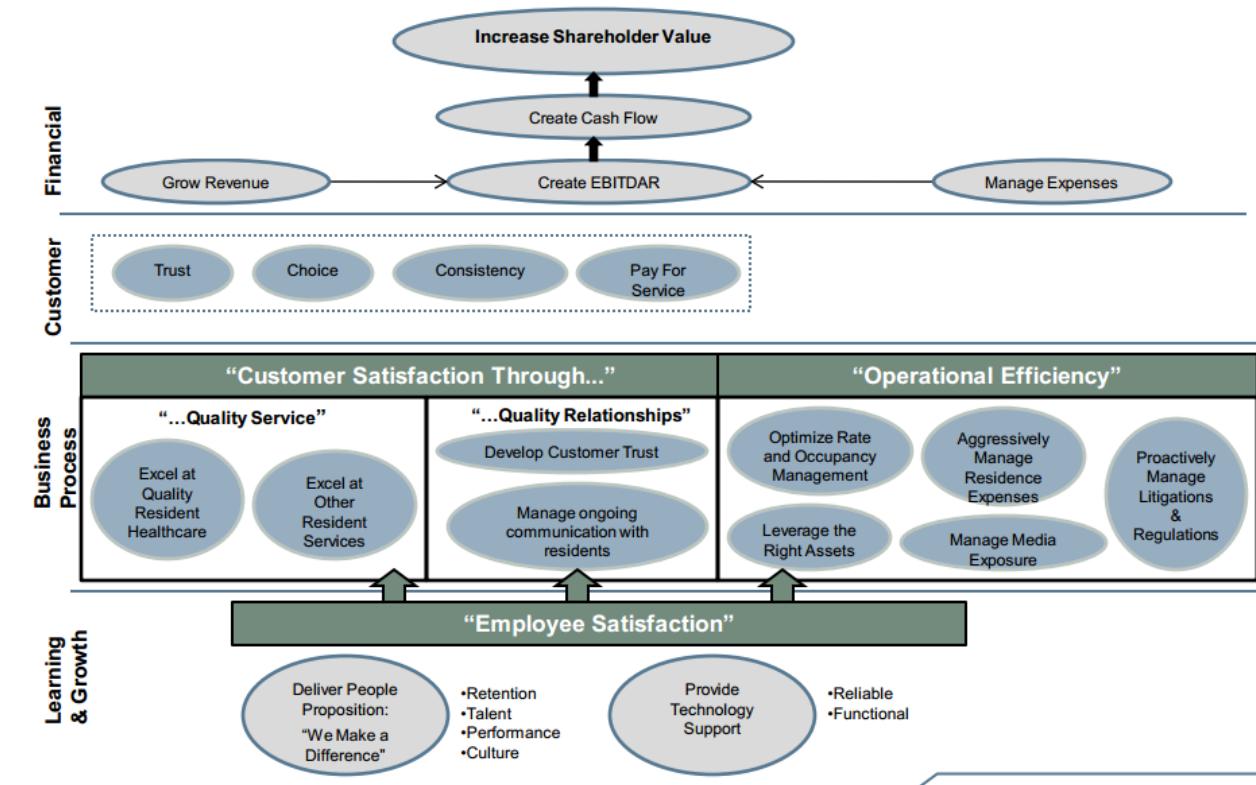


Figure 9: Strategy map – Healthcare
Source: www.thepalladiumgroup.com

Linking KPIs

- KPIs should be clearly linked to the strategy
- After strategic objectives have been identified and defined:
 - KPIs are selected that provide answers to the most important questions
 - Selected KPIs must be capable of monitoring progress and gaining relevant insights to help manage and improve performance
- Although metrics should be derived from strategic goals, it is rarely implemented in practice
- An API survey of more than 1,100 organizations indicated that:
 - Only 15% of respondents believed that all their performance indicators were linked to the enterprise strategy
 - 92% of respondents felt that many of their indicators were neither meaningful nor relevant

Key performance questions (KPQs)

- After the strategy map has been created, the next step is the selection of KPIs
- Intermediate step (between strategy map creation and KPIs selection):
 - Involves key performance questions (KPQs)
 - Objective of KPQs is to enable identification of meaningful and relevant KPIs
- KPQs accurately capture what management requires for implementing the corporate strategic objectives
- Ensure that all only relevant performance indicators are selected
- KPQs:
 - Help capture more valuable information
 - Guide discussions
 - Facilitate communication

Gathering dashboard KPI and metric requirements

Use a top-down approach be determine requirements

- Traditional BI projects:
 - Usually follow the bottoms-up approach for determining requirements
 - Tend to focus on the data and the relationships that exist within the data
- For dashboard projects:
 - Top-down approach should be used for identifying metrics and KPIs
 - Approach starts with determining the high-level business decisions that need to be supported
 - Subsequently, data needed to support those decisions is identified

Top-down approach

- In this approach, business users who will be using the dashboard are actively involved, as they are the only ones who can determine:
 - Which decisions need to be made
 - Performance criteria to be utilized
 - Data required to support the decision making
- In many cases, users have a very good understanding of the data that is important to them
- In this process:
 - Business users are interviewed so that the KPIs and metrics required to support decision making are identified
 - When it is concluded, specific dashboard KPIs and metrics will be clearly identified

Goal of the interview process

- Interview process involves determining two items:
 - Questions for which answers are needed, and

- Subsequently, when answers become available, the actions or decisions that will be triggered
- Interview process can involve determining:
 - Why the question(s) are important
 - Identifying where the supporting data is located
 - Potential issues that the identified KPIs may create
 - Some specific items such as data granularity, dimensions, measures and targets, etc.

Objective of the business questions

- Objective of asking questions is to define the requirements, so that it becomes easy to identify the data required to answer the questions
- If the question is “Who are my top customers,” the follow up questions might be:
 - “Is this based on revenue or profit” and
 - “How frequently does this need to be provided?”
- Such questions can lead to the identification of specific data used to calculate the KPI
- After answer(s) are obtained, a user may need to:
 - Perform additional analysis
 - Make a decision or take some action
- Objective is to continue breaking down the questions so that the lowest level, where a decision is required, is reached
- Benefit of this process is that it:
 - Screens out the nice to have metrics
 - Retains the ones that are essential for making decisions

Information required to design KPIs

Indicators

Indicator basics

- Every KPI should be identifiable with a unique identification number, which enables easy tracking
- Indicator should also:
 - Have an appropriate name, which meaningfully conveys what the indicator represents
 - Identify an owner, who will be responsible for the indicator's performance

Indicator design

- Indicator design should include information that provides more clarity regarding the indicator
- It can include:
 - Data source
 - Measurement scale

- Data collection frequency
- Collection period
- User responsible for collecting and updating data
- Brief description of the data collection method

Collecting data

What data collection involves

- Data collection is the technical aspect of the process
- In this step, the data collection methods are evaluated to determine:
 - Their strengths and weaknesses
 - If they are appropriate for the dashboard project being undertaken

Data collection methods

- Task involves identifying and describing the method used to collect data
- Many methods are used for collecting data including:
 - Interviews
 - Questionnaires
 - Surveys
 - Focus groups
 - Workshops
 - Documentation reviews

Data source

- In this step, the data source is identified
- Important associated task requires determining if the identified data can be accessed easily and cost-effectively
- Also to be determined is whether the source can provide accurate and reliable data
- If analysis leads to a negative conclusion, then alternative collection method may need to be selected

Formula/scale/assessment

- Indicator designer will determine the best way for capturing the raw data
- If required, the designer will create derived data, which can include aggregates and indexes comprising other indicators
- Designer will also specify:
 - Any formulas that may be needed
 - Scales, intervals, ratios, etc.
- Design decisions can impact how the data can be used:
 - For example, if the nominal scale is used, it will not be useful for determining the order or relative size

- An ordinal scale will indicate if one is greater or better than another, but not by how much
- If the Likert scale is used, the 5-level, it will just indicate the range from strongly agree (1) to strongly disagree (5)

Data collection responsibility

- It is always advisable to assign data collection responsibility
- Person or group responsible for collecting and updating data are assigned in this step
- Responsibility for measuring can be assigned to an:
 - Internal user or function
 - External organization because many companies outsource the collection of specific indicators (such as customer satisfaction, reputation, brand awareness, and employee satisfaction)

Cost of data collection

- Cost and effort is:
 - Associated with creating and maintaining performance indicators
 - Not recognized by many executives and managers
- Costs components include:
 - Measurement cost
 - Data collection cost
 - Administrative cost
 - Performance reporting and analysis costs
- These costs must be identified and considered when evaluating the overall cost

Data collection frequency

Data collection frequency

- Timing and frequency of data collection varies
- Depends on:
 - Type of dashboard (strategic or operational)
 - Metrics being monitored
- Some indicators are collected:
 - Continuously and in real-time
 - On an hourly, daily, monthly, quarterly or annual basis
- Examples:
 - Traffic to a website might need to be monitored continuously
 - Customer satisfaction might be limited to a couple of times a year or even just annually

Impact of infrequent data collection

- If data is not collected at a rate required to support monitoring and analysis, it can limit performance assessment
- For example, many organizations survey employees annually:
 - Such large gaps in data collection and assessment can be useless
 - Due to the time gap, meaningful assessment of any corrective actions is prevented
- In cases where frequent surveys can be disruptive and expensive, sampling surveys can fill the gap at a reasonable cost and enable faster feedback.
- Common problem is that data collection is done on an ad-hoc and un-coordinated manner:
 - Leads to data being collected at different times
 - Can cause users to receive numerous and fragmented requests for performance data
 - Can become difficult or impossible to obtain valid performance snapshots across different areas or functions if data is collected at different periods and intervals

Temporary indicators

- Some indicators are developed with the understanding that they will only be used for a specific period, such as the duration of a major project or initiative
- Issue is that a significant number of temporary indicators:
 - Are introduced but not discarded after completing their purpose
 - Continue to be collected indefinitely because no one identifies the need to stop using and collecting the indicator(s)
- For such indicators:
 - Review dates should be specified, when it can be determined if they are still needed
 - Process should be initiated for reviewing all indicators to ensure that they are still required and used

Targets and performance thresholds

Need for benchmarks

- Every performance indicator should have a target or benchmark associated with it, so that performance levels can be put into context
- Frequently, organizations base their targets on previous performance numbers:
 - Leads to targets that look comparatively better, even though the potential could exist for reaching far higher numbers
- Typically, targets are calculated in percentage increments:
 - Like a 4% sales growth increase
 - However, such targets are arbitrarily assigned without considering if they:
 - Are too low or too high

- Are too stretched
- Can be achieved based on the available resources

Approaching target setting

- Target setting should be an integrated and important part of designing relevant and meaningful performance indicators
- Desired performance level goal should be specified:
 - For a specific time period
 - With expected targets
- Such targets, which need to be achieved within a specific period:
 - Must be achievable
 - Can be stretched
- Targets can be set based on different criteria such as:
 - Absolute
 - Proportional
 - Percentage
 - Compared to appropriate benchmarks
- Good targets can be set by reviewing and analyzing:
 - Current performance
 - Trends
 - Historical performance
 - Seasonality
 - Industry best practices benchmarks

Good and bad targets

- Good target is specific; for example:
 - Telecom company can have a target that specifies churn reduction by 5% within 12 months
 - Hospital can have a target for reducing the number of post-surgery patient infections by 3%
- Example of a poor target is:
 - Reducing software bugs by 75% within 2 weeks.
 - Such a target does not address the remaining 25% of defect:
 - Which could remain open for months
 - Cause the overall defects situation to be worse than before

Validating and reviewing the indicator

Validating indicators

- Indicators should be validated to ensure that they are measuring performance, as per design
- Should be evaluated to ensure if and how well:
 - They are providing answers to questions

- Supporting the decision making process
- For financial performance, which is a standard common process used widely:
 - Confidence in indicators is high
 - Can be measured with well-established tools
- Confidence is lower for intangible measurements
- Confidence levels can be expressed in:
 - Percentages
 - Grades (low, medium and high)
 - Colors codes (red, green and yellow)
 - Symbols

Functional behavior triggered by an indicator

- Indicators, if not properly designed, can encourage wrong behavior and cheating
- Identify potential ways in which an indicator can be misused or applied incorrectly
- Benefit will be that it will:
 - Raise awareness of possible cheating behaviors
 - Enable closer monitoring by everyone
 - Encourage users to identify potentially better ways of collecting and assessing performance

Reporting the performance information

Access to performance indicators

- Is restricted and is based on role and authorizations
- Primary audience:
 - Those directly involved in the management and decision-making related to the strategic goal being monitored
- Secondary group:
 - Includes users who can view and benefit from the data
- Third group consists of external stakeholders

Reporting frequency

- If the data is not provided in a timely manner, it is useless
- Reporting frequency of indicators should support the decision-making needs of the organization
- Reporting frequency:
 - Is distinct from the data collection frequency
 - Indicator might be collected every day but only reported once a quarter
- Reporting and measurement frequency should be aligned so that data is available when needed and required

Methods of reporting performance

- Many reporting channels can be utilized to communicate data and reports
- Method and frequency:
 - Depends on the recipient and the frequency of reporting
 - Can vary significantly
- For example:
 - Indicators may need to be provided to directors, managers, employees, corporate board members, or external stakeholders
 - Depending on the recipient, they may need to be provided once a day, week, month, quarterly, annually, or upon request
- Alignment should exist between the:
 - Reporting channels
 - Reporting and measurement frequency

Reporting format

- Performance can be reported in different formats, which need to be determined so that the data is presented in the best way
- Designer should determine how the data should be presented, such as a table, graph, narrative and notes, etc.
- Most effective presentation is a mix of numerical, graphical, and narrative formats
- In many cases, historical performance adds value, especially for displaying trends
- Displays can include targets and benchmarks
- Many organizations use traffic lights or speedometer dials to present performance data

Module 6: Process, architecture and requirements

Process and architecture

Design process

What effective design provides for users

- Dashboards and visualization are cognitive tools that:
 - Improve "span of control" over a lot of business data
 - Help to visually identify trends, patterns and anomalies
 - Guide towards effective decisions
- With scorecards, dashboards and other visualization tools now widely available to business users for analyzing their data, visual information design is extremely important
- Effective design is crucial as it:
 - Clearly communicates key information to users
 - Makes supporting information easily accessible
 - Leverage visual capabilities

Typical design progression

- Dashboard design is often initiated by a manager or an executive in a typical process involving the following steps:
 - Product manager independently recognizes the need for a dashboard or hears others talk about dashboards:
 - Leads to a general requirement for a dashboard to be built for a specific product, group, or department
 - IT analyzes the databases to identify the data collected by the system:
 - It then displays some tables and visualizations (bar charts and pie charts) on the dashboard
 - Feedback from some user(s), for visual enhancement, leads to the dashboard being enhanced by IT:
 - Typically, this involves graphical enhancements like adding more colors, rendering all the charts in 3D, etc.
 - If a graphics expert is available, s/he designs widgets that:
 - Emulate the kinds of dials found on an actual car dashboard
 - Which leads to wow comments
- This typical process can be improved significantly

Features affecting how dashboards are designed

- Six features determine how dashboards will be used and by whom
- They affect the way dashboards are designed
- Six features are:
 - Update frequency: Daily, hourly or real-time
 - User expertise: Novice, journeyman, expert
 - Audience size: One user, multiple users with the same requirements, multiple users who need to monitor different data sets
 - Technology platform: Desktop/laptop, standard screen, mobile device
 - Screen type: Extra large screen, standard screen, small screen, variable screen
 - Data type: Quantitative or non-quantitative

Top checklist items for designing dashboards

Stephen Few offers the following checklist for designing dashboards:

- Organize the information to support its meaning and use
- Maintain consistency for quick and accurate interpretation
- Make the viewing experience aesthetically pleasing
- Design for use as a launch pad
- Test design for usability

Status of dashboard design

- Dashboards have been widely designed for a couple of decades
- Despite improvements over the years, there exists significant room for improvement
- Focus has primarily been 'under the hood,' primarily for:
 - Connecting data to dashboards
 - User administration
 - Security
- Focus on dashboard design principles has been lacking:
 - Hence, there is little understanding of such principles

Process for designing a dashboard

- In the phase after requirements have been gathered, the steps to produce a design that works include:
 - Begin by sketching
 - Refine the design into a wireframe (neater, better looking, more detailed mockup)
 - Test the design for usability
 - Prove the concept on the cheap (using Excel or other tool)
 - Find a tool that makes good design easy and has layout flexibility

Best way to architect dashboards and scorecards

- Many ways in which dashboards and scorecards can be architected
- These are full-fledged information systems:
 - Require extracting and merging data from multiple systems
 - Their technical architecture must map to the business if the desired functionality is to be delivered
- Basic three questions should be asked to determine the specific reason why the dashboard will be useful to the organization:
 - Who is my audience?
 - What value will the dashboard add?
 - What type of dashboard am I creating?

Business architecture

Organization's business architecture

- Consists of (Figure 10):
 - Stakeholders (investors, board, executives, workers)
 - Strategy (mission, goals, objectives, vision, values)
 - Tactics and resources (people, technology, capital, projects)
- Performance management system needs to align with an organization's business architecture

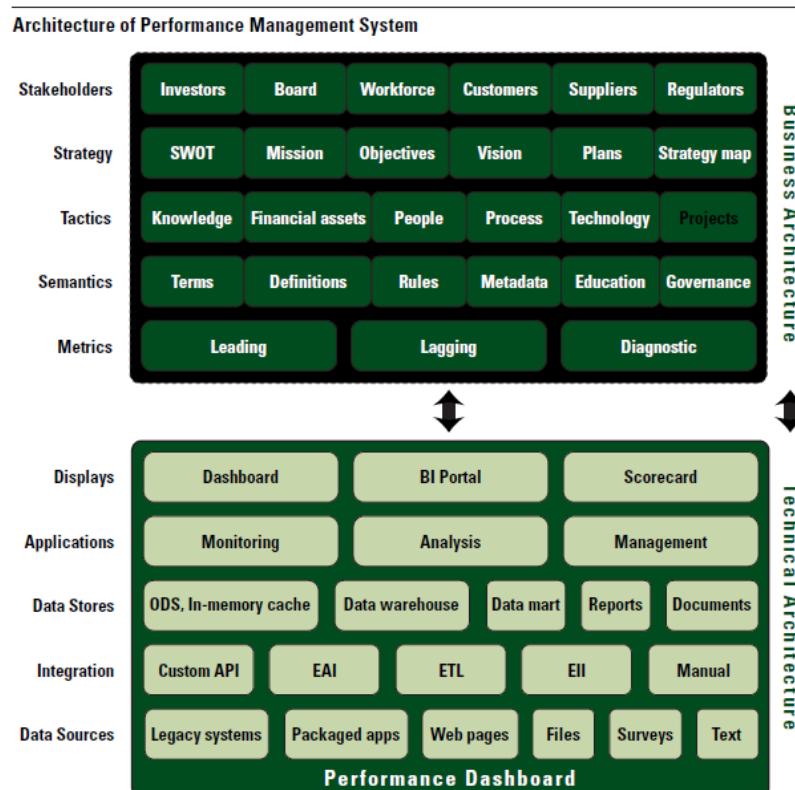


Figure 10: Architecture of performance management systems
Source: Deploying dashboards and scorecards, Eckerson, TDWI

Basics of the business architecture

- Business architecture is based upon business semantics and metrics
- Semantics are the terms, definitions, rules, and metadata that:
 - Comprise an organization's vocabulary, and
 - Govern how it communicates about performance
- Metrics translate an organization's strategy into measures that enable the organization to track its performance against goals

Importance of KPIs and metrics

- Dashboards and scorecards are comprised almost entirely of KPIs, which collectively embody the corporate strategy tailored to each individual in the organization by role and level
- Metrics are the linchpin that join the business and technical elements of a dashboard or scorecard
- Importance of appropriate metrics:
 - Well-designed metrics propel an organization down the path defined by the corporate strategy
 - Poorly designed metrics accelerate the organization's movement in the wrong direction

Targets

- Reflect the desired end-states (such as sales achievement for the year)
- Interim targets are used to monitor the intermediate end-state goals (such as monthly sales achievement targets)

Thresholds

- Most KPIs have minimum and maximum targets, i.e., "thresholds," which define an acceptable range of performance for intermediate and end-state goals
- When performance exceeds a specified threshold, dashboard can highlight the status change
- Highlighting can be done through various methods such as conditional formatting, stoplights that change color, and transmitting alerts

Technical architecture

Components of the technical architecture

- Displays
- Applications
- Data stores
- Integration
- Data sources

Architecting performance management systems

- When the architecture of a performance management system is designed:
 - Designers should select different components at each level of the architecture that best meet business needs
- For example:
 - Strategic dashboards:
 - Use a scorecard interface that compiles both documents and data in a data mart that is frequently updated both automatically and manually from Excel files, web pages, and packaged applications
 - Operational dashboards:
 - Frequently use custom APIs, ETL, EII (Enterprise Information Integration), and caching technologies to pull data from legacy and other transaction systems
- Key to joining the business and technical architectures together are metrics that accurately reflect and measure the business strategy and performance

Objectives and business requirements

Objectives and users

What objectives should reflect

- Objective should be clear: Strategic or operational
- For example, requirements will be quite different for the following two objectives:
 - Keeping 10,000 employees aligned to strategic goals
vs.
 - Management of a departmental goal (such as maximizing revenue, increasing profitability, minimizing risk, managing marketing campaigns, optimizing supply chains, or monitoring network threats)

Business users' perspective

- From their perspective, efficient use of a dashboard comes with a number of prerequisites and requirements
- Dashboard will become an efficient support tool for the business only if the requirements are delivered

Determining end user needs

- To ensure dashboard success, from an implementation and usage perspective, inclusion of key players and collaboration is imperative
- If end user needs are determined to start with, it lays the foundation for ultimate success
- Since dashboard objective is to quickly inform users and enable them to take immediate action, their metric needs must be understood and implemented by the designer

- User needs can be determined using a variety of techniques, such as interviews and workshops

Key groups participating in creating a dashboard

- Many groups and roles are involved in the overall process
- Key groups involved in developing a dashboard are:
 - End users (includes executives, managers, analysts, others)
 - Business analysts (BAs)
 - IT team
 - Project manager (while not a group, this position is important)

Designing a dashboard as an effective BI tool

- Anything presented on the dashboard must be directly relevant to the critical business activities
- Business users must be able to act on the displayed information
- Overall, a dashboard:
 - Needs to be easily adaptable to the user's needs
 - Must present information that allows the user to act where it matters to the business
- Means that the dashboard must be business-driven, rather than technology-driven

Basic functional requirements

Main user requirements for designing a dashboard

- Content
- Accuracy
- Presentation
- Display
- User action
- Access
- Output
- Distribution

Basic requirements

- Dashboard should contain information that answers key business questions
- It should enable a user to:
 - Quickly digest the key metrics
 - Identify any exceptions, so that appropriate investigation and/or action can be taken
- Users should be able to:
 - Understand cause and effect
 - Identify trends and correlation to key drivers

- Users should be able to obtain a clear picture, in a single integrated view:
 - Of the current status
 - How it was reached
- Data displayed on the dashboard should be:
 - Accurate
 - Clear
 - Consistent
 - Unambiguous
- Dashboard should support users in analyzing the presented data through:
 - Filtering
 - Sorting
 - Grouping
 - Other techniques

User action requirement

- Dashboard should:
 - Only contain concise actionable information
 - Avoid all extraneous data and visuals
- If no action is required or expected from the user, the business information presented, ultimately, serves little or no purpose

Presentation and display requirements

- Two fundamental principles should guide the selection of the ideal display medium for a dashboard:
 - It must be the best way to display a particular type of information that is commonly found on dashboards
 - It must be able to serve its purpose even when sized to fit into a small space
- Appropriate KPIs, charts, and colors should be used as they:
 - Provide the necessary overview of the state of the business and, also
 - Drive attention to where the performance falls short of expectations
- Bar charts are common and useful because they are relatively intuitive
- Heat maps are becoming more popular since they provide a better overview for more concurrent data dimensions
- GIS maps are also popular as they are intuitive and reduce the risk of misinterpreting geographical business information

Output and distribution requirements

- Dashboard should support the export of data, which can range from spreadsheet downloads to PDF and e-mail outputs
- Output type and quality, as well as distribution requirements:
 - Can vary significantly
 - Can range from online viewing to sophisticated printouts used for external reports

Determining requirements

Basic questions for determining requirements

Optimizing for the organization

- Every organization has its own business needs and corporate culture
- Since what may be effective for one may not work for other organizations:
 - Start by using best practice guidelines that apply to overall dashboard use
 - Subsequently, optimize based on the specific organization

Common aspects to be considered for all dashboards

- Irrespective of the type of dashboard being implemented, three basic aspects that should be considered include:
 - Identifying the correct metrics
 - Providing the right level of detail to end users
 - Ensuring that information is timely

Common technique used to determine requirements

- Developing an effective dashboard application is a collaborative process
- Stakeholders and users should be included in the process to determine the requirements that the tool is expected to deliver
- Requirements are determined by asking some key questions

Key objective questions that need to be asked

- Is the dashboard objective strategic or operational?
- What are the future goals and anticipated use of the dashboard?
- Who will be the primary users of the dashboard?
 - Will they provide analytics or only operational information?
- Who will be the primary targets:
 - CEO
 - Executives
 - Department heads
 - Line workers
- Do data views need to be customized for:
 - Different users
 - Across hierarchies
 - Functions

Key questions regarding metrics

- Objective of this set of questions is to determine if the:
 - Process(es) being measured are clearly defined
 - Process/system is transparent from top to bottom with a clear break-down of tasks, events and responsibilities

- Key questions to ask for determining the metrics include the following:
 - How are effective metrics defined?
 - Which metrics are essential?
 - Which metrics are nice to have?
 - What are the top 5-10 metrics that need to be measured on a regular basis?
 - How do these metrics enable informed decisions?
 - Are the measures clearly defined?
 - Are the dependency/relationships among different measures well understood?

Questions regarding responsibilities and user actions

- How will the dashboard be used?
- Who are the owners for the business process?
- Who is responsible for managing or monitoring the task, events and processes?
- What action needs to be taken upon viewing the high-level information?
- Should alerts be provided for exceptions or major issues?
- Should request for more information or status checks be automated when certain thresholds are reached?

Questions pertaining to views

- Will the dashboard paint the complete picture?
- Will missing relevant business information leave the user with more questions than answers?
- What type of views will the dashboard provide:
 - Analytical, strategic, operational monitoring (with ability to drilldown to transaction data) or
 - Consolidated view
- Which views/reports need to be supplemented by comparative and historical data?
- What is the navigation path for analyzing a process or report/view?
- What are the key takeaways (key conclusion) from each report/view?
- Has a look-and-feel theme been selected that can be consistently applied across all reports; using different colors to represent the same process across different reports can send a confusing message

Questions pertaining to monitoring frequency

- How frequently will the dashboard be monitored?
- How frequently will data be updated?
- Is the monitoring frequency in sync with:
 - Rate at which information changes
 - Speed at which a response must be made

Questions pertaining to security

- How sensitive is the information being viewed?
- Who will be authorized to view the information?
- What are the role and user restrictions?
- Who will be responsible for the authorization process?

Technology and environment questions

- Which current BI, reporting and analytics initiatives may be redundant or complementary to the dashboard initiative?
- What is the appropriate technology that is available or can be implemented?

Design questions

Key design element pertaining to users

- For designing a successful solution, users need to be queried as they provide:
 - Insights
 - Experience
 - Business objectives
- Key design element requires having a detailed understanding of user needs at:
 - High level (business goals, decision requirements, workflow)
 - Low level (appropriate metrics, context and visuals)

Prerequisite for identifying metrics

- Dashboard goal must be a prerequisite for identifying metrics
- Dashboard's objective:
 - Does not require looking at everything available
 - Focuses on a narrower goal
- Enables gaining insight into what is occurring within the business:
 - For making better decisions
 - Anticipating issues that can be acted upon quickly

Key dashboard design requirement questions

- Are the appropriate KPIs being measured?
- What are the domain specific best practice metrics for the business process?
- How actionable is the information being presented on the dashboard?
- What is the data source and what is the quality like?
- Will the dashboard provide contextual information, such as data source, refresh date/time, schedule for the next refresh (daily, weekly, monthly)?
- Are the right analytical constructs used to synthesize insights?
- How will users be empowered to act on disseminated information
- Will users be able to add end user comments pertaining to the displayed information

- Can dashboard guide a new user through a prescribed path to do analysis, in addition to exposing them to cubes to explore data at will?
- How should data be displayed, where and how does it need to be placed
- Which types of interactions need to be supported and how should data be presented

Data to be displayed

Questions that are helpful in determining which data should be displayed on a dashboard include:

- Are users accessing the dashboard for making a decision or reacting to specific events or situations?
- What triggers a user's accessing the dashboard?
 - Is it due to routine access at the start of the day, or
 - Is it in response to an alert such as a system-generated email alert?
- How frequently will users visit the dashboard?
- What is a user trying to assess: "How are we doing" or "How are we doing at what"?
- What critical decisions does a user have to make?
- Should some conditions, such as a critical out of range parameter, trigger a user alert?

Placing data: Where and how

- Data to be displayed should be based on supporting the user's workflow, rather than page aesthetics
- Questions that need to be asked include:
 - What are the critical must-see or must-do items?
 - These should be provided prominent placement and stronger visual treatment
 - What is the likely flow of a user's focus?
 - Is there a logical grouping scheme?
 - Will users like to compare data?
 - If so, then comparative data should be placed side by side
- Choosing appropriate ways to view information can be as important as the data being monitored
- Visualizations can be combined or separated based on how the metrics are interrelated
- Visualization types should be matched with their objective for providing the most effective design

Types of interactions to be supported

- Since a dashboard needs to support some user goal or interaction, the key questions to be asked include:
 - What will be the users' subsequent actions that the dashboard design will need to support?
 - Which data would the users like to drilldown to?
 - Will the dashboard support the next step after a problem has been identified, such as opening a help desk ticket or generating an alert?
 - Would users need conceptual information, such as a description or definition of an out-of-range metric?

How data should be presented

See section titled “Data presentation options” (Module 9)

Module 7: Dashboard design principles

Design principles and elements

Design importance and key principles

Effective design

- Good information design will:
 - Clearly communicate key information to users
 - Make supporting information easily accessible
 - Provide the business with benefits derived from improved performance
- Designers should:
 - Understand the users, what they need, and their business goals
 - Iterate through sketches, mockups and prototypes to explore, evaluate, and narrow down prospective solutions
 - Use creativity and expertise, internal/external, to get best ideas and the right result

Key design principles

- Space available:
 - Dashboards are now frequently embedded in BI portals
 - Space is limited and must be used wisely
- User relevance:
 - Data presented must be relevant to a particular role
 - In terms of both KPIs used and data latency
- Data latency:
 - Frequency of data updates must be relevant
 - Real-time data is needed for operational use
 - Daily, weekly or monthly data can suffice for executive use
- Personalization:
 - Includes menus and capabilities, security and software interface
- Interconnection with other BI tools:
 - Dashboards are a great starting interface to connect to ad hoc query, data mining and other more advanced BI tools
- Collaboration tools:
 - Ability to share a dashboard view with others in the enterprise or externally
- Agility:
 - Changing the dashboard KPIs as corporate objectives change
- Value:
 - Dashboard must be more than a nice to have
 - Must deliver actionable insight into every day decision making
- Overall:
 - Dashboard should act as a relevant indicator of performance

- Should provide capability to act on the signals it provides, by allowing the user to:
 - Drilldown to the root cause
 - Determine a suitable course of action

Understanding and applying design principles

Ineffective displays

- Every information user (analyst, senior manager or knowledge worker) needs access to good, clear information
- Ineffective displays are common due to:
 - Variety of chart and graph widgets available
 - Lack of training in graphical methods

Objective of graphics

- Graphics should clearly indicate what is being conveyed:
 - Target
 - Actual

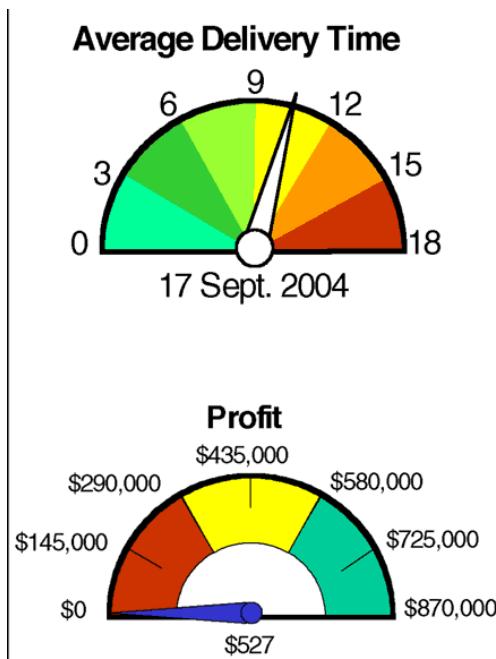


Figure 11: Inadequate gauges
Source: www.information-management.com

- In Figure 11, units of measurement have not been identified (days, weeks or hours) for “Average Delivery Time”:
 - Zero is implied as the target
 - Not realistic (all deliveries require some time)

- In both cases:
 - Gauge representation does not provide an explicit indication of the target measure
 - Uses a lot of color and space to indicate very little information - a single value!

Key element in designing an effective representation

- Designer needs to understand the information consumer's needs
- Which metrics do the users need to see?
- What context does each metric require to make it meaningful?
 - Target
 - Variance
 - Trend
 - Breakdown by region
- Which visual representation best communicates the metric?
 - Should visual be a gauge, a table or a bar chart with a reference line?
 - Should a pie chart or bar chart be used?
 - Line chart or a scatter plot or some entirely unique visual?

Sketches, mockups and prototypes

- Sketches and mockups help conceptualize possible solutions
- Design process can be significantly accelerated through a simple tabular list of metrics and indicator icons, as well as visualizations
- These can reduce the risk of delivering the wrong solution

Desired complexity of sketches

- Sketches can be as simple as whiteboard drawings or PowerPoint mockups

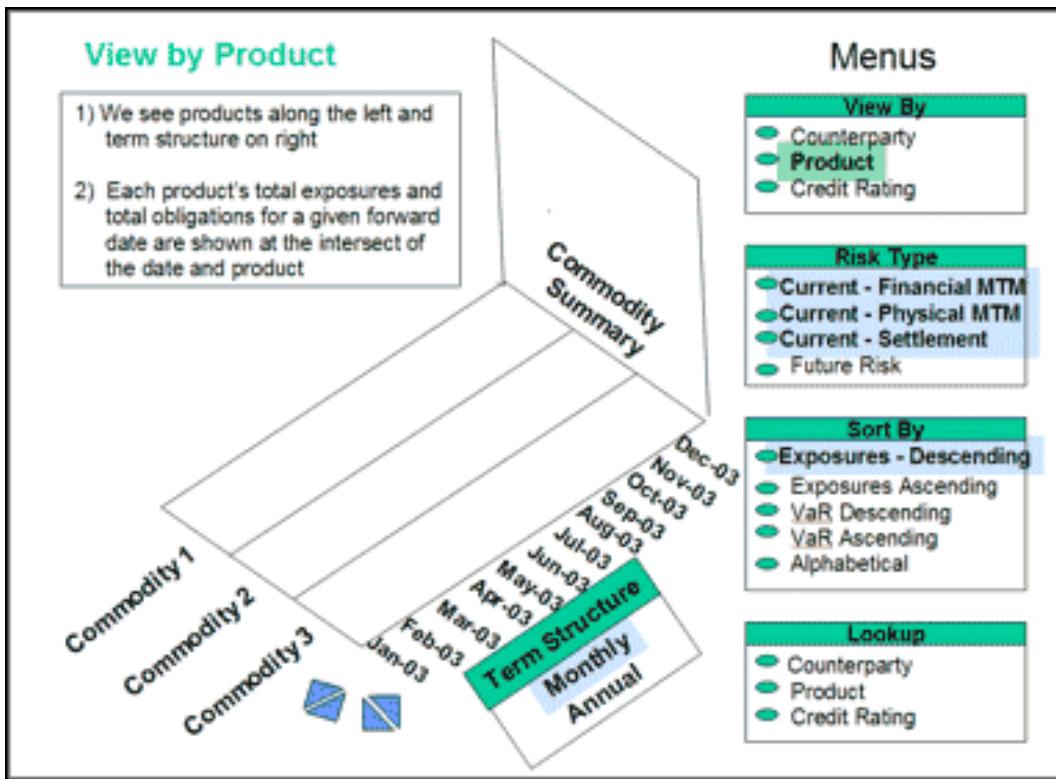


Figure 12: Mockup example

Source: www.information-management.com

- Figure 12 is an example of an early mockup of a risk dashboard
- Mockup can be created by the business users after a whiteboard session
- With such a simple drawing, everyone can articulate:
 - What they need to see
 - How they would like to interact with it

Mockup benefits

- Business users:
 - Are able to create various "walk-through" scenarios that can indicate if the solution will handle their different requirements
- Technical staff:
 - Are able to identify the data and infrastructure required for the application
- Overall design and project team:
 - Are able to refine these ideas into a visual design and a supporting technical architecture

Impact of poorly designed appearances

- Getting the right design for the visual interface is critical for success
- Poor interface can have negative impact
- Glitzy dashboard, like the gauge examples or pie charts, may obscure or miss key information
- Complex dashboard, such as patchwork solution of many different technologies:
 - May be too difficult to use
 - Provide little or no value

Iterative process

- Many aspects of dashboard design can change
- By using sketches and prototypes, design can be refined to suit the users' needs and requirements. For example:
 - Certain areas can require more detailed information to be available at the "top" level
 - Need for various interactive drilldown capabilities can be identified
 - Integration of analysis and planning tools can be specified
- Design iteration:
 - Helps everyone refine vague design ideas into the best possible solution
 - Engages everyone to invest in the progression of the overall solution, which results in a higher degree of success

Recognizing uniqueness

- All dashboards are unique
- Unlikely that an off-the-shelf dashboard will meet all the needs of a complex organization or complex system (such as ERP or CRM, each with unique insights and proprietary ways of adding business value)
- Objective of creating a dashboard is to:
 - Assemble a unique collection of metrics with: appropriate visual presentation and easy interfaces
 - Understand and drilldown to the required data level for making effective decisions
- Each company has:
 - Unique culture
 - Unique strengths
 - Competitive advantage that can be reflected in its unique processes and the data that it captures
 - Departments with unique expertise and capabilities

Leveraging external expertise

- Creativity, whether generated internally or with the help of consultants, potentially opens up new, innovative solutions
- Individuals and organizations with expertise in dashboard design and implementation bring:
 - Depth of understanding
 - Experience of successes and failures from previous projects
 - Research and diversity of skill sets

Effective principles of dashboard design

Introduction

Levels of awareness to be supported by a dashboard

- Dashboard designed to support situation awareness must support all three levels of awareness:
 - Perception of one's environment
 - Comprehension of its meaning
 - Projection of that understanding into the future to anticipate what might happen
- Failure in any of these areas will undermine the dashboard effectiveness

Implementing best practices and standards

- Most of the best practices standards (in the subsequent sections):
 - Can be quickly implemented on every new dashboard:
 - Have been proven in production implementations and received overwhelming user acceptance
- Avoid approach of:
 - “Getting something out the door”
 - Going back later to apply best practices
- Start using standards and best practices from the very start with the first release
- Avoid getting swept away in a deluge of data and be distracted from what really matters

Avoiding information overload

- Despite desire to display all kinds of new information, realize that some data:
 - Is a distraction
 - Not relevant to the decision-making process
- Be cautious of information overload that can hinder the dashboard effectiveness
- Each organization must determine:
 - What really matters to decision-makers
 - Implement dashboards around the metrics most relevant to each department

Implement appropriate design

Design for rapid performance monitoring

- For dashboards, looks do matter but they are not just eye candy
- Dashboards have become a standard point of reference for managers and executives who need to monitor operations, often at a glance, for making timely decisions
- Dashboards effectively support rapid performance monitoring only if designed to work with the human eyes and brain

Organizing dashboard content

- Should reflect the nature of the information
- Support efficient and meaningful monitoring
- Make important items more visually prominent than less important items
- Items that need to be scanned in a particular order should be arranged in a manner that supports that sequence of visual attention

Responsive design

- Appropriate design also encompasses the idea of responsive design:
 - Is an approach to web design that supports the layout of web pages regardless of the visitor's screen size and orientation
- No organization is immune to the BYOD phenomenon:
 - Responsive design in BI applications is increasingly important to support the various mobile devices being introduced into the corporate environment

Provide insight, not reports

Understand what the user really wants

- When a key user drops off a stack of Excel spreadsheets in response to a request for "requirements," try to understand what:
 - Results the user is trying to derive from that content
 - Is being searched
 - Is marked up with a yellow highlighter
 - User looks at after becoming aware of an exception

Techniques for making dashboards effective

- Multiple ways can provide insight from the same content packed into one Excel spreadsheet (which offered no insight, just data)
- Enable consolidating multiple Excel spreadsheets into a single, flexible report module, which can fit into the upper left hand corner of a dashboard
- Techniques that can make a dashboard effective include:
 - Column selectors
 - View selectors
 - Charts

Utilize valuable real estate

Value of real estate

- Printed report:
 - Can get away with saying “the answer is on page 42”
 - Same is not true for online dashboards
- Most likely there will be a restriction to fit into an 1024 x 768 pixel screen (or greater if the dashboard is three pages long)
- If a user cannot derive insight in the first few seconds of viewing a dashboard, design could use improvement

Organize screens

- Screen size:
 - Is a big limitation when it comes to dashboard design
 - Only possible to cram so much onto a typical laptop screen
- Since scrolling is not ideal, how to fit everything a user needs to see?
 - Think of dashboards like websites with navigation and multiple screens
 - Perhaps the first screen is a summary dashboard, a condensed version of the user's most important KPIs
 - Subsequent dashboard views can present more details and other views
- If a dashboard does not measure up, take stock of shortcomings and improve the user experience

Eliminate white space

- Will look incomplete to the users
- Space is being wasted

IT skills should be complemented by business skills

Leverage web skills

- Most users in today's business world are familiar with:
 - Browsing the web
 - Navigation/selection controls used to shop, bank, research, and consume information
- Use controls like:
 - Dropdowns
 - Buttons
 - Checkboxes
 - Text fields
 - All of these are widely used by popular websites

Need to complement technical skills with business skills

- To create insightful reports, report designers need to know more than what the business users are asking for in a report
- Successful project will have designers who:
 - Know the business side well
 - Can develop new reports and enhance existing ones without explicit instruction from the business users

What designers should avoid

- Move away from simply asking what:
 - User wants the report to look like
 - Which data is required in the database
- Need exists to:
 - Move towards understanding the business processes
 - Determine which data and reports will provide insight that the users need

Designers' interaction with users

- After understanding the processes driving the reports, designer can make suggestions to the users on what they need to be successful
- Most users have no idea what kind of reports a particular tool is capable of producing when utilized to its full potential
- With time spent getting to better know the business, it will be possible to deliver powerful, insightful reports the users had not considered or didn't even know were feasible

Use an iterative design process and continue to refine

Iterative process

- Dashboard design requires multiple iterations to be successful
- Business users often don't know or realize what they want until they:
 - Can see something they like, or
 - Recognize something that needs to be changed
- Encourage an iterative process
- In the build process, plan should include several levels of refinement
- Plan should include a sound strategy for:
 - Capturing and documenting user input
 - Prioritizing changes
 - Determining complexity
- Careful planning of this process will ensure that:
 - All iterations run smoothly
 - Add as much value as possible

Post-rollout tasks

- Continue to review and refine
- After rollout:
 - If implementation is viewed as a success by the users, word will get out
 - Enhancements will start coming in
- Periodic review should be done to assess if the dashboard is still meeting the needs of the business, as well as when it was first deployed
- Refinement may be needed to evolve the dashboard with the business and, sometimes, even more dramatic re-do's are necessary

Layout, colors, and fonts

Importance of layout

- Layout and stylizing of dashboards is important:
 - Some common practices have emerged
- When creating dashboards, function should always follow form:
 - How the dashboard works and how the user should interact with the dashboard should take precedence over how the dashboard is going to look and feel
 - Find a balance between the two

Chart elements (467)

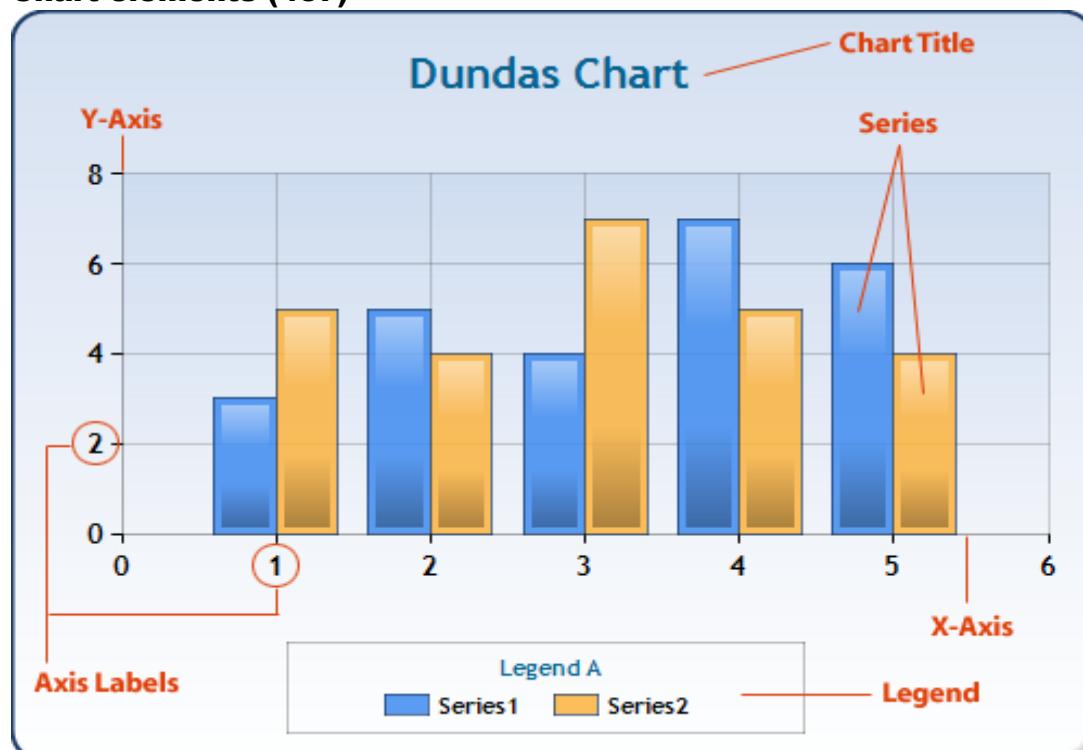


Figure 13: Elements of a chart

Source: www.dashboardinsight.com (Alexander Chiang)

Basics of general styling

- Before starting any styling, look for a starting color palette:
 - Usually, there are corporate colors to work with
 - In the worst case, create a simple palette from a logo that is being used
- If there are no brand colors or logos, generally go with a simple palette of white, a primary color like a cool blue, and a light gray

Color	Hex Value (RGB)	
Cool Blue	#6b97bf (107,151,191)	
Light Gray	#bdbdbd (189,189,189)	

Figure 14: Neutral colors used as base color palette
Source: www.dashboardinsight.com (Alexander Chiang)

Color	Hex Value (RGB)	
Blue	#1a3b69 (26,59,105)	
Orange	#fcb441 (252,180,65)	
Red	#e0400a (224,64,10)	

Figure 15: Example of a corporate color palette
Source: www.dashboardinsight.com (Alexander Chiang)

Colors to be favored

- Avoid use of bright colors (left) except to highlight particular data
- Stick with subdued colors (right) for most displays



Figure 16: Bright versus subdued colors
Source: Information Dashboard Design, Few

Creating a diverse range of colors

- From the base color palette, palette generator can be used to create a more diverse range of colors
- When there exist multiple data visualization components and various legends, all the extra matching colors may be needed
 - Figure 17 shows eight colors that can be used:

Hex Value (RGB)	
#69BF92 (105,191,146)	
#E3D0BF (227,208,191)	
#BFBD69 (191,189,105)	
#BF6995 (191,105,149)	
#696ABF (105,106,191)	
#9FD5D6 (159,213,214)	
#AF7F4B (175,127,75)	
#B9D69F (185,214,159)	

Figure 17: Color palette using a free open source tool

Source: www.dashboardinsight.com (Alexander Chiang)

Visualization backgrounds

- For data visualization backgrounds and the dashboard background:
 - Generally use neutral colors such as light pastel colors and light tones of gray
 - If possible, use a very light version of a color from the base color palette, which makes data visualization elements like bars and pointers to stand out

Color	Hex Value (RGB)	
Light Gray 1	#EDEDED (237,237,237)	
Light Gray 2	#F0F0FF (240,240,255)	
Pastel 1	#F7FFF0 (247,255,240)	
Pastel 2	#FFFFB3 (255,255,235)	

Figure 18: Some neutral background colors

Source: www.dashboardinsight.com (Alexander Chiang)

Fonts to be used

- Attention to detail is important in general, but fonts should get extra attention
- Use consistent font types and sizes throughout the entire dashboard.
- In a web environment, use Trebuchet MS or Verdana
- For desktop dashboards, use :
 - Myriad, Calibri or Arial for titles
 - Verdana or Tahoma for content
- Font sizes for objects like axis titles, axis scales and legend descriptions are around 10pt
- Use 12pt to 14pt and possibly bolded text to distinguish main titles from the other titles
- Decide early on the minimum font size for the dashboard text

More design principles and tips (for real-time monitoring)

Call center dashboard characteristics

- Should be designed to support real-time “situation awareness”
- Grab attention when it is needed
- Make it easy to spot what is most important on a screen full of data
- Provide the means to understand what is happening and respond without delay
- To do this, expert visual design is required
- Measures of performance must be expressed clearly, accurately, directly, and without distraction

Flicker and audio alarm

- To demand immediate attention, real-time dashboards must be more assertive than others
- Users monitoring real-time displays don't have their eyes trained on them at all times; for example:
 - Call center monitoring requires vigilance; however,
 - Glancing at the dashboard periodically is usually enough
- Exception:
 - When something suddenly goes wrong and a delayed response is out of the question
 - Dashboard must have the means to grab attention to the problem, even if the user who relies on it is looking elsewhere
- When the dashboard is even peripherally within eye span, visual flicker is usually sufficient:
 - Flashing alert icon will often suffice in such circumstances—if flicker is only reserved for circumstances that are truly urgent

- Do not use flicker for anything but the most urgent of circumstances, as it can become distracting and be ignored
- If dashboard is not within vision range, audio alarm is required unless environment is too noisy
- Whenever flicker or sound is used to grab attention, ensure that an easy means is provided to turn it off
- Use flicker and audio alarm appropriately

Maintain situational awareness

- Situation awareness is not well maintained by systems that are used only when alarms go off
- Encourage active thinking about the data, not just passive reaction to alarms
- Primary real-time dashboard goal is to maintain a level of awareness that allows a user to spot potential problems before they arise
- Dashboard must be designed to provide an overview of what is going on, which can be used to update awareness
- If user has not been engaged in monitoring frequently enough to maintain awareness, when an alarm goes off that interrupts the user while in the midst of other activities:
 - User will be less prepared to respond
 - Too much time will be required to get the bearings when action is needed
- Best dashboards for maintaining situation awareness are those that users monitor frequently in a way that makes them think about what is going on
- Viewing the dashboard:
 - Must not be just a mechanical process of scanning a series of gauges for extreme conditions
 - Must use the display to assist in thinking about what is going on
 - Otherwise, it won't engage the user's mind at the level necessary to understand what is going on and respond intelligently

Avoid excessive automation

- Don't over-automate actions to the point where users become disengaged
- Humans become disengaged when a system for situation awareness does all of the thinking for the user, i.e.:
 - Using algorithms and rules to recognize problems
 - Automating every response that a computer is capable of handling
- Let the computer handle calculations and highly repetitive procedural tasks, but don't use it to displace human intelligence
- Make the dashboard a partner to the person who uses it:
 - Supporting his intelligence
 - Not attempt to replace it
- No matter how great a dashboard:
 - At times no computer will be able to respond adequately or appropriately

- At such times, there is need for a fully engaged user who knows what is going on

Enable easy responding

- For situations requiring immediate response, systems should make it easy to respond once a course of action has been chosen
- When responses are too difficult, people are tempted to second guess the need to respond
- Monitoring call center activity requires interacting with those who operate the phones when action is required
- If hold times are too long and the abandonment rate is rising, there may be a need to:
 - Get to the calls faster
 - Communicate with operators who are offline to get them back into action
 - Communicate the situation to all the operators and encourage them to turn calls around more quickly
 - Inform those who are falling behind to catch up
- All these potential responses require communication
- Example of a “smooth and simple means to respond” in such an event might involve a mechanism built right into the dashboard to:
 - Instant message all or selected operators with either a prewritten message, or
 - With a message that is composed on the spot

Share the whole picture with the team

- Entire team should share a common understanding of the situation by providing them a similar overview:
 - Applicable when responses to problems require the cooperative efforts of a team
- In call centers:
 - Don't want phone operators to constantly monitor activities of the call center as a whole
 - Focus should be on the conversation
 - All should see the big picture occasionally:
 - Understand what they see on the dashboard
 - What it means
 - What response is required
 - More they understand the big picture, and where they fit into it, more they will be willing and able to respond to problems or opportunities when they arise

Support projections for proactive responses

- Real-time dashboard should do more than display what is going on
- Do this in a way that helps anticipate what will happen if things continue their current course
- Ideally, dashboard should help people prevent problems from occurring
- One of the best and easiest ways to support this need is by providing enough historical context for people to easily spot trends that are heading in the wrong direction
- Dashboards have limited space, so common tools such as line graphs cannot be relied upon to provide time-series information leading up to the present
- An abbreviated version of line graphs, called sparklines, can be used:
 - Invented by data visualization visionary Edward Tufte
 - Serve this purpose well on dashboards
- Figure 19 shows the use of sparklines (also see Figure 23):

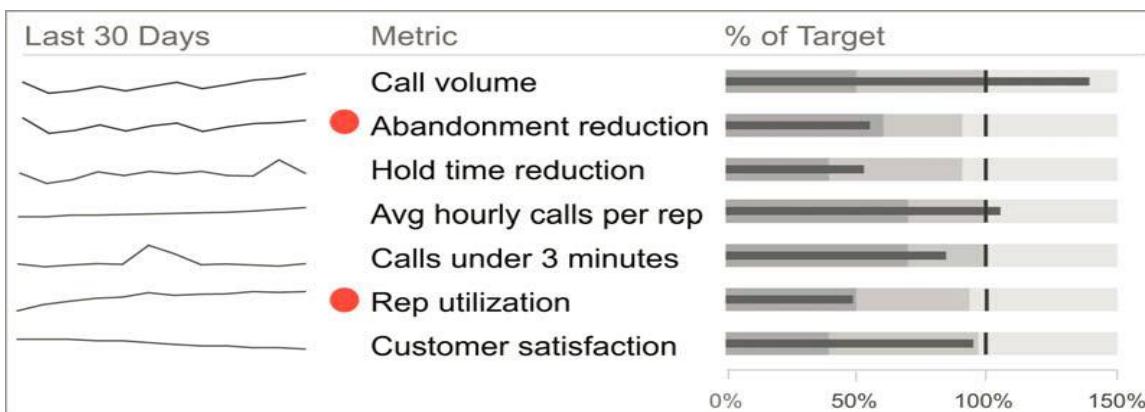


Figure 19: Meaningful context has been added to these metrics in the form of sparklines, which provide a quick sense of the history that has led up to the present
Source: www.inovasolutions.com

- Sparklines:
 - Look like a line graph without axes, scales, and labels
 - Not meant to replace line graphs
 - Rather, to provide an abbreviated sense of the ups and downs of history leading up to the present in a limited amount of space
 - Are like trend arrows but much richer in the history that they provide
- Figure 19 shows:
 - “Hold time reduction” performance took a dive yesterday, even though it is performing satisfactorily today

- More importantly, it is clear that customer satisfaction performance, even though it is currently close to target, has been steadily declining over the last 30 days
- Even though no alarms are going off, something needs to be done to head off a negative trend

Match the mental model

- Users who are experts in what they do construct a model in their heads to help them understand the domain
- Model includes:
 - All significant players (such as people, things, events)
 - How they relate to one another, such as how they fit into the overall process and how they affect one another
- To some degree, this model is actually a lot like a picture or diagram of the domain that someone might draw on paper if asked to explain it; thinking is highly visual
- Closer a dashboard is able to match the mental model of the domain that it is used to monitor:
 - Easier it is for the user to make sense of the information, and
 - Plug the facts revealed on the dashboard into that internal model
- Take time to get the dashboard users to explain the models in their heads
- Strive to display the information in a manner that emulates that model

Module 8: Data visualization

Understanding data visualization

Visual representation

Effectiveness of visuals

- Humans primarily perceive their surroundings through their eyes, despite the availability of five sensory skills, which allow one to see, touch, hear, taste, and smell
- Seeing often equates to understanding because vision: dominates the senses and is faster

Overcoming memory limitations

- To bypass short-term memory limitations:
 - Humans tend to reduce the need to rely on it
 - One way to do that, in the business environment, is to place all the important information on a single screen
- Dashboard:
 - Acts as an external form of memory where all information is available in front of the eyes
 - Takes away the need to memorize information, i.e., to move it into long term memory (where it is retained for years)
 - Explanation for this phenomenon is that when information is in front of the eyes, it can be quickly moved in/out of memory at an extremely fast speed, as it is processed
- A dashboard with a well-designed layout and content facilitates rapid processing

Why charts are more powerful than tables

- Picture is worth a thousand words!
- When something is displayed on a chart, the data gets highlighted immediately
- Since data is presented visually on a dashboard in graphical form, it becomes a very effective medium for conveying information
- Figure 20 displays call volumes for two call centers over 12 months (24 values) in a table

2003 Call Volume (in thousands)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
United States	1,983	2,343	2,593	2,283	2,574	2,838	2,382	2,634	2,938	2,739	2,983	3,493
Europe	574	636	673	593	644	679	593	139	599	583	602	690
	2,557	2,979	3,266	2,876	3,218	3,517	2,975	2,773	3,537	3,322	3,585	4,183

Figure 20: Tabular display of call volume data

Source: Dashboard design for real-time situation awareness, Stephen Few

- After reading a table of numbers, like in Figure 20, once eyes are taken off of it:
 - At most, only 4 or 5 of the numbers will be remembered
 - One per slot of memory

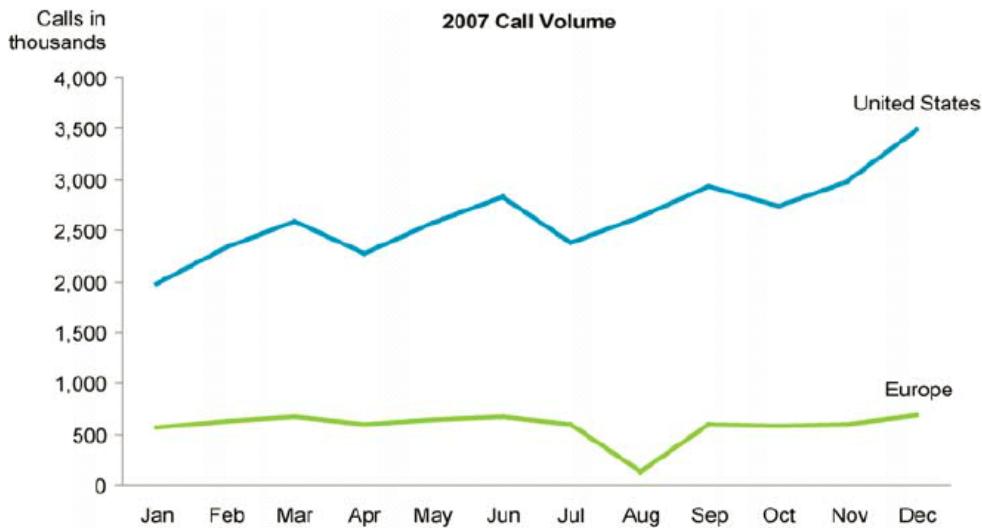


Figure 21: Same call volume data, as in Fig. 20, which highlights patterns and trends
Source: Dashboard design for real-time situation awareness, Stephen Few

- By viewing the line graph (Figure 21):
 - Entire pattern formed by the line's shape, i.e., 12 monthly values, can be stored as a single chunk of memory
- Much more information can be stored in short term memory , than could be if the values were written as numbers, when quantitative information is displayed in visual form:
 - In a simple manner that can be easily seen
 - In a way that meaningfully represents the values (such as a line that goes up and down to represent the rise and fall of values through time)
- Simply by encoding information visually, ability to think about it can be significantly expanded by making more of it available at any moment

Value of visualization in business decisions

Data visualization benefits

- Foundation of successful businesses is sound and informed decision making
- Such decisions can only be made if the data is available for analysis
- Problem is that as an organization grows and the available data grows in tandem:
 - It becomes a challenge to analyze such data
 - This is especially true if provided in spreadsheets or static reports, which do not facilitate the determination of data patterns and trends

- Decision makers in such organizations need BI tools, especially visual tools, which can help them make decisions quickly and correctly
- Data visualization provides many benefits such as:
 - Enabling quick analysis of large data volumes
 - Identifying exceptions
 - Exposing problems at an early stage
 - Providing early warning alerts
 - Indicating trends in an easy to understand format

Use of data visualization in business analysis

- Data has been presented visually since centuries:
 - By a wide range of users including analysts, scientists, and students
 - For a wide range of applications including finance and astrology
- As a presentation tool, its widespread use and importance in business is a recent phenomenon
- Data visualization has been driven:
 - By the large volumes of data being collected, which is increasing exponentially
 - Widespread availability of BI technology and analysis tools at an affordable cost
- Presentation medium of choice for fast and accurate decision making has been the dashboard:
 - It is now considered by businesses to be an important tool in their competitive effort
 - Despite this fact, data visualization value is often not appreciated or is implemented ineffectively

Key to successfully using data visualization

- Most appropriate type of data visualization should be used
- Data presented should:
 - Be supplemented with contextual information that provides clarity
 - Enable users to take action

Visual display elements used by dashboards and scorecards

- To make it easy for users to ascertain performance at a glance, a variety of visual display elements are used
- Display elements include:
 - Visual icons
 - Charts
 - Tables
 - Alerts

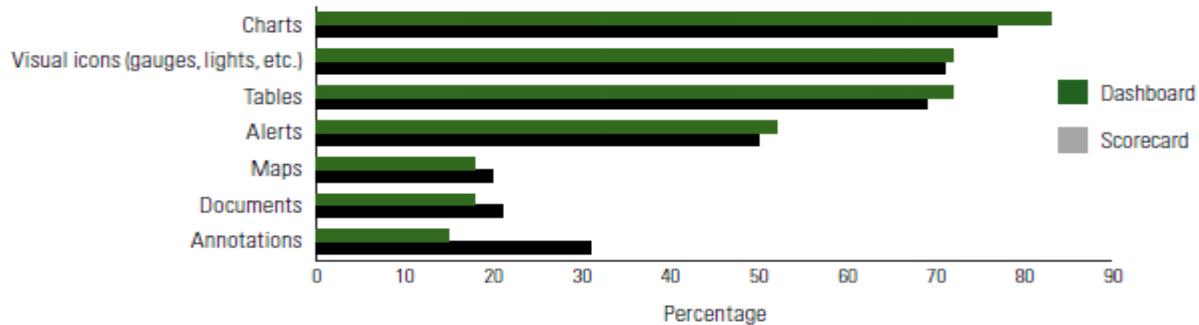


Figure 22: Visual elements

Source: Deploying dashboards and scorecards, Eckerson, TDWI

Presentation characteristics

Presentation media types

- Four types of presentation media are widely used in business:
 - Dashboards
 - Scorecards
 - Visual analysis tools
 - Reports
- All four types:
 - Have their own unique attributes
 - Help users to identify trends, patterns, correlations, anomalies, deviations, and the state of the business

Dashboard presentation characteristics

- Well-designed dashboard can:
 - Enable very powerful monitoring:
 - Be used by employees at different hierarchical levels, not just senior executives
- Two key characteristics that provide its monitoring capability are its:
 - Visual nature
 - Integration of multiple items onto a single easy to monitor screen
- Other important characteristics include:
 - Displays most important KPIs
 - Is interactive
 - Supports filtering
 - Supports drilldown; however, drilldown should not be required to determine which indicators are underperforming
 - Updates data automatically without user intervention:
 - Update frequency varies by organization and function
 - Most dashboards are updated at least daily
 - Uses multiple tabs when all visuals cannot fit on a single screen, which avoids scrolling

Scorecard presentation characteristics

- Scorecard contains:
 - At least one measure, with its value and target
 - Visual indication of the status:
 - Status can be presented, for each displayed row, using traffic lights
 - Example: green (indicating good), yellow (warning), and red (real issue)
- Scorecard:
 - Can be used in a dashboard or a visual analysis tool
 - Does not need to be interactive
 - Can contain columns that show trends in sparklines

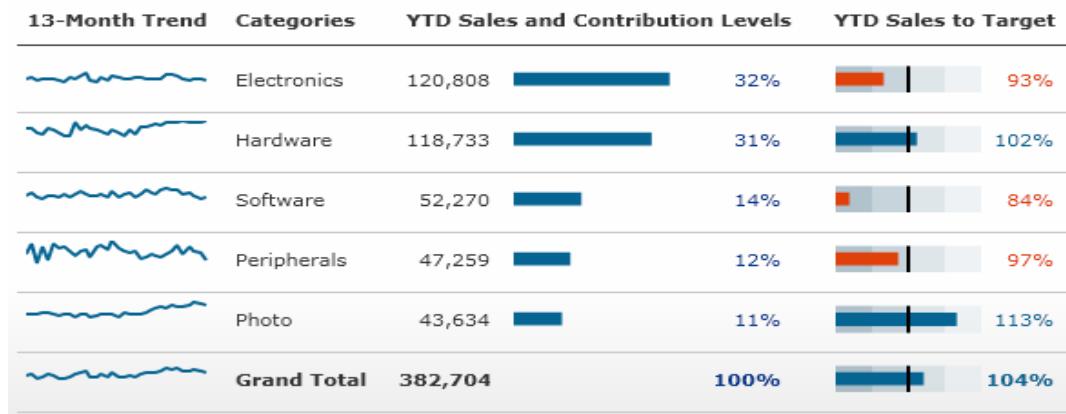


Figure 23: Sparklines
Source: Dashboardinsight.com

Report presentation characteristics

- Reports present data in an organized static format, though they can be provided with filters and drilldown capabilities
- Contain detailed data including numbers and tables, which is displayed in a tabular form
- Often span multiple pages
- Can contain visualizations that highlight important information
- Optimized for printing and export into other formats, such as Word and PDF documents
- More popular with detail oriented users, such as lawyers and accountants, who prefer to work with text and numbers rather than visuals

Visual analysis tool characteristics

- Primarily used to identify trends, patterns, correlations, anomalies, deviations, and state of the business
- Are favored by advanced users like data analysts and researchers
- Key characteristics of such tools:
 - Display data on a single screen
 - Contain scroll bars when there exist too many rows (for tables) or too many data points (for charts)
 - Highly interactive and support filtering and drilldown capabilities
 - Typically use historical data, though real-time data is also supported in some cases

Common forms of data visualization

Charts and status indicators

Popular forms of data visualization

- Most commonly used type of data visualization is the chart
- Most popular forms of this type of visualization include:
 - Line
 - Bar
 - Area
 - Pie
- Two key attributes of a well-designed chart are that it should:
 - Enable the data to be analyzed
 - Quickly extract relevant information



Figure 24: Line/Area combo chart

Compares sales cycles for current & previous year to demonstrate patterns & trends

Source: <http://www.dashboardinsight.com/Article.aspx?id=4148>

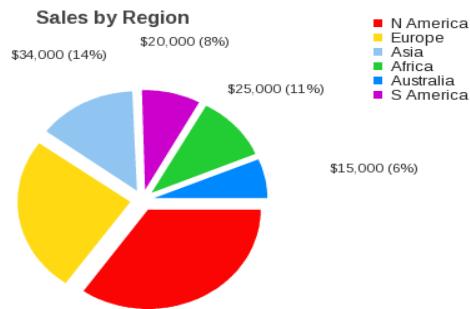


Figure 25: Pie chart displays sales distribution by region

Source: <http://www.jpowered.com/graphs-and-charts/gallery/2d-pie-chart.htm>

Status indicators

- Used to indicate the status of a particular measure or unit of data
- This form of data visualization comes in many varieties, including:
 - Gauges
 - Traffic lights
 - Symbols
- Their effectiveness is enhanced when used with incorporated contextual metrics, such as targets and thresholds
- Including contextual metrics helps provide immediate feedback regarding a specific measure, indicating if it is:
 - Good or bad
 - High or low
 - Above or below target

Regional Calls Scorecard (By Location)					
Call Centre	Rates		Calls To		
	Response	Status	Total	Threshold	
Connecticut					
North Shore	25.2 %	●	77,387	★	
Sunny Vale	22.3 %	○	38,194	✓	
Lakewood	25.3 %	●	12,940	✓	
Maine					
North Shore	22.1 %	○	83,510	★	
Sunny Vale	22.3 %	○	41,616	✓	
Lakewood	21.8 %	○	14,327	✓	

Figure 26: Status indicators for scorecard

Status indicators display how each regional call center is performing compared to target

Source: <http://www.dashboardinsight.com/Article.aspx?id=4148>

Advanced data visualization

Examples of advanced data visualization

- Bullet graphs
- Sparkline charts
- Scatter plots
- Heat maps
- Tree maps
- Pareto charts

Leveraging data visualization

Quick analysis

Spreadsheet limitations

- Figure 27 demonstrates the limitations of spreadsheets:
 - Data is presented in a typical traditional spreadsheet, where the sales numbers for each month are easy to determine
 - Two spreadsheets display, separately, monthly sales revenue and exhibit visitor traffic
- Cumbersome and time consuming to identify any pattern or trend that may indicate deviations, anomalies, and potential problems
- For identifying such issues, and taking any action if necessary, further in-depth analysis will be required

Revenues			
Year	Month	Revenue	%
2010	Jan	\$31,540	3.5
	Feb	75,430	8.3
	Mar	75,200	8.2
Apr			
May			
Jun			
Jul			
Aug			
Sep			
Oct			
Nov			
Dec			
2009			
	Jan		
	Feb		
	Mar		
	Apr		
	May		
	Jun		
	Jul		
	Aug		
	Sep		
	Oct		
	Nov		
	Dec		
		88,450	9.4
		76,400	8.1

Exhibits			
Year	Month	Exhibit	Visitors
2010	Jan	Air-blown Glass	291
	Feb	History of Flight	560
	Mar	History of Computers	580
	Apr	John Audubon	610
	May	Teapots	540
	Jun	Art of Taxidermy	310
	Jul	Ming Dynasty	810
	Aug	African Safari	760
	Sep	Life and Times of Jane Austen	720
	Oct	Ancient Egypt	1001
	Nov	Edwardian Furniture	823
	Dec	History of Saint Nicholas	762

Figure 27: Spreadsheets separately displaying monthly sales revenue and visitor traffic

Source: <http://www.dashboardinsight.com/Article.aspx?id=4148>

How visuals overcome spreadsheet limitations

- Figure 28 presents data in a visual format
- Patterns can be determined easily, simply by observing the height of the bars and the trend line
- Correlates:
 - # of exhibit visitors and revenues, and
 - Trend and sales cycle based on previous year's data
- Visual contains additional contextual information that helps in analyzing the data



Figure 28: Line/bar combo chart

Source: <http://www.dashboardinsight.com/Article.aspx?id=4148>

Comparing analysis speed: visuals versus spreadsheets

- Analyzing a spreadsheet is very slow compared to a well-designed visual
- Spreadsheet user needs a lot of time to:
 - Review
 - Understand
 - Process data, especially in complex scenarios
- On the other hand, an analyst receiving the same data in a visual format can:
 - Obtain the results by just glancing at the visual
 - Immediately start work on determining the cause of any problem
 - Implementing decisions required to improve the performance of that measure or KPI

Using visuals effectively

- Figure 29:
 - Shows a gauge that indicates an isolated value
 - Shows more than 50% (250 is half the scale)
 - Has limited value as it does not compare the value to a target

- Does not trigger a call for action because feedback is not provided compared to a target or an expected result

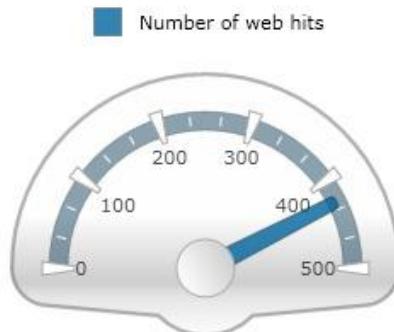


Figure 29: Number of hits

Source: <http://www.dashboardinsight.com/Article.aspx?id=4148>

- Figure 30:
 - Shows that expected target is not being hit
 - Prompts problem investigation and corrective action



Figure 30: Number of web hits vs. target

Source: <http://www.dashboardinsight.com/Article.aspx?id=4148>

- Figure 31:
 - Gauges show volume and distribution of support requests across different mediums
 - Manager can notice possible problem with e-mail support volume and respond in a timely manner



Figure 31: Data for three categories
Source: <http://www.dashboardinsight.com/Article.aspx?id=4148>

Taking action

Why decision makers need to interact with data

- When appropriate data is collected, it can:
 - Answer key questions
 - Provide insight into issues that contribute directly to the decision making process
- Decision makers need to interact with their data in order to identify:
 - Exceptions
 - Trends
 - Potential problems
 - Opportunities
- Those who interact with the data are in a far better position to raise flags quickly and respond in a timely manner
- When data is presented visually:
 - Opportunities and issues can be pointed out quickly
 - Communicated across the organization
 - Decision makers can take appropriate action in a timely fashion
- If findings are not shared, it can cause delayed decisions with associated consequences

Module 9: Effective visualization

Designing effective dashboard displays

Prerequisites and guidelines

The prerequisites

- Focus on requirements and data first
- Know the users
- Enlist visual designers
- Create a prototype
- Employ usability labs
- Iterate

How to start: Initial scope

- Best to limit dashboard to 4-5 key areas that encompass 7-10 metrics
- Leave room to connect to other visualizations, reports, or data sources based on in-depth analyses that might be required

Guidelines for creating displays

- Display information on a single screen
- Start with less but enable subsequent drilldown for gaining deeper insight
- Balance sparsity and density
- Balance should be provided between:
 - Concept of analyzing information and overall data visibility, with
 - Providing instant access to the most important metrics required for regular monitoring
- Eliminate decoration
- Use an intuitive layout
- Arrange components, such as tabs and filters, intelligently
- De-emphasize design elements
- Leverage dashboard themes
- Identify dashboard templates that can be used to drag and drop visualizations into general dashboards

Guidelines for designing charts

- Less is more
- Make comparisons easy
- Use pre-attentive processing (visual perception that occurs below the level of consciousness)
- Predefine drill paths and interactivity
- Choose the right graph

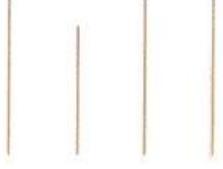
Using the proper visualizations

Visualizing information

- Goal of visualizations is to enable easy information analysis
- Design has to consider that information is viewed differently, based on individual preferences and roles
- After defining metrics, evaluate how to visualize the information
- Debate continues to exist within the data visualization world regarding the types of visualizations that are most effective:
 - Some state that simple sparklines and line graphs provide the best way to demonstrate how organizations are performing against targets
 - Others prefer more visually appealing ways for viewing information

Attributes of visual perception

- Can be organized into four categories:
 - Color
 - Form
 - Spatial position
 - Motion

Category	Attribute	Illustration
Color	Hue	
		
Intensity		
		
Form	Line length	
	Line width	

Category	Attribute	Illustration			
Form <i>(continued)</i>	Orientation				
			/		
Size		•	•	•	•
		•	•	●	•
		•	•	•	•
Shape					
			■		
Added marks					
			+		
Enclosure					
			□		
Position	2-D location	•	•	•	•
Motion	Flicker	A visual attribute of an object, such as color, that continuously changes back and forth between two values, or the entire object itself repeatedly appears and then disappears			

Figure 32: Attributes of visual perception
Source: Information Dashboard Design, Few

Attributes of color



Figure 33: Saturation
Source: Information Dashboard Design, Few

- Lightness (or brightness) measures the degree to which any hue appears dark or light, ranging from fully dark (black) to fully light (white)
- Full range of lightness is shown for the red hue below



Figure 34: Lightness
Source: Information Dashboard Design, Few

- Saturation and lightness are both referred to as intensity
- Color is dramatically influenced by the surrounding context, as shown by the grey squares:
 - Squares appear to vary in intensity
 - However, all are exactly the same as the lone square

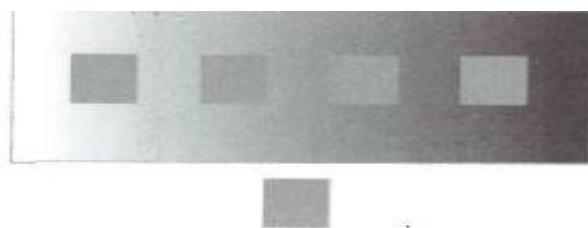


Figure 35: Intensity
Source: Information Dashboard Design, Few



Figure 36: Effect of background color
Source: Information Dashboard Design, Few

Difference between standard and emphasis colors



Figure 37: Standard versus emphasis colors

Source: Information Dashboard Design, Few

Objective of specific visualizations

- Charts and graphs:
 - Provide a general view of sales and time-series type of information.
- Gauges and bullet charts (with targets identified):
 - Provide a good way for determining how well organizations are performing against set targets
 - After goals are set:
 - Gauge dial will change based on performance, or
 - Range marker will move towards the target or threshold



Figure 38: Dial gauges

Source: Information Dashboard Design, Few

- Bar charts:
 - Good way to identify overall sales based on products or services, or
 - To compare individual performance (whether individual, service or product based)
 - Can be oriented horizontally or vertically

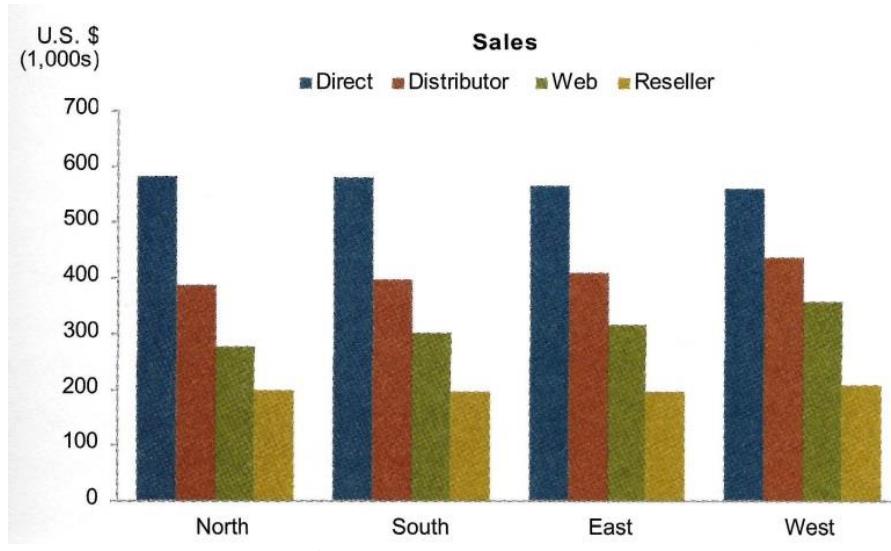


Figure 39: Bar chart
Source: Information Dashboard Design, Few

- Figure 40 chart compares actual to budgeted revenue values for various regions

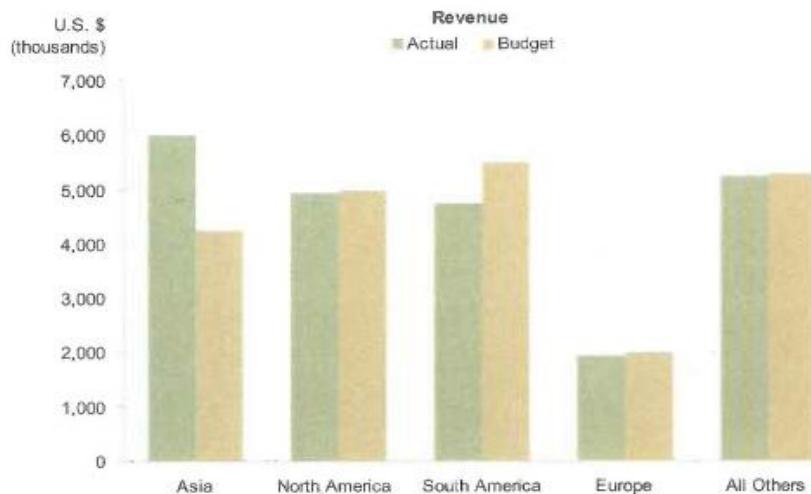


Figure 40: Regional view
Source: Information Dashboard Design, Few

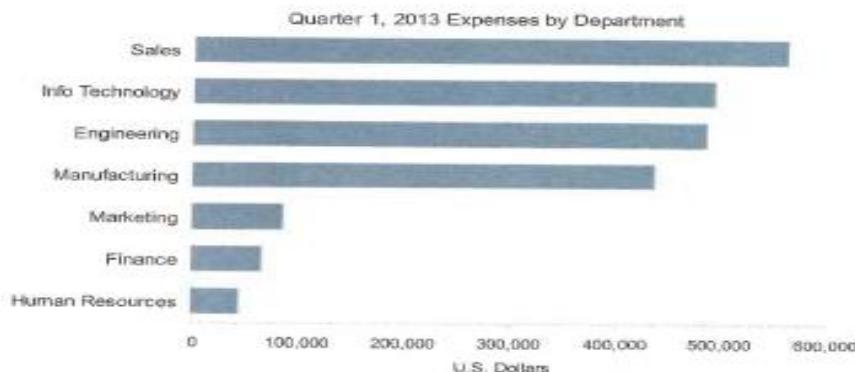


Figure 41: Horizontal bars
Source: Information Dashboard Design, Few

- Stacked bar chart:
 - Right choice only when there is a need to display multiple instances of a whole (such as a region) and its parts, with emphasis on the whole

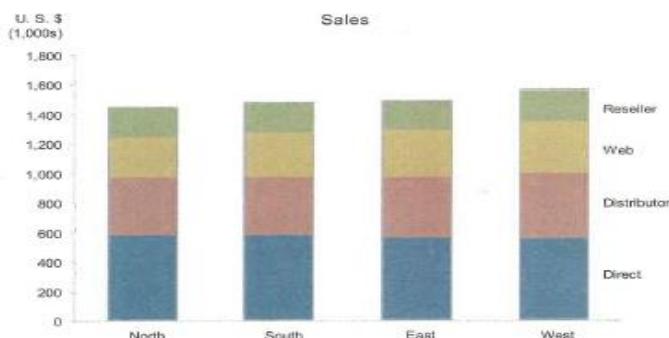


Figure 42: Stacked bar chart
Source: Information Dashboard Design, Few

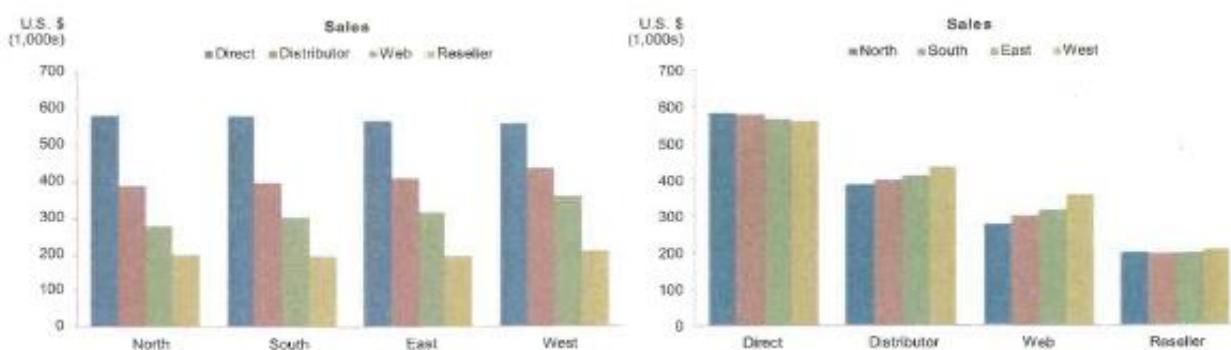


Figure 43: Stacked bar charts with regional and channel views
Source: Information Dashboard Design, Few

- Figure 44 shows a better way to represent the stacked bar information

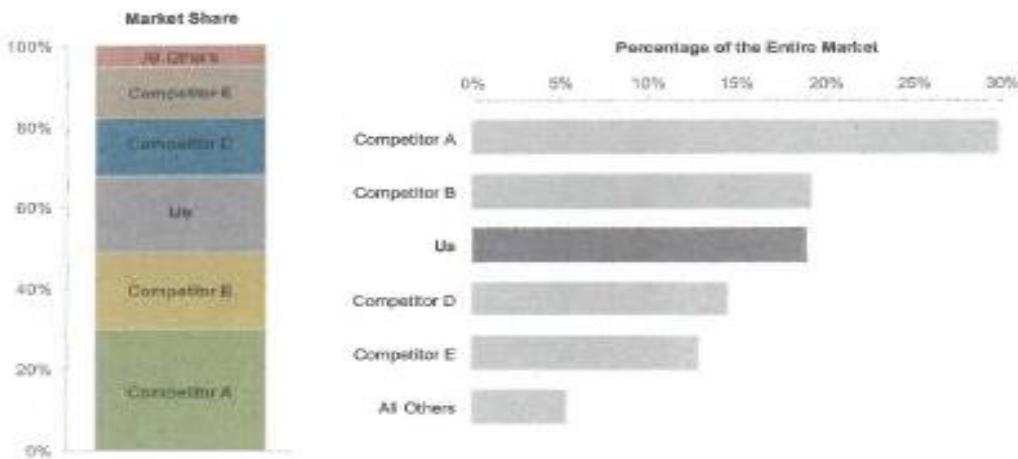


Figure 44: Better way to display stacked bar information

Source: Information Dashboard Design, Few

- Stacked bar charts and pie graphs can compare products against each another
- Pie chart:
 - Can compare sales percentages or identify regional performance:
 - Additionally, drill-through capabilities can enable in-depth analysis
 - Some pie charts can automatically group information together, if it falls under a certain percentile, to focus on the larger numbers
- In most cases, bar can represent better than pie, as shown in Figure 45

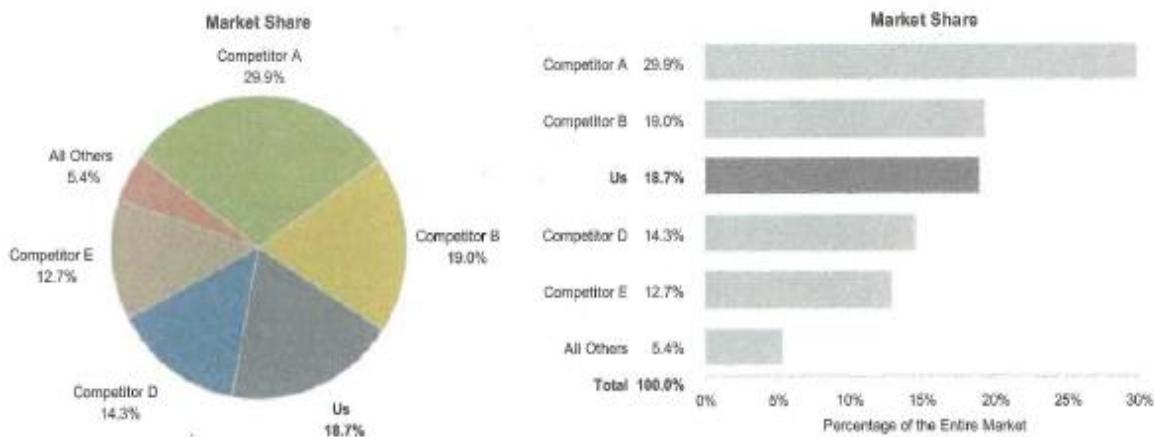


Figure 45: Pie chart versus bar chart

Source: Information Dashboard Design, Few

- Bullet chart:
 - Is a variation of the bar graph; developed by Stephen Few
 - Serves as a replacement for dashboard gauges and meters, which typically display too little information, require too much space, and are cluttered with useless and distracting decoration
 - Compares a given quantitative measure (such as profit or revenue) against qualitative ranges (poor, satisfactory, good) and related markers (such as same measure a year ago)
 - Compares one value (represented by a horizontal bar) to another value (represented by a vertical line) and relate those to qualitative ranges

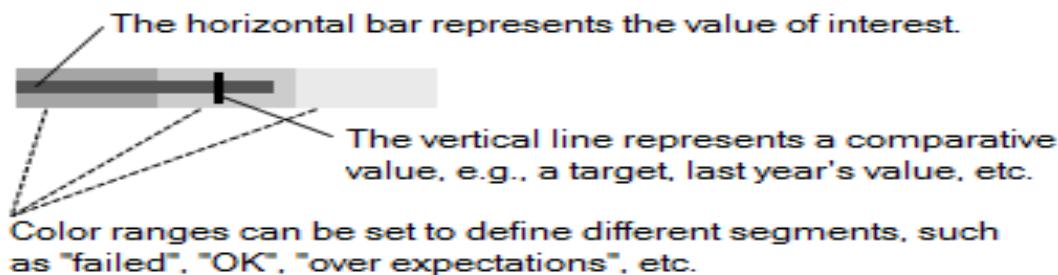


Figure 46: Bullet chart

Source: https://docs.tibco.com/pub//spotfire/5.5.0-march-2013/UsersGuide/bg/bg_what_are_bullet_graphs.htm

- Sparkline chart:
 - Provides effective way to summarize data as a trend with a known end point
 - Enables a lot of data to be displayed within a limited area

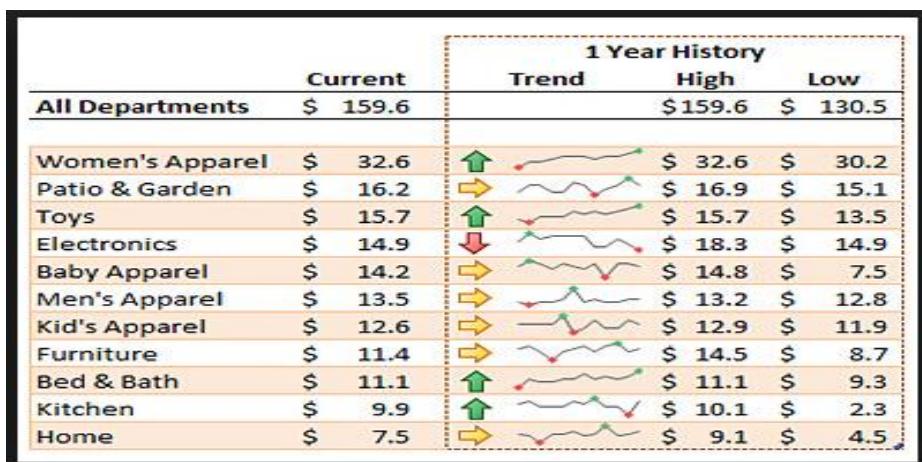


Figure 47: Sparkline chart

Source: <http://tech.gaeatimes.com/index.php/archive/microsoft-excel-2010-10-best-new-features-in-microsoft-excel-2010/>

- Tree map:
 - Diagram shows hierarchical data as a set of nested rectangles of varying sizes

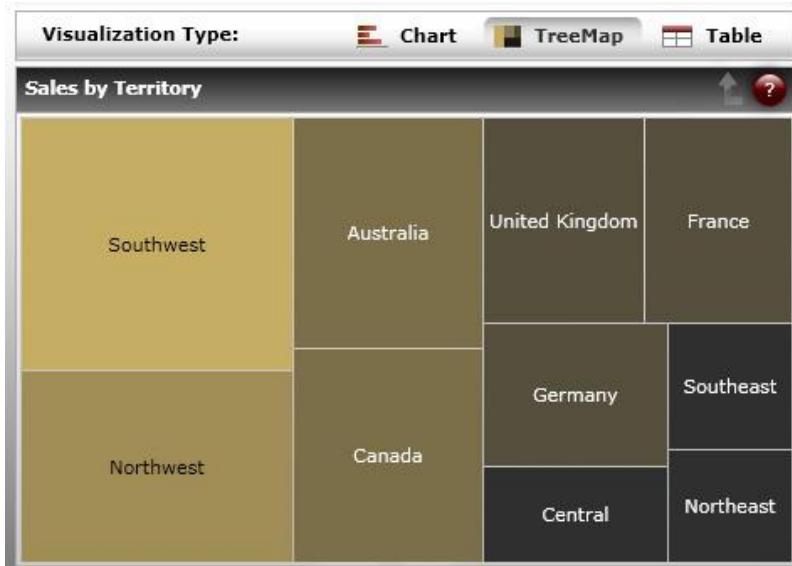


Figure 48: Tree map

Uses size and color to indicate distribution of sales (size) and performance against target (color). In this case, gold color indicates the best performance

Source: <http://www.dashboardinsight.com/Article.aspx?id=4148>

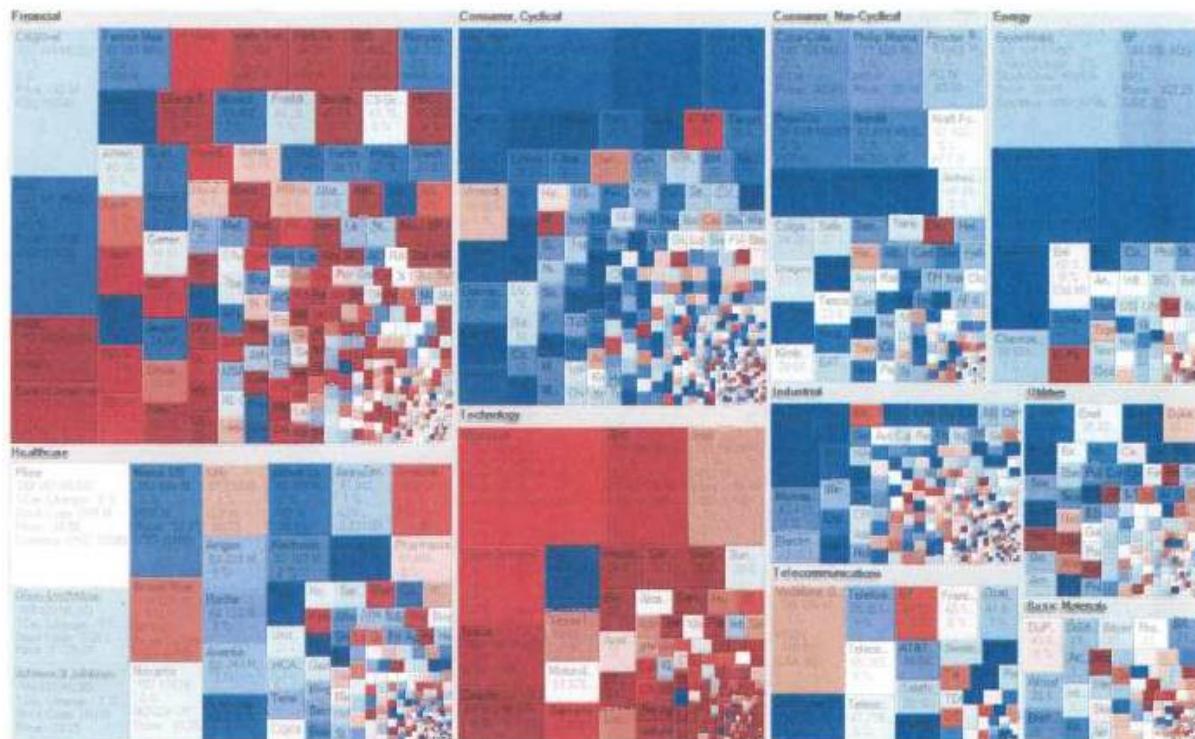


Figure 49: Tree map

Source: Information Dashboard Design, Few

- Scatter plot:
 - Graph in which the values of two variables are plotted along two axes
 - Pattern of the resulting points reveals any correlation that may be present
- With a scatter plot:
 - A mark, usually a dot or small circle, represents a single data point
 - With one mark (point) for every data point, a visual distribution of the data can be seen
 - Depending on how tightly the points cluster together, one may be able to discern a clear trend in the data

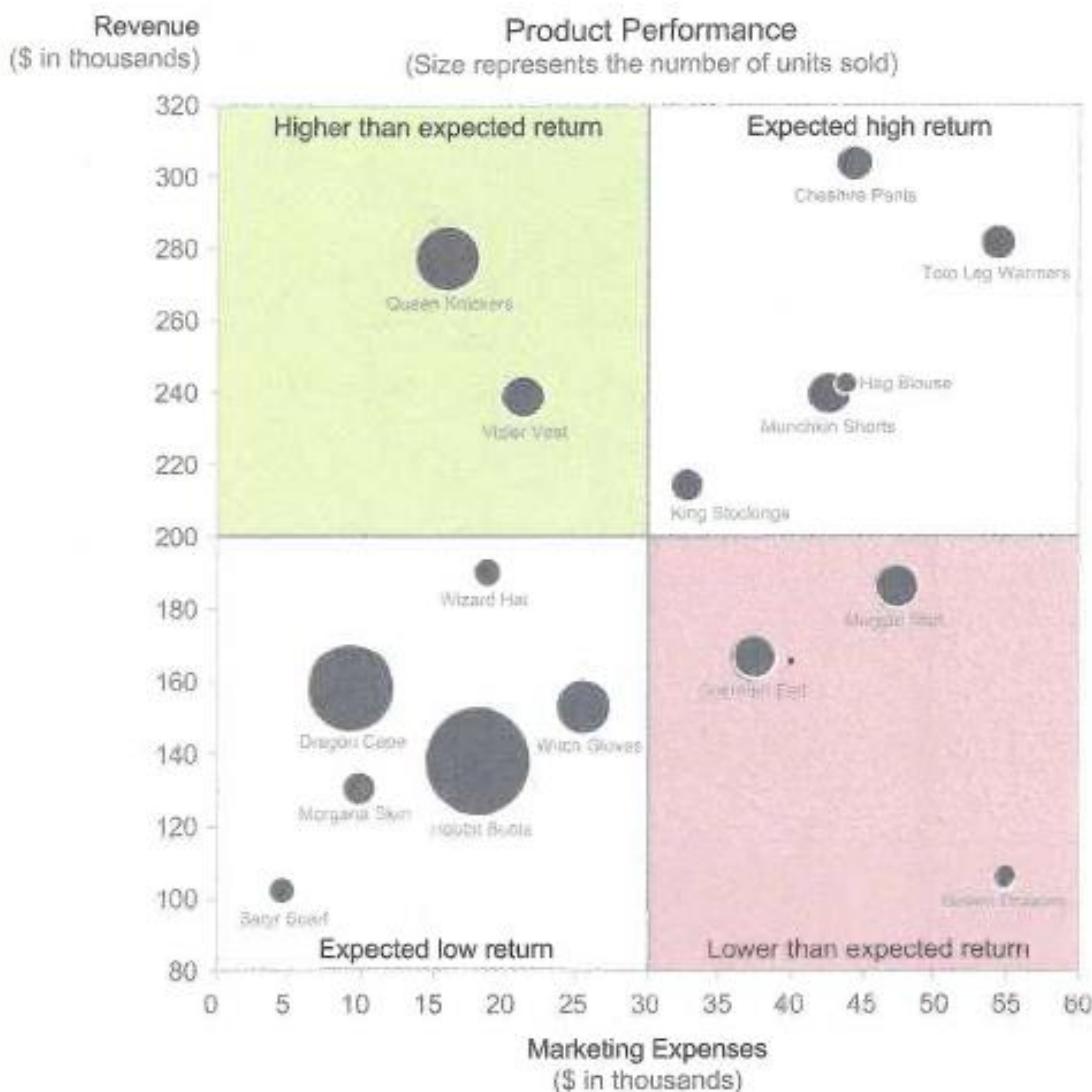


Figure 50: Scatter plot
Source: Information Dashboard Design, Few

- Heat maps:
 - Graphical representation of data where the individual values contained in a matrix are represented as colors
 - Identify general trends and product popularity, as well as comparisons

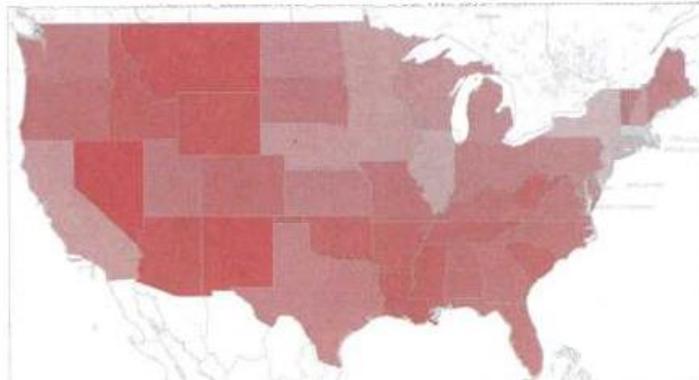


Figure 51: Heat map
Source: Information Dashboard Design, Few

- Funnel chart:
 - Type of chart, often used to represent stages in a sales process and show the amount of potential revenue for each stage
 - Measures progress through a process



Figure 52: Funnel chart
Source: Information Dashboard Design, Few

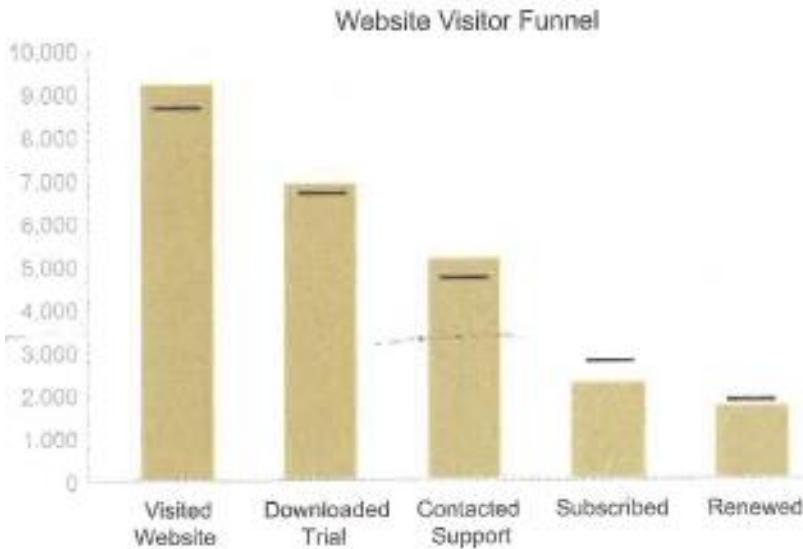


Figure 53: Bar chart displaying funnel information
Source: Information Dashboard Design, Few

- Small multiples (Figure 54):
 - Useful when there are too many variables for a single graph
 - Displays information in a series of graphs—called “Small multiples”
 - Arranged in a tabular fashion
 - Can consist of a single row, single column, or multiple rows and columns
- Matrix of small multiples:

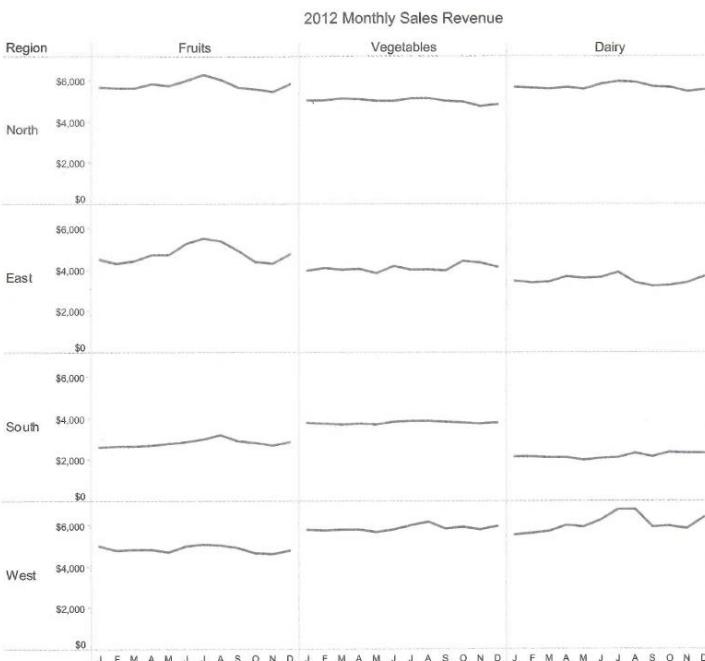


Figure 54: Small multiples
Source: Information Dashboard Design, Few

- Figure 55 displays three variables

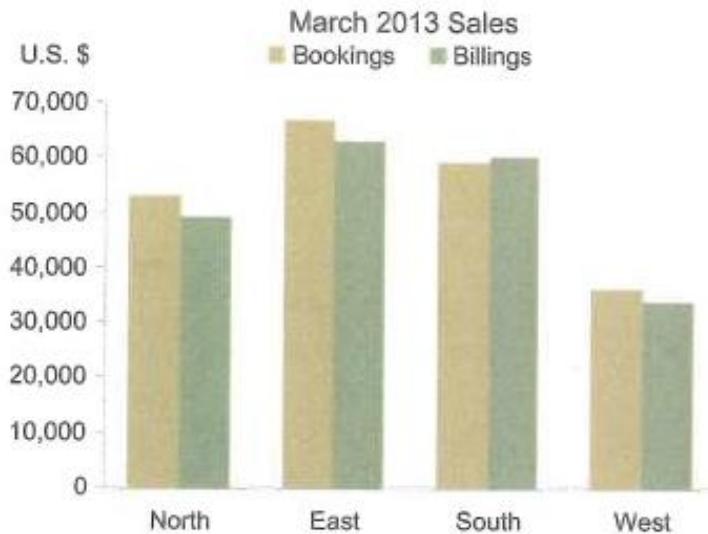


Figure 55: Bar chart representation
Source: Information Dashboard Design, Few

- Chart in Figure 55 cannot display split among sales channels (direct sales, distributor, and reseller)
- Small multiples display can solve the problem and also be space efficient



Figure 56: Small multiple representation
Source: Information Dashboard Design, Few

Visualizing dynamic data

Challenge of visualizing dynamic data

- Visualizing dynamic data is an aesthetic and readability challenge in dashboard design
- Amount of data will change depending on how the user interacts with the dashboard
- Figure 57 displays how filters can be used to display a trend chart:
 - Displays a line chart from January 2010 to December 2010
 - Has a filter that allows the user to select the analysis period

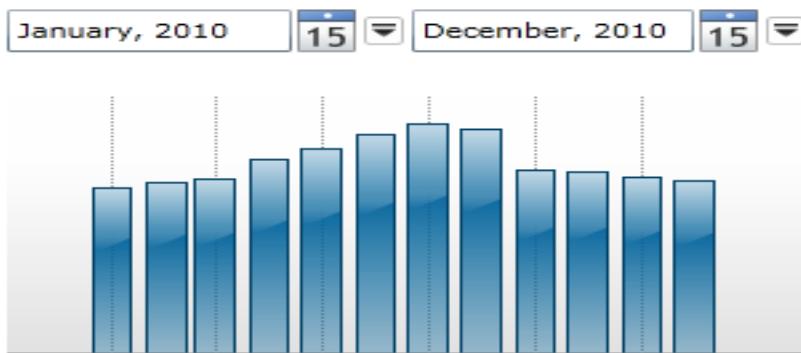


Figure 57: Trend chart

Source: www.dashboardinsight.com (Alexander Chiang)

- Range can now be changed, from Jan. 2010 to Feb. 2010 (Figure 58):

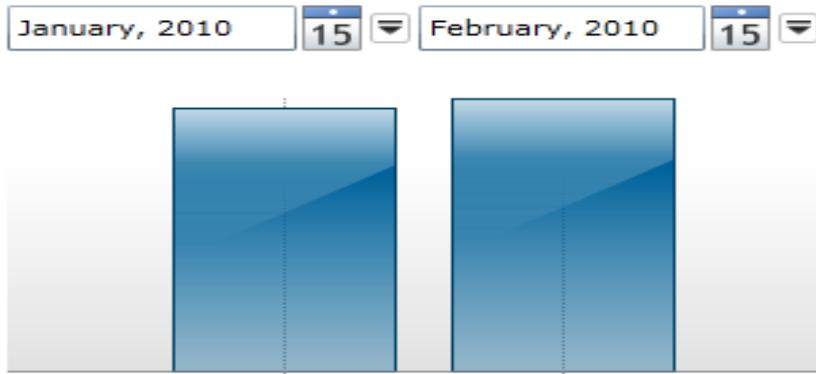


Figure 58: Trend chart that looks visually awkward

Source: www.dashboardinsight.com (Alexander Chiang)

- Figure 59 contains a visualization that compares the values of a list:
 - Bar chart compares how sales reps are performing against each other
 - Additionally, a filter enables the user to select the reps to display

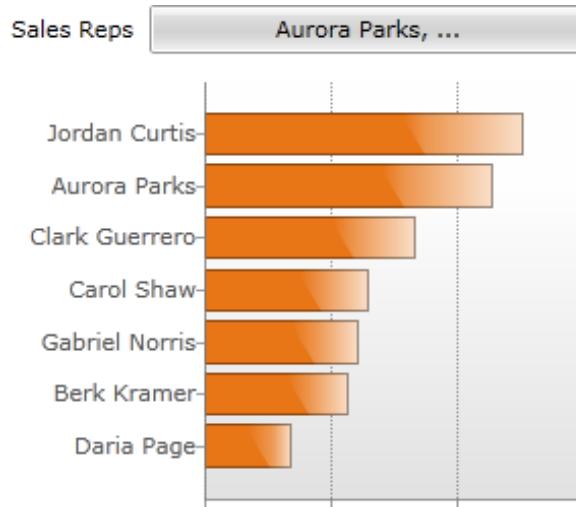


Figure 59: Clear comparison chart

Source: www.dashboardinsight.com (Alexander Chiang)

- If more reps need to be compared (Figure 60)

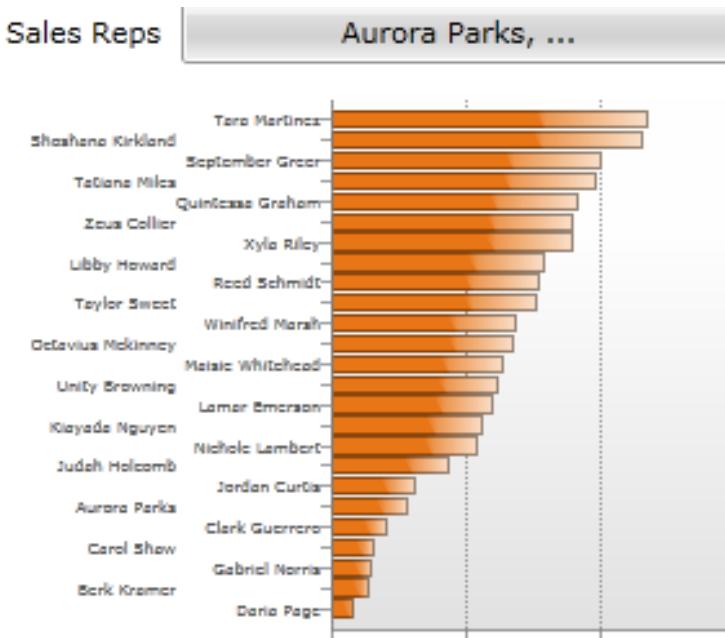


Figure 60: An unreadable bar chart

Source: www.dashboardinsight.com (Alexander Chiang)

- Figure 60 displays a serious visualization issue, as the rep names cannot be read easily
- Solution might be to:
 - First determine the purpose and, also, if so many reps need to be displayed simultaneously
 - How about top ten?

Trends and data presentation options

Trends

Visualizing multiple trends on a chart

- When there exists a need to compare a large number of trends on the same scale:
 - Line chart is a great way to visually compare trends on a common axis
 - Too many trends on a single chart can result in an unreadable mess (Figure 61)

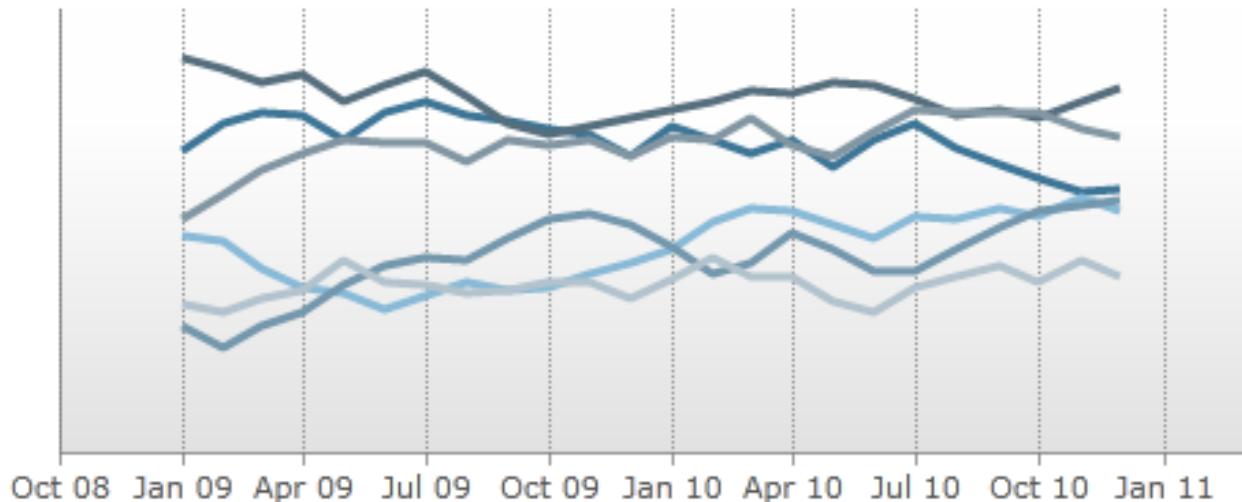


Figure 61: Large number of trends on a single chart creates an unreadable mess
Source: www.dashboardinsight.com (Alexander Chiang)

- Data visualization experts, such as Stephen Few and Edward Tufte, emphasize the value of simplicity when designing dashboards

- To display the total, such as for sales and its components (sales by region), over time, it might make sense to use two conventional line graphs (one above the other)

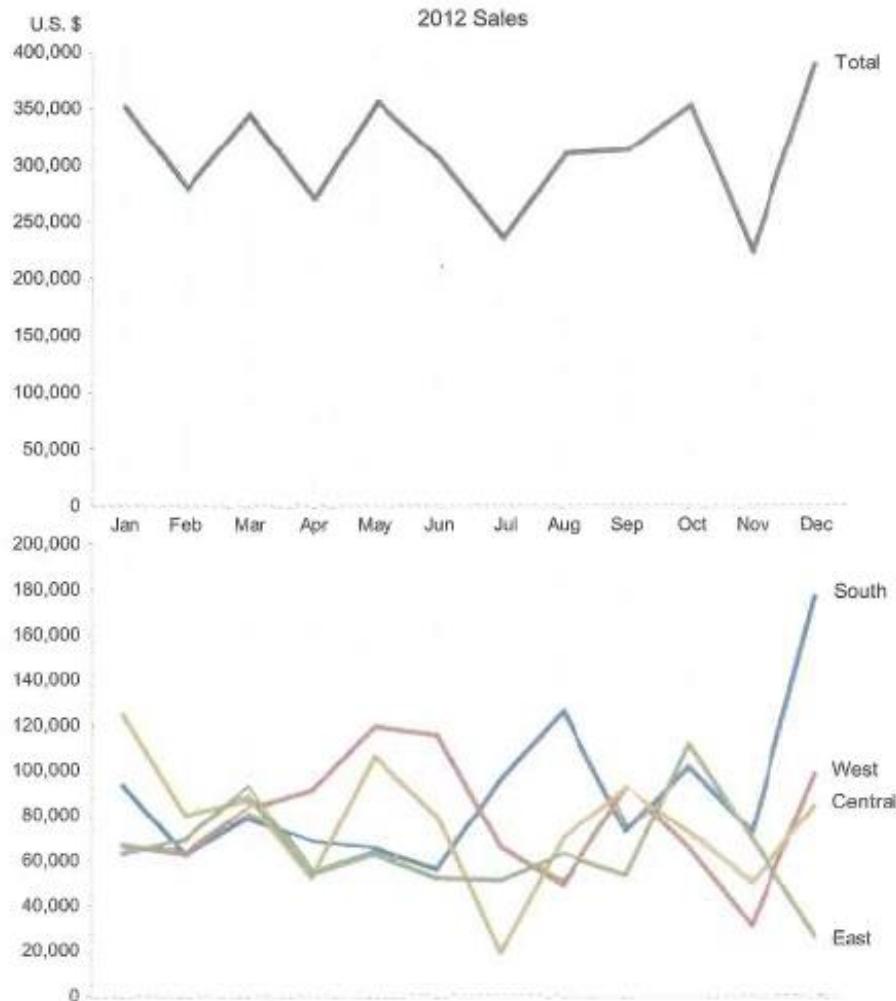


Figure 62: Using two graphs instead of one
Source: Information Dashboard Design, Few

Traditional approach when comparing multiple trends

- Traditional approach when comparing multiple trends:
 - Place them in a scorecard, with each trend displayed on a separate row
 - Problem with this approach is that ability to visually compare trends on a common scale is lost
- Two solutions allow keeping trends on the same scale, while improving clarity and reducing clutter:
 - User selectable lines
 - Highlighting lines

Using user selectable lines

- Easy solution is to allow the user to filter visible series in the legend
- User can select relevant metrics for a simple side-by-side comparison (Figure 63)

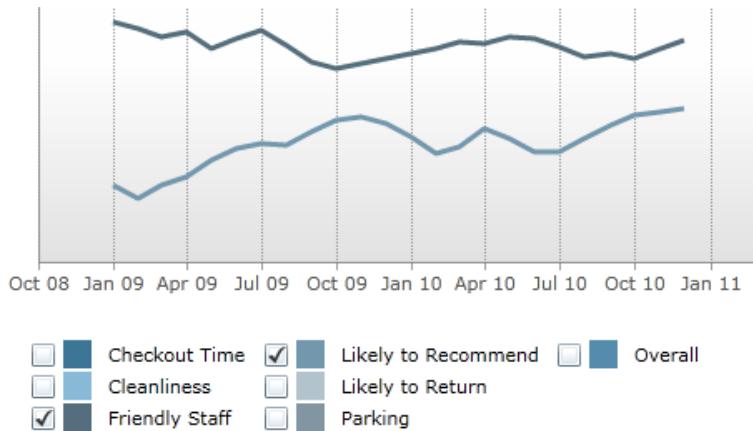


Figure 63: Using checkboxes to show and hide trends

Source: www.dashboardinsight.com (Alexander Chiang)

- When legend item is unchecked:
 - Corresponding line will disappear from the chart
 - Technique allows the user to decide which trends to display

Easily highlighting trends

- Another approach is to highlight trends in response to mouse input
- When the mouse is moved over a line, it highlights that line while others become grayed out (Figure 64)



Figure 64: Highlighting a trend in response to mouse input

Source: www.dashboardinsight.com (Alexander Chiang)

Balancing simplicity and depth

- Well-designed dashboards walk a fine line between:
 - Simplicity
 - Depth
- Make use of interactions to power visualizations
- Proper dashboard design can be very challenging:
 - Addition of interactions is one way to add depth while maintaining simplicity

Data presentation options

Vertical bar chart

- Use bar charts to compare data across categories, such as percent of spending by department
- Use a vertical bar chart when users need to compare values or occurrences among nominal variables or frequencies, such as sales by region (Figure 65)
- If primary purpose of a chart is to show trends, consider using a line graph instead

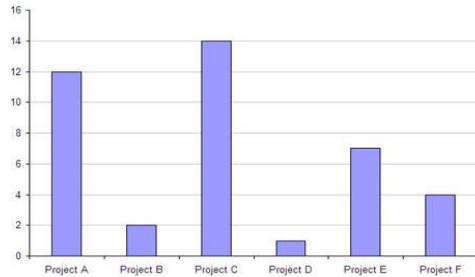


Figure 65: Example of a vertical bar chart – Time spent on projects

Source: www.uxmatters.com, Mike Hughes

Horizontal bar chart

- Use a horizontal bar chart when there is a need to compare values or occurrences among nominal variables (Figure 66)
- Horizontal bar charts make it easier to read labels
- Do not use horizontal bar charts to show time trends

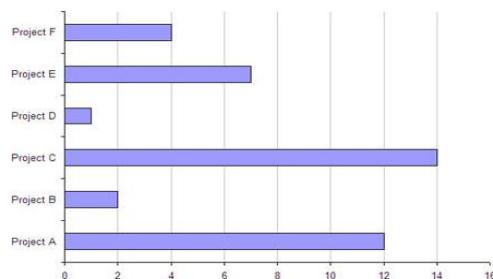


Figure 66: Example of a horizontal bar chart – Time spent on projects

Source: www.uxmatters.com, Mike Hughes

Using a pie chart

- Use a pie chart when there is a need to see proportional distribution (Figure 67):
 - Example: "How are sales distributed across the sales centers?"

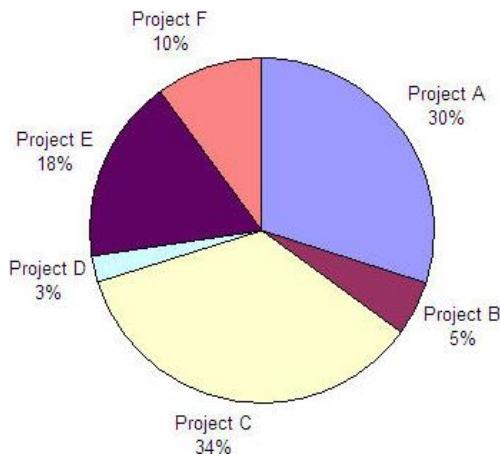


Figure 67: Example of a pie chart – Distribution of time spent on projects

Source: www.uxmatters.com, Mike Hughes

- Pie charts tend to be overused
- Problem with pie charts is that humans cannot effectively compare area or circular representations as well as linear representations of data

Ease of interpretation: Bar chart vs. pie chart

- Bar chart is quicker and easier to process than a pie chart
- Line length (height) attribute is used by the bar chart

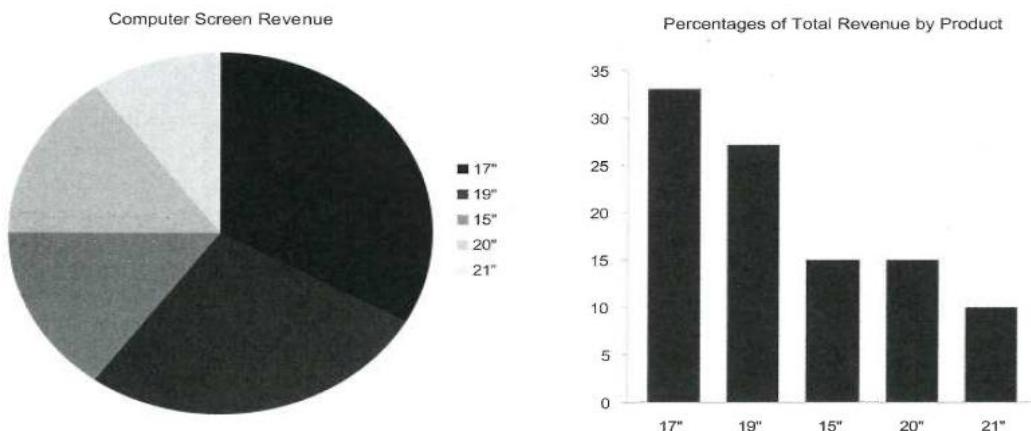


Figure 68: Pie chart compared to bar graph

Source: Information Dashboard Design, Few

Using a line graph

- Line charts are the most effective way to show change over time
- Use a line graph when there is a need to see values and trends over time (Figure 69):
 - For example, to determine if something is increasing, decreasing, or staying the same
- Use a line graph to determine relationships between independent and dependent variables:
 - For example, to determine a server's transaction rate and response time

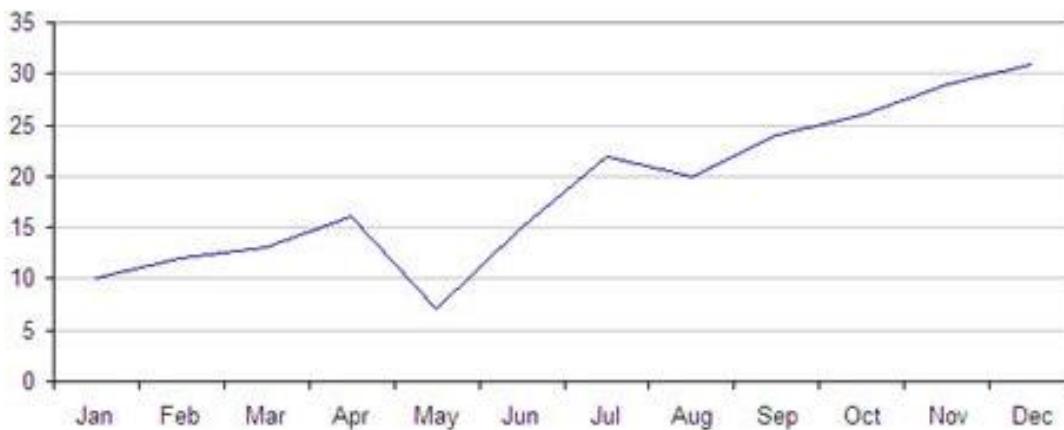


Figure 69: Example of a line graph showing a trend

Source: www.uxmatters.com, Mike Hughes

- Same information is displayed in the two charts in Figure 70; however, different aspects are highlighted

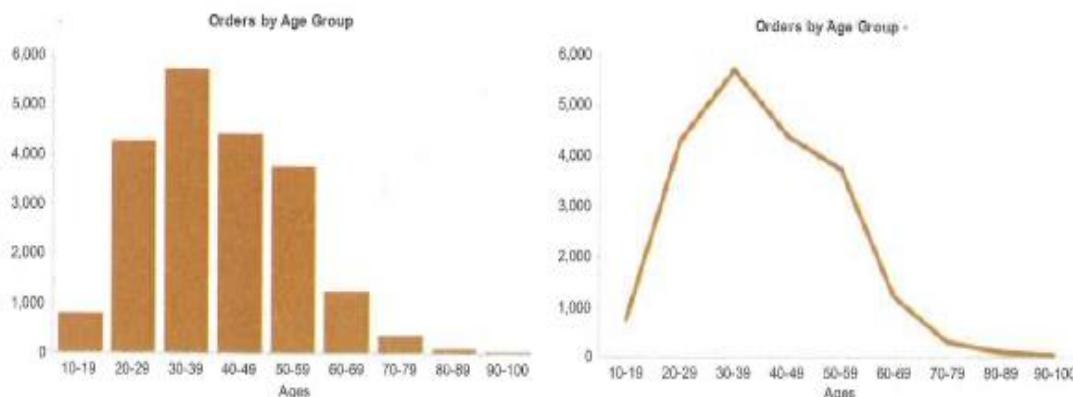


Figure 70: Bar chart versus line chart

Source: Information Dashboard Design, Few

- In Figure 71, trend is much easier to determine in the line graph

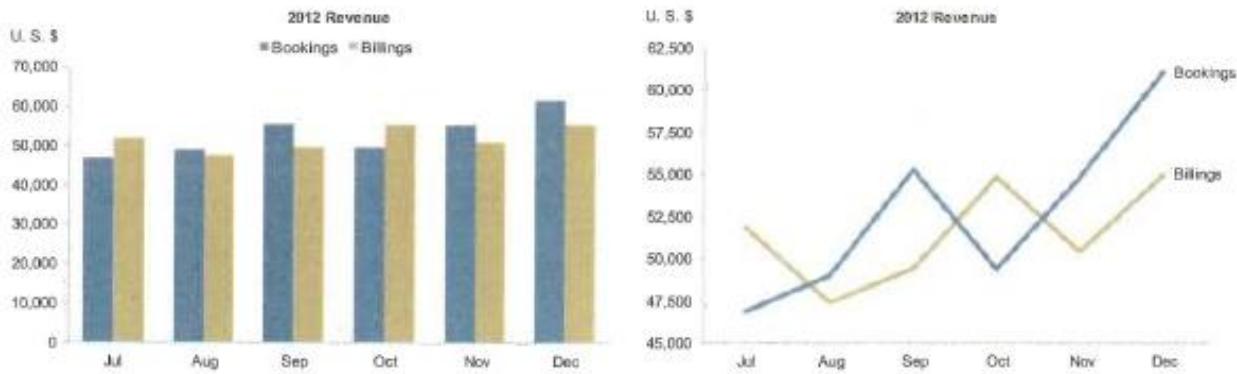


Figure 71: Bar chart versus line chart
Source: Information Dashboard Design, Few

- It is possible to combine line charts with bar and trend lines to provide a different perspective, as shown in Figure 72

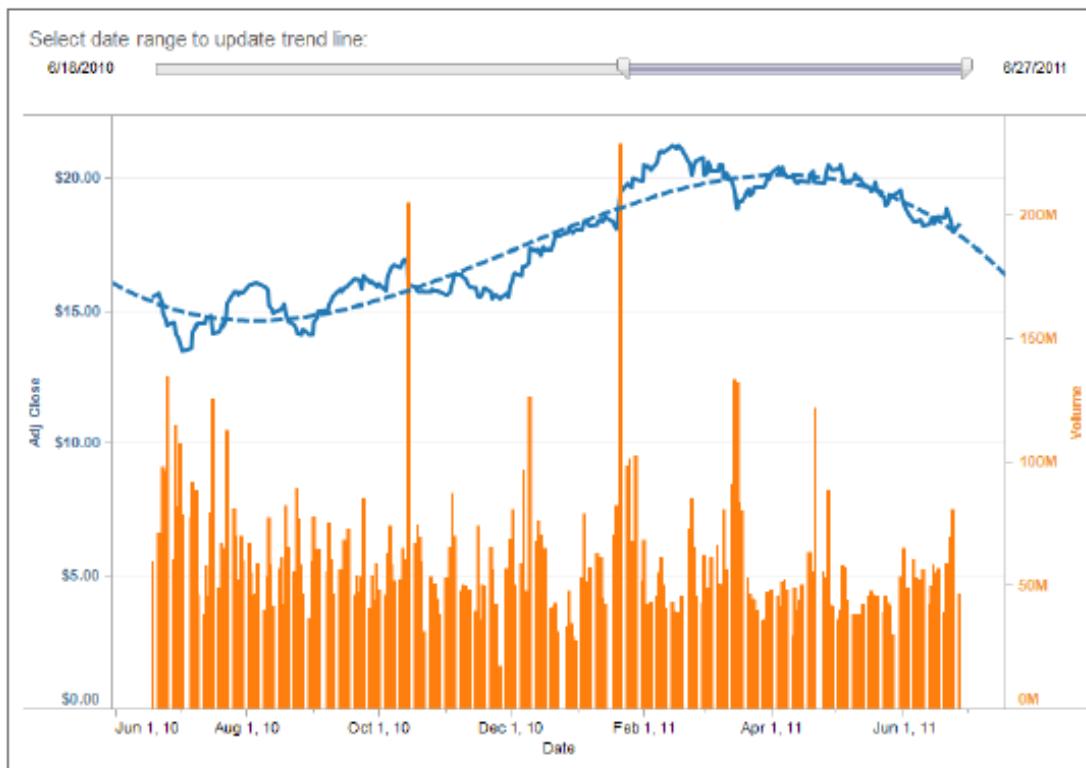


Figure 72: Combining line charts with bar and trend lines
Source: Which chart is right for you, Tableau Software

- In Figure 72, stock performance over a one year period is combined with trading volume during the same time period; Figure 73 shows another example, for Apple stock in this case



Figure 73: Combining line charts with bar and trend lines
Source: www.stockcharts.com

Guidelines for making graphs more readable

- Reduce the non-data pixels
- Eliminate all unnecessary non-data pixels
- De-emphasize the remaining non-data pixels
- Enhance the data pixels
- Eliminate all unnecessary data pixels
- Highlight the most important data pixels that remain

- Bar chart in Figure 74 shows unnecessary, non-data pixels
- Border and shaded background:
 - Are visual elements that compete for the viewer's attention
 - Add no informational value
 - In Figure 75 they have been eliminated

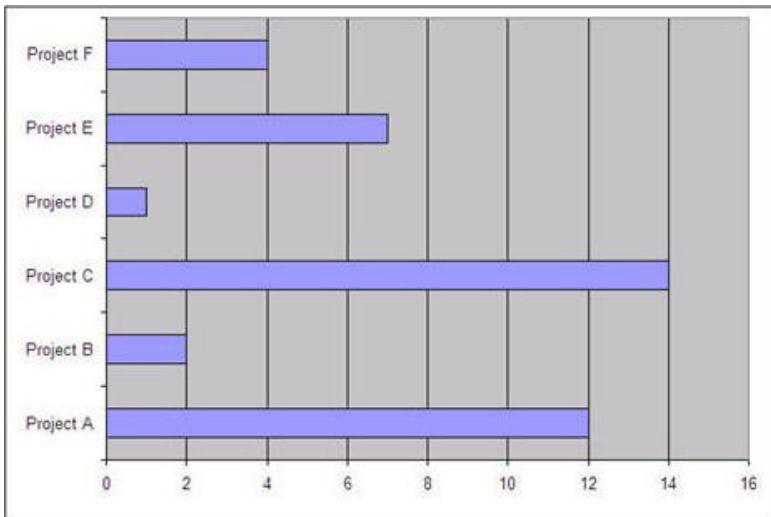


Figure 74: Chart with unnecessary, non-data pixels

Source: www.uxmatters.com, Mike Hughes

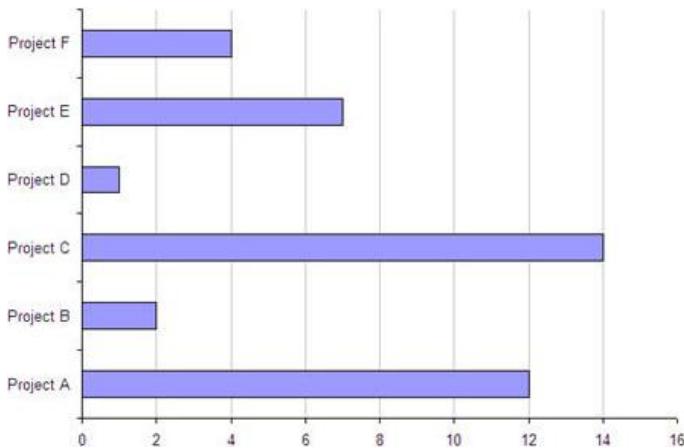


Figure 75: Chart with unnecessary non-data pixels removed

Source: www.uxmatters.com, Mike Hughes

- Another visual enhancement is toning down the grid lines to a softer gray—de-emphasizing the non-data pixels that remained

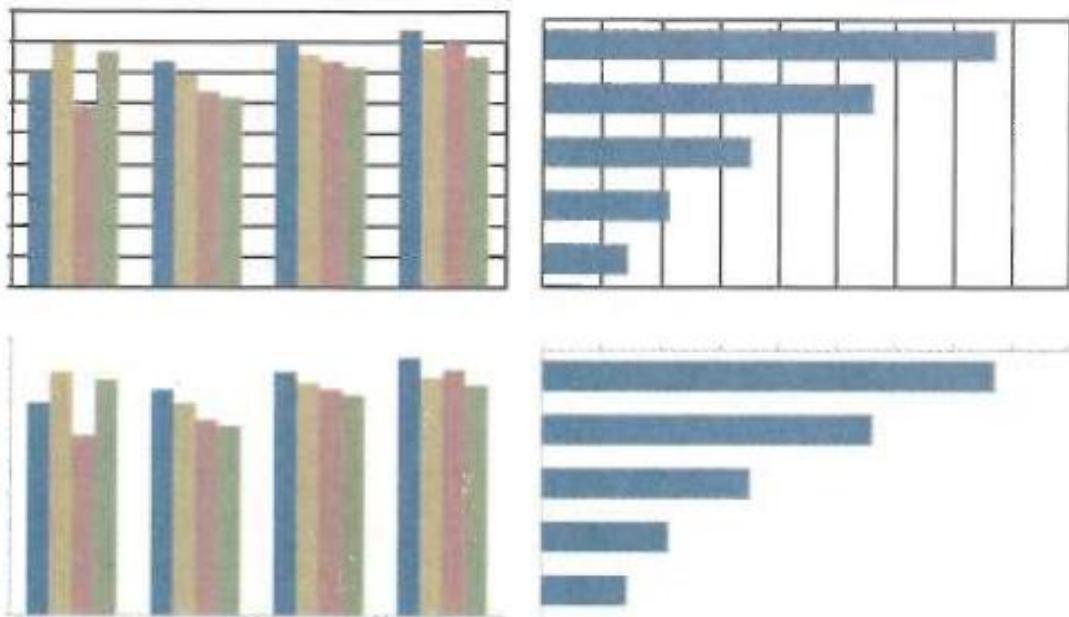


Figure 76: Chart with/without unnecessary lines
Source: Information Dashboard Design, Few

Selecting the type of chart to use

- Bar charts:
 - Comparing data across categories:
 - Volume of shirts in different sizes
 - Website traffic by origination site
 - % of spending by department
- Line charts:
 - Viewing trends in data over time:
 - Stock price change over a 5 yr period
 - Website page views during a month
 - Revenue growth by quarter
- Pie charts:
 - Showing proportions:
 - Percentage of budget spent on different departments
 - Response categories from a survey
 - Breakdown of how Americans spend their leisure time
- Map charts:
 - Showing geocoded data:
 - Insurance claims by state
 - Product export destinations by country, car accidents by zip code
 - Custom sales territories

- Scatter plot:
 - Investigating the relationship between different variables:
 - Male vs. female likelihood of having cancer at different ages
 - Shipping costs of different product categories to different regions
- Bubble:
 - Showing the concentration of data along two axes:
 - Sales concentration by product and geography
 - Class attendance by department and time of day
- Histogram:
 - Understanding the distribution of data:
 - Number of customers by company size
 - Student performance on an exam
 - Frequency of a product defect
- Bullet:
 - Evaluating performance of a metric against a goal:
 - Sales quota assessment
 - Actual spending versus budget
 - Performance spectrum (excellent/good/poor)
- Heat map:
 - Showing relationship between two factors:
 - Segmentation analysis of target market
 - Product adoption across regions
 - Sales leads by individual rep

UI design principles

Introduction

UI importance for users

- Basic reality of application development:
 - User interface is the system to the users
- Users want applications that:
 - Meet their needs
 - Are easy to use

Developer issue

- Too many developers think that they are artistic geniuses:
- Do not bother to follow UI design standards or invest the effort to make their applications usable
- Mistakenly provide importance to items that are not critical, such as:
 - Writing superior code
 - Implementing an eye-catching color scheme

Importance of UI design

- Good UI allows users to work with the application without having to read manuals or receive training
- More intuitive the user interface, the easier and less expensive it is to use
- Better the UI:
 - Easier it is to train people to use it, which reduces training costs
 - Less the help users will need to use it, reducing support costs
 - More the users will like to use it and their satisfaction will increase

Basic principles of UI design

Structure principle

- Structure principle is concerned with overall user interface architecture
- Design should organize the UI purposefully in meaningful and useful ways based on:
 - Clear, consistent, models that are apparent and recognizable to users
 - Putting related items together and separating unrelated items
 - Differentiating dissimilar items and making similar items resemble one another

Simplicity principle

- Design should:
 - Make simple, common tasks simple to do
 - Communicate clearly and simply in the user's own language
 - Provide good shortcuts that are meaningfully related to longer procedures

Visibility principle

- Design should keep all needed options for a given task visible without distracting the user with extraneous or redundant information
- Good designs do not:
 - Overwhelm users with too many alternatives
 - Confuse users with unnecessary information

Feedback principle

- Design should keep users informed of:
 - Actions or interpretations
 - Changes of state or condition
 - Errors or exceptions that are relevant and of interest to them
- Communication should be through clear, concise, and unambiguous language familiar to users

Reuse principle

- Design should reuse internal and external components and behaviors
- Design should maintain consistency

Tolerance principle

- Design should:
 - Be flexible and tolerant, reducing the cost of mistakes and misuse by allowing undoing and redoing
 - Prevent errors, wherever possible, by tolerating varied inputs and sequences, and interpreting all reasonable actions

More visual tips

Effect of gradients of fill color

- Color gradients, in the background and the bars as well, add distracting non-data pixels

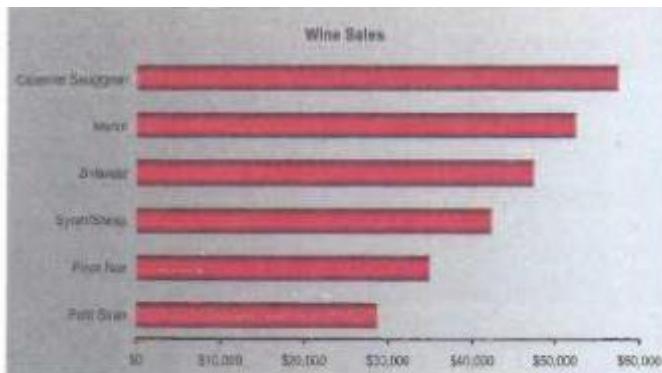


Figure 77: Color gradients

Source: Information Dashboard Design, Few

Mute axis lines

- Axis lines used to define the data region of a graph are typically useful
- Can be muted as shown on the right chart

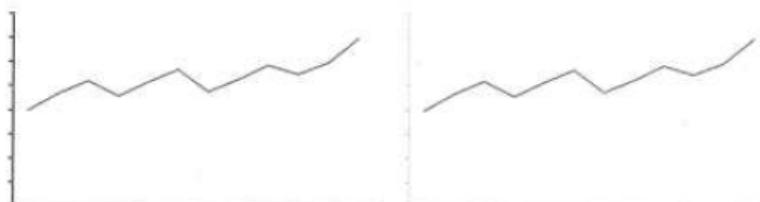


Figure 78: Muting axis lines

Source: Information Dashboard Design, Few

Mute lines and borders

- Lines, borders or fill colors can be used to delineate data sections when white space is insufficient
- Keep line weight and color intensity to a minimum, as shown in the lower section of Figure 79

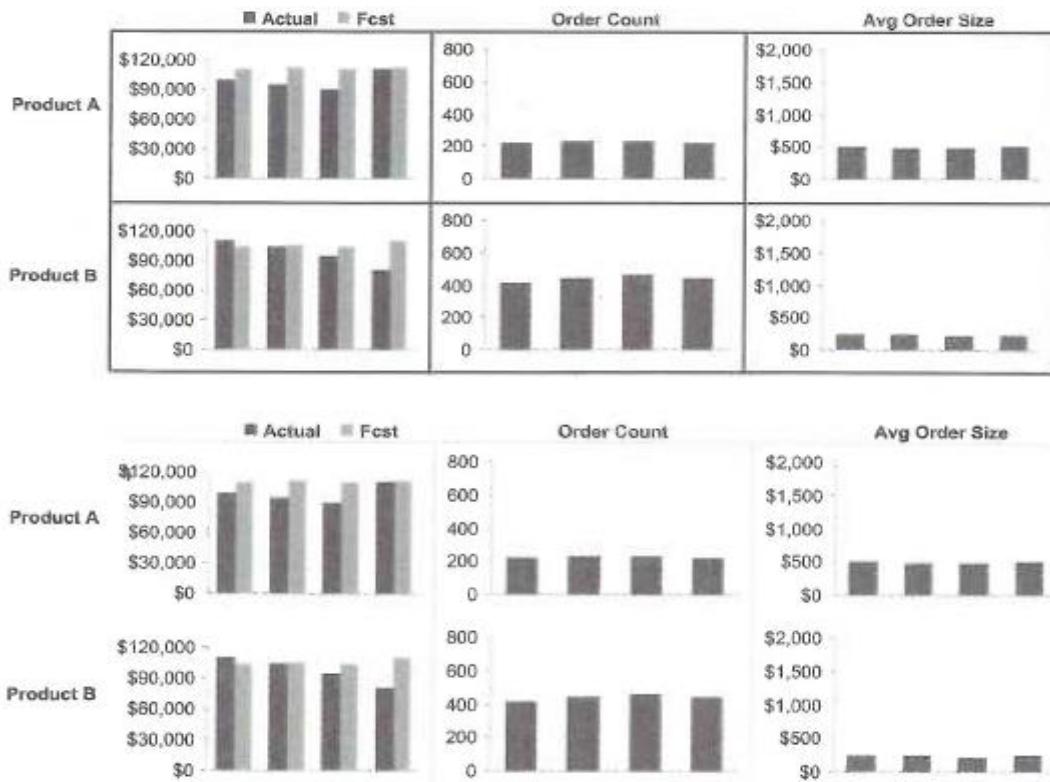


Figure 79: Muting line borders
Source: Information Dashboard Design, Few

Gridlines and fill muted

- Grid lines are rarely useful
- Are among the most prevalent forms of distracting non-data pixels found on dashboards
- Grid lines in tables, especially thick ones, can make displays visually difficult

Salesperson	Jan	Feb	Mar	Salesperson	Jan	Feb	Mar
Robert Jones	2,834	4,838	6,131	Robert Jones	2,834	4,838	6,131
Mandy Rodriguez	5,890	6,482	8,002	Mandy Rodriguez	5,890	6,482	8,002
Terri Moore	7,398	9,374	11,748	Terri Moore	7,398	9,374	11,748
John Donnelly	9,375	12,387	13,024	John Donnelly	9,375	12,387	13,024
Jennifer Taylor	10,393	12,383	14,197	Jennifer Taylor	10,393	12,383	14,197
Total	\$35,890	\$45,464	\$53,102	Total	\$35,890	\$45,464	\$53,102

Figure 80: Gridlines in tables
Source: Information Dashboard Design, Few

- Use fill colors to delineate rows when rows are wide
- Fill colors on the left could have been avoided

Salesperson	Jan	Feb	Mar	Salesperson	Jan	Feb	Mar
Robert Jones	2,834	4,838	6,131	Robert Jones	2,834	4,838	6,131
Mandy Rodriguez	5,890	6,482	8,002	Mandy Rodriguez	5,890	6,482	8,002
Terri Moore	7,398	9,374	11,748	Terri Moore	7,398	9,374	11,748
John Donnelly	9,375	12,387	13,024	John Donnelly	9,375	12,387	13,024
Jennifer Taylor	10,393	12,383	14,197	Jennifer Taylor	10,393	12,383	14,197
Total	\$35,890	\$45,464	\$53,102	Total	\$35,890	\$45,464	\$53,102

Figure 81: Fill colors in tables
Source: Information Dashboard Design, Few

- Use grid lines and/or fill color in tables when white space alone cannot adequately delineate columns and/or rows
- Lower table is muted

Product	Jan	Feb	Mar	Q1 Total	Apr	May	Jun	Q2 Total	YTD Total
Product A	93,993	84,773	88,833	267,599	95,838	93,874	83,994	273,706	541,305
Product B	87,413	78,839	82,615	248,867	89,129	87,303	78,114	254,547	503,414
Product C	90,036	81,204	85,093	256,333	91,803	89,922	80,458	262,183	518,516
Product D	92,737	83,640	87,646	264,023	94,557	92,620	82,872	270,048	534,072
Product E	83,733	75,520	79,137	238,390	85,377	83,627	74,826	243,830	482,220
Total	447,913	403,976	423,323	1,275,212	456,705	447,346	400,264	1,304,314	2,579,526

Product	Jan	Feb	Mar	Q1 Total	Apr	May	Jun	Q2 Total	YTD Total
Product A	93,993	84,773	88,833	267,599	95,838	93,874	83,994	273,706	541,305
Product B	87,413	78,839	82,615	248,867	89,129	87,303	78,114	254,547	503,414
Product C	90,036	81,204	85,093	256,333	91,803	89,922	80,458	262,183	518,516
Product D	92,737	83,640	87,646	264,023	94,557	92,620	82,872	270,048	534,072
Product E	83,733	75,520	79,137	238,390	85,377	83,627	74,826	243,830	482,220
Total	447,913	403,976	423,323	1,275,212	456,705	447,346	400,264	1,304,314	2,579,526

Figure 82: Muted table display
Source: Information Dashboard Design, Few

Gestalt principle of proximity

- Can be used to encourage vertical or horizontal scanning
- Natural inclination: Scan horizontally as rows on left and vertically as columns on right

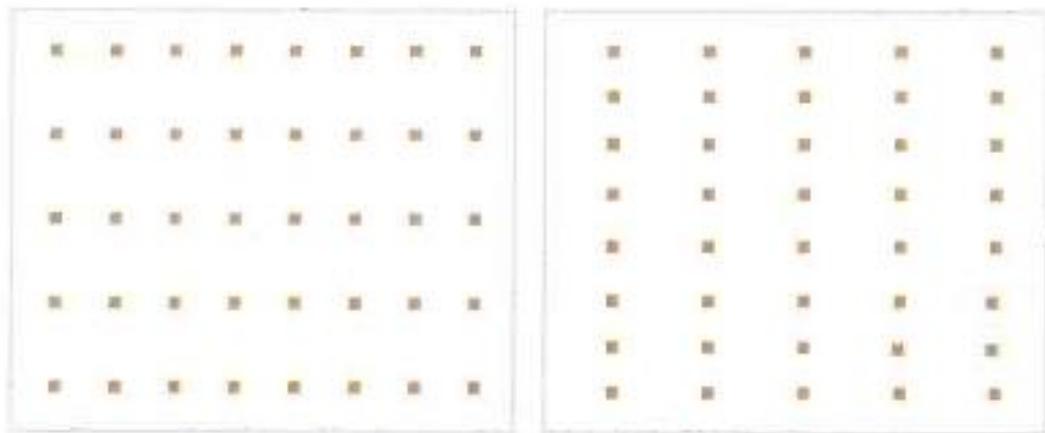


Figure 83: Principle of proximity
Source: Information Dashboard Design, Few

Module 10: Dashboard design and visualization tips

Design and navigation tips

General

Three symptoms of a less than successful solution

- Avoid three symptoms:
 - Too flat
 - Too manual
 - Too isolated

User needs and preferences should be the top priority

- Taking user preferences and business needs into account will ensure a business-driven dashboard solution
- Given user and business requirements and preferences:
 - IT must design the dashboard according to guidelines that will ensure user acceptance
 - These guiding principles are often different compared to how IT develops applications for day-to-day business operations
- Different interfaces must be adapted for different user needs and groups

Limit KPIs used

- Limit the information to what is necessary:
 - Having too many KPIs will submerge the truly important ones
- Include KPIs that measure the important activities and not simply the activities that are easily measurable

Don't disregard familiar and widespread solutions

- At least initially (this particularly concerns spreadsheet programs)
- Dashboard solution should:
 - Leverage existing solutions and
 - Offer the capability to export the results to these widely used solutions

Ensure consistency

- Ensure user interface works consistently
- If double-clicking on items in one list makes something happen, then:
 - Double-clicking on items in any other list should generate the same type of action
- Put buttons in consistent places on all windows
- Use the same wording in labels and messages

- Use a consistent color scheme
- UI consistency enables users to build an accurate mental model of the way it works
- Accurate mental models lead to lower training and support costs

Explain the rules

- Users need to know how to work with the application
- When an application works consistently:
 - Rules have to be explained only once
 - Eliminates need to explain to users, in detail, how to use each application feature

IT administration

- Assure easy administration:
 - Allow the dashboard to remain flexible to changing user demands, thereby becoming truly business driven
- Automate what is regularly analyzed and reported:
 - Do not force the user to spend time on repetitive tasks, which will help ensure user acceptance
- Ensure plenty of support so that dashboards can be efficient and trouble-free

Navigation tips

Pay attention to navigation between major UI items

- Navigation between major user interface items should be well designed
- If it is difficult to navigate from one screen to another, users will quickly become frustrated
- If the flow between screens matches the user's work flow, the application will make sense to the user
- Since different users work in different ways, system needs to be flexible enough to support their various approaches
- User interface flow diagrams should be developed, optionally, to further the understanding of the UI flow

Expect users to make mistakes

- Accidental deletions are to be expected
- Design the user interface to recover from mistakes made by users

Organize screen navigation

- Navigation within a screen is important
- In Western societies, people read left to right and top to bottom:

- Since users are familiar with this, organize screens left to right and top to bottom when designing the user interface
- Organize navigation between widgets in a manner familiar to users

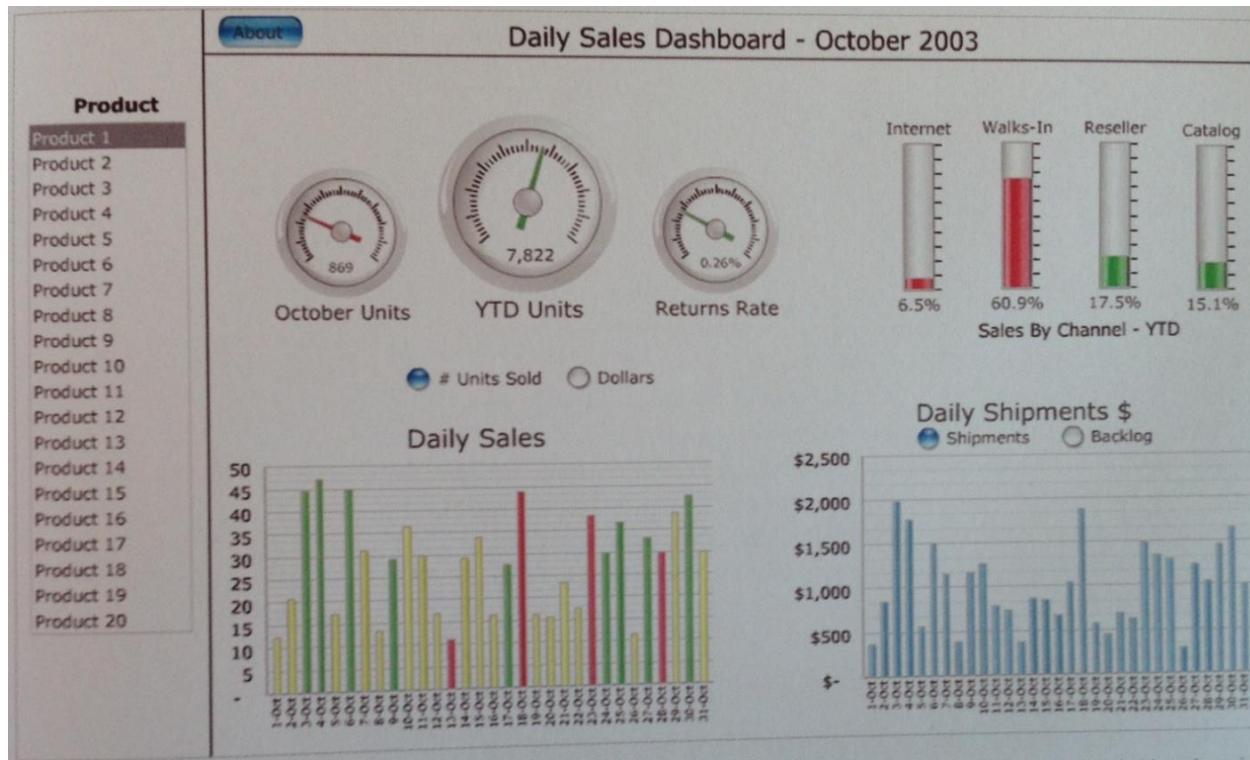


Figure 84: Navigation required for each product
Source: Information Dashboard Design, Few

Visualization tips

UI and visual tips

Set and enforce standards

- To ensure consistency within an application:
 - Set user interface design standards
 - Stick with them
- When developing the UI:
 - It will be discovered that stakeholders often have some unusual ideas regarding how the UI should be developed
 - Listen to those ideas but also make the stakeholders aware of:
 - Corporate UI standards
 - Need for conformity

Word messages and labels effectively

- Text displayed on the screens is the primary source of information for users:
 - If text is worded poorly, the interface will be perceived poorly by the users
 - Use full words and sentences, as opposed to abbreviations and codes, which will make text easier to understand
- Messages should be worded positively:
 - Imply that the user is in control
 - Provide insight into how to use the application properly
 - For example, which message do you find more appealing?
 - “You have input the wrong information” or
 - “An account number should be eight digits in length”
- Messages should be:
 - Worded consistently
 - Displayed in a consistent place on the screen

Understand the UI widgets

- Use the right widget for the right task:
 - Helps increase the application consistency, and
 - Probably makes it easier to build the application
- To learn how to use widgets properly, review the corporate UI standards and guidelines

Beware of other applications' limitations

- Unless verified that another application follows the corporate UI standards and guidelines, don't assume the application is doing things right
- Reviewing the work of others is always a good idea
- Too many developers make the mistake of imitating the UI of poorly designed software
- Be careful until you can distinguish between good and bad UI design

Use color appropriately

- Color should be used sparingly
- Be aware that some users may be color blind
- If using color for highlighting, do something else to make it stand out for such users
- Use colors consistently so that there is a common look and feel throughout the application
- Avoid variations in color that don't encode any meaning

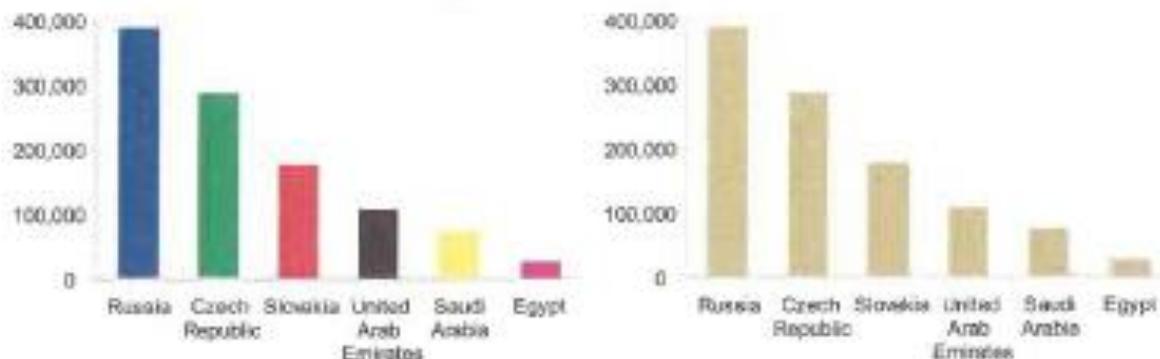


Figure 85: Unnecessary use of colors
Source: Information Dashboard Design, Few



Figure 86: Unnecessary fill colors used to separate display sections
Source: Information Dashboard Design, Few

Follow the contrast rule

- Follow the contrast rule if color is used in the application
- Ensure that the screens are still readable:
 - Use dark text on light backgrounds and light text on dark backgrounds
 - Reading blue text on a white background is easy
 - Reading blue text on a red background is difficult
 - Not enough contrast exists between blue and red to make it easy to read
 - Lot of contrast exists between blue and white

Align fields effectively

- When a screen has more than one editing field, organize the fields so that it is:
 - Visually appealing
 - Efficient
- Best way to do so is to left-justify edit fields:
 - Make the left-hand side of each edit field line up in a straight line, one over the other
 - Corresponding labels should be right-justified and placed immediately beside the field, which is a clean and efficient way to organize fields on a screen

Design should be intuitive

- If users don't know how to use the software, they should be able to use it by making educated guesses
- Even when the guesses are wrong:
 - System should provide reasonable results from which the users can readily understand and, ideally, learn

Do not create busy user interfaces

- Crowded screens are:
 - Not easy to understand
 - Difficult to work with
- Overall density of the screen should not exceed 40% or so

Group items effectively

- Items that:
 - Are logically connected should be grouped together on the screen
 - Have nothing to do with each other should be separated
- Use white space between collections of items to group them; boxes can be put around them to accomplish the same objective

Presentation tips

Charts

Use appropriate charts

- Use bar graphs for showing category series because they make the text easier to read

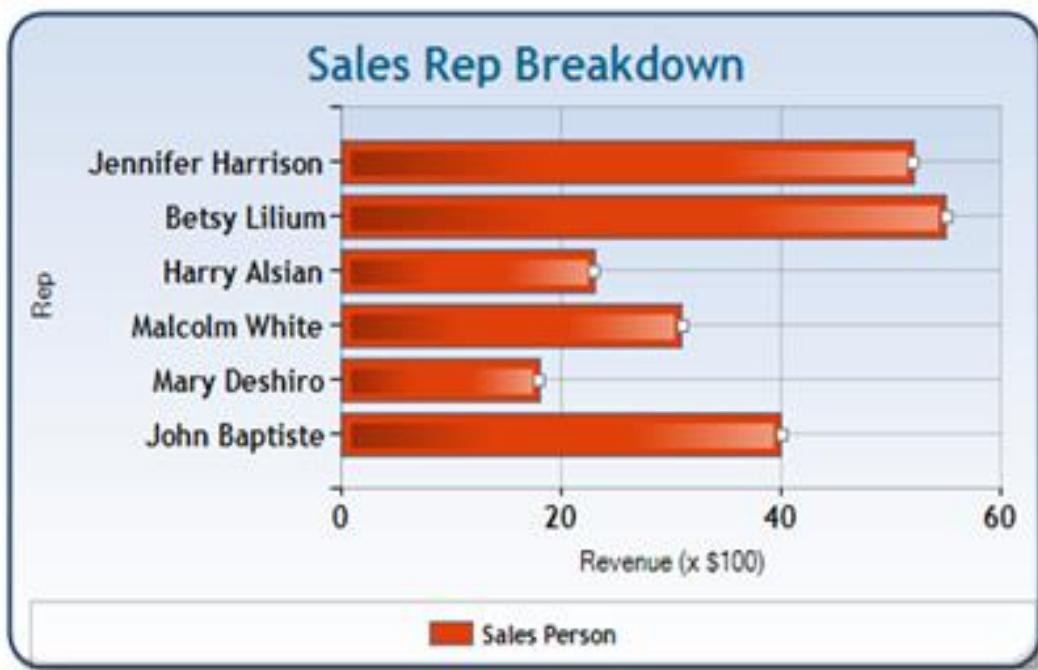


Figure 87: Bar chart

Source: <http://www.dundas.com/discover/article/the-art-of-dashboard-design/>

Give charts meaningful titles

- Can eliminate the need for axis titles, which can free some valuable screen real estate

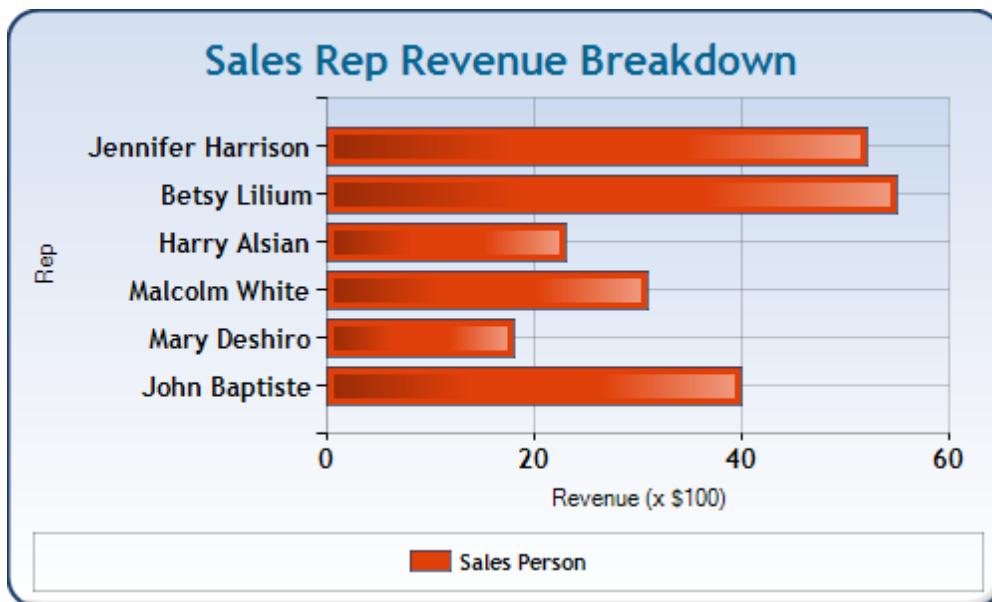


Figure 88: Chart with meaningful title

Source: <http://www.dundas.com/discover/article/the-art-of-dashboard-design/>

Gauge styling

For pointers, be careful with using similar colors

- Using colors that are similar for pointers can make it difficult for some users to distinguish between the pointers



Figure 89: Pointers with similar colors

Source: <http://www.dundas.com/discover/article/the-art-of-dashboard-design/>

Pick a base color as the starting point for one pointer

- Find complementing colors for the other pointer(s)
- If more than two pointers are needed:
 - Rethink the gauge
 - Will the user be able to read the pointers at a glance?



Figure 90: Gauge with too many pointers

Source: <http://www.dundas.com/discover/article/the-art-of-dashboard-design/>

Use a legend to distinguish pointers

- Typically there are at least two pointers:
 - Actual value
 - Benchmarking value (such as an average or a target)

Use global legends

- If multiple gauges show the same metrics, global legend can:
 - Save space
 - Reduce the proliferation of redundant information



Figure 91: Unified legend saving space

Source: <http://www.dundas.com/discover/article/the-art-of-dashboard-design/>

Use gauge style appropriately

- Gauge style (circular, linear) choice:
 - Depends on the type of information being presented
 - Usually depends on the overall layout
- For example, pick:
 - Linear or semi-circular gauges when the work area is not in a square aspect ratio (The **aspect ratio** of an image describes the proportional relationship between its width and its height)
 - Fully-circular gauges when the area is in a square aspect ratio

Use neutral color for the gauge background

- Use a neutral color for the gauge background to pop the overlaid elements (such as the pointer and scale)



Figure 92: Neutral background to make pointers pop out

Source: <http://www.dundas.com/discover/article/the-art-of-dashboard-design/>

Choose a complementary color for the target color

- Pick a:
 - Bold color for the actual value pointer, and
 - Complementary color for the target color
- If corporate color is neutral, use a strong primary color such as blue or red for the pointer

Range colors

- For ranges, use colors that depict what the range implies, such as:
 - Green to reflect a good range
 - Red for bad

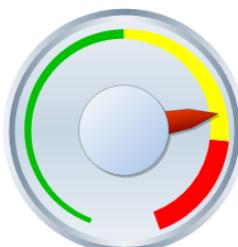


Figure 93: Gauge (with ranges indicating good, fine, or bad values)

Source: <http://www.dundas.com/discover/article/the-art-of-dashboard-design/>

Scale labeling

- Labels for the scale:
 - Should generally be kept at a minimum as they tend to overlap when there are many tick marks
 - Keeping a small font size (10pt) should also provide more visibility to the scale

Don't underestimate the UI importance

- UI of an application will often make or break it
- Application functionality provided to users is important:
 - Way in which it provides that functionality is equally important
 - Application that is difficult to use won't be used, even if it is technically superior or provides enhanced functionality

Tips to guarantee dashboards work effectively

- Organization:
 - Organize information to support its meaning and use
 - Organize groups according to activities, entities, and use
 - Co-locate items that belong together
 - Expose lower level conditions
 - Maintain consistency to enable quick and accurate interpretations
- Comparisons:
 - Delineate groups using the least visible means
 - Support meaningful comparisons
 - Discourage meaningless comparisons
- Display and visualization:
 - Put supplementary information within reach
 - Use pop-up windows where possible
 - Make the experience aesthetically pleasing
 - Choose appropriate and meaningful colors
 - Use high-resolution text and images
 - Align content whenever appropriate
 - Use a legible font
- Monitoring:
 - Provide audio alerts
 - Prevent excessive alerting
 - Accommodate real-time monitoring
 - Keep viewers in the loop
 - Reduce information to what's essential
 - Provide a means to halt updates
 - Enable time stamp alerts

Module 11: Dashboard design mistakes

Common mistakes identified by Stephen Few

1. Exceeding the boundaries of a single screen
2. Supplying inadequate context for the data
3. Displaying excessive detail or precision
4. Expressing measures indirectly
5. Choosing inappropriate display media
6. Introducing meaningless variety
7. Using poorly designed display media
8. Encoding quantitative data inaccurately
9. Arranging information poorly
10. Highlighting important information ineffectively or not at all
11. Cluttering the display with visual effects
12. Misusing or overusing color
13. Designing an unattractive visual display

Exceeding the boundaries of a single screen

Benefit of displaying consolidated information

- Provides convenience for viewer
- Saves valuable time
- Paints a complete picture that can bring to light important connections that might not be visible otherwise

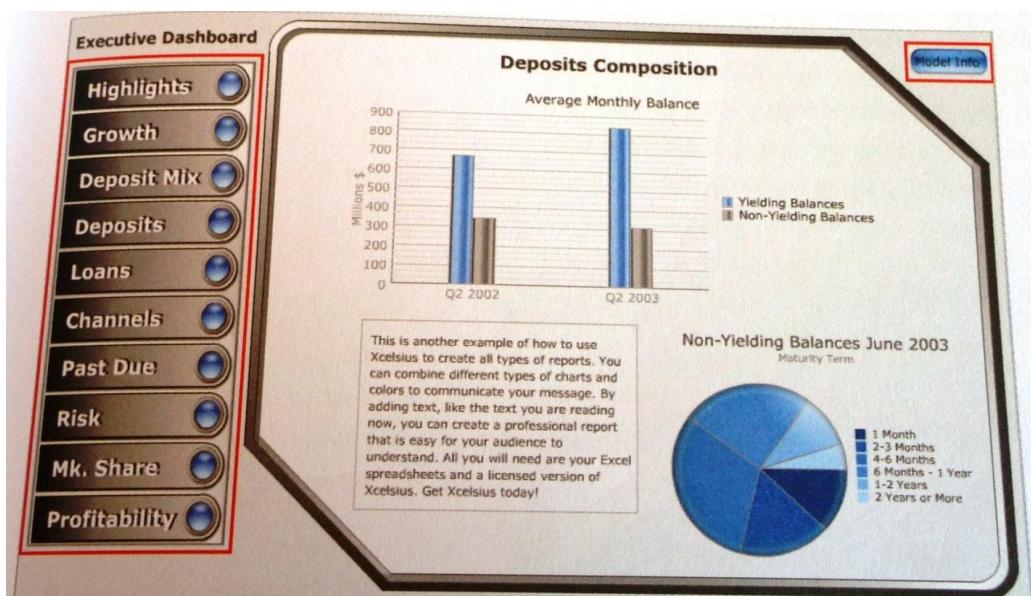


Figure 94a: Incomplete picture (Source: Information Dashboard Design, Few)



Figure 94b: Incomplete picture (Source: Information Dashboard Design, Few)

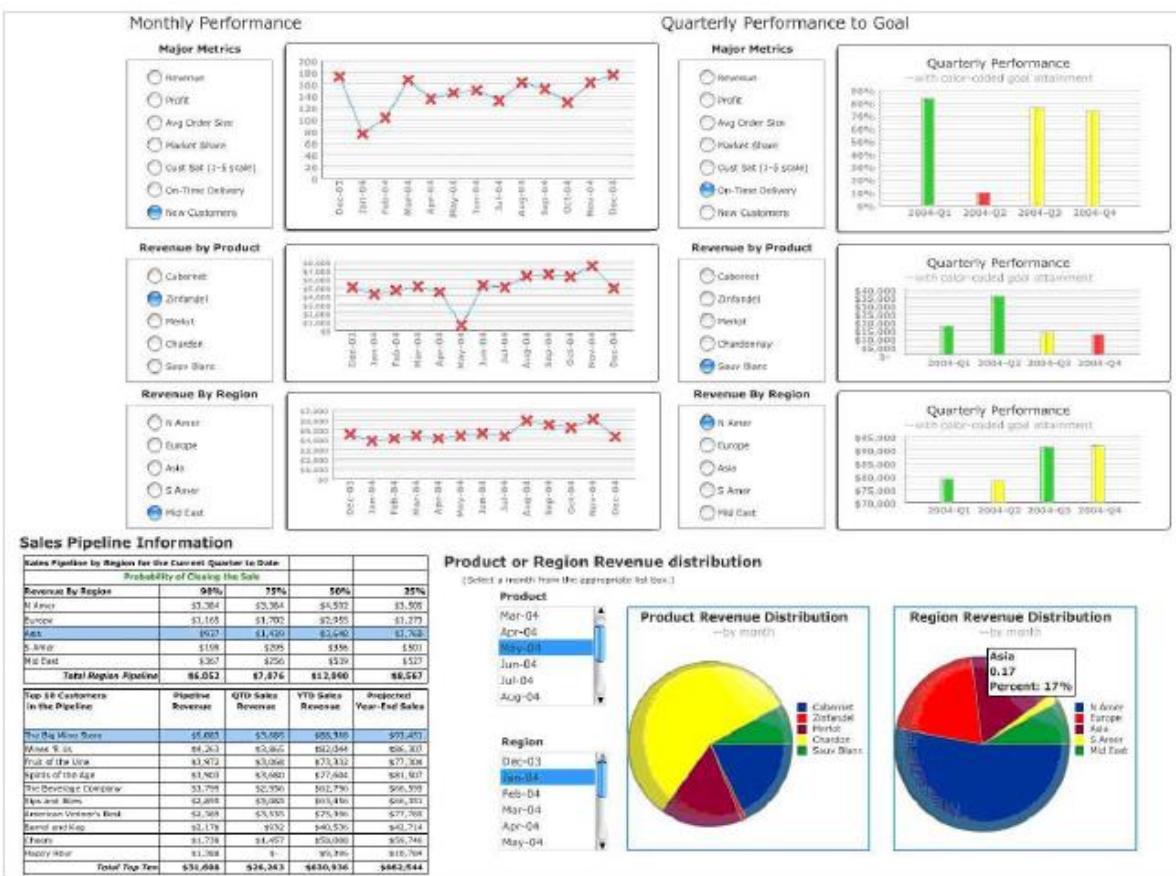


Figure 95: Fragmented dashboard (Source: Information Dashboard Design, Few)

- Sales dashboard fragments data into many slices by requiring users to select individual pieces without any means to see the whole picture

Impact of hidden data

- Something critical is sacrificed when a viewer loses sight of some data and, in order to see the rest, has to:
 - Scroll down
 - Scroll over
 - Move from screen to screen
- Part of the problem is that humans can only hold a few chunks of information at a time in short-term memory
- Relying on the mind to retain a visualization that is no longer visible is usually ineffective
- Benefit of dashboards is the ability to simultaneously see everything that one needs
- Another dashboard design defect is that:
 - Data is often fragmented into separate screens
 - Data that a user might need to monitor is fragmented into tiny slices on the dashboard
- Tip: Use radio buttons or list boxes to narrow views

Supplying inadequate context for the data

Quantitative data can be insufficient

- For monitoring the business, dashboards are usually populated predominantly with current quantitative measures
- Measures of what is currently going on in the business, however, rarely do well as a solo act:
 - They need a good supporting cast to get their message across
 - QTD number...is it good/bad? How bad? Are we on track?
- Right context for the key measures makes the difference between numbers that just sit there on the screen compared to those that enlighten and inspire action

Enriching the display

- Measures of what is currently going on can be enriched by providing:
 - One or more comparative measures, such as a target or some history
 - Quick visual means for assessing the measure's qualitative state (such as good, satisfactory, or bad).
- For example, gauge in Figure 96:
 - Could have easily incorporated useful context
 - Falls far short of its potential
 - Other than estimating that net income is around \$3.5 million, gauge tells us nothing
 - Typical dashboard display media often provide little if any useful context for the measure that they present



Figure 96: Gauge without context

Source: Common pitfalls in dashboard design, Few

- Quantitative scale on a graph, such as suggested by the tick marks around the gauge in Figure 96:
 - Are meant to help interpret the measure
 - Can only do so effectively if the scale is labeled with numbers and enriched with context

Expressing measures indirectly

Measures poorly expressed should be avoided

- To express measures appropriately, understand exactly:
 - What viewers need to see
 - How they plan to use the information
- For a measure to be meaningful, viewers must know:
 - What is being measured
 - Units in which the measure is being expressed
- Measure is poorly expressed if it fails to directly, clearly, and efficiently communicate the meaning that the dashboard viewer must determine

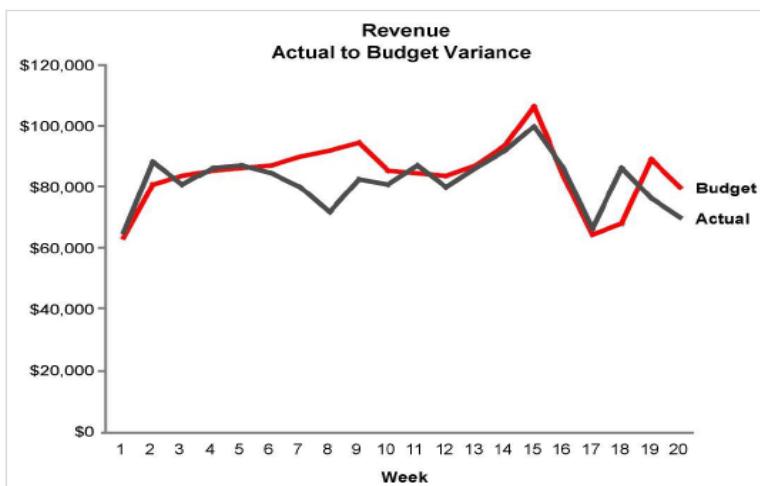


Figure 97: Graph fails to express the variance amount directly

Source: Common pitfalls in dashboard design, Stephen Few

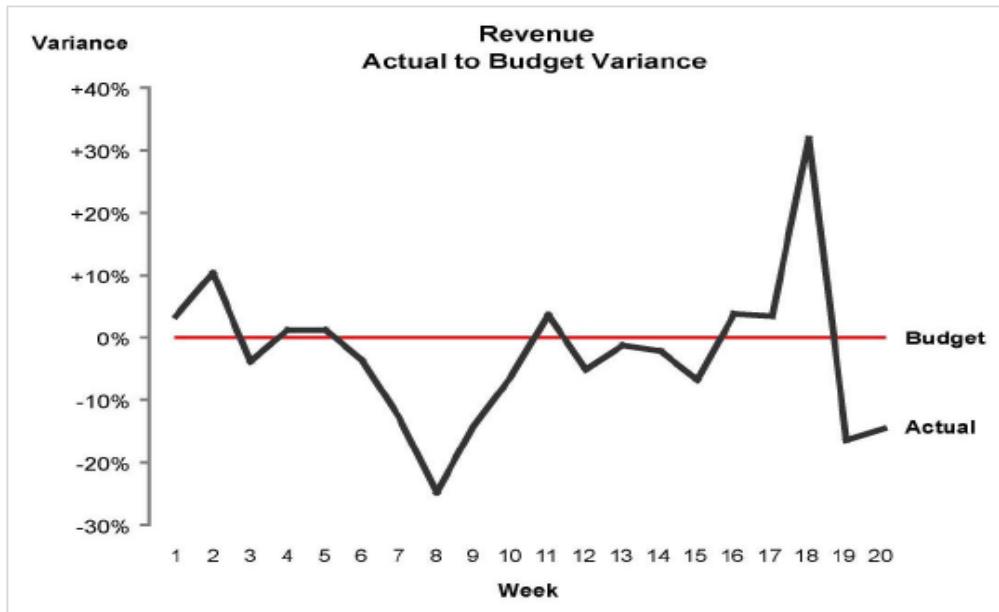


Figure 98: Graph directly expressing variance between actual and budgeted revenue, making it much easier to analyze

Source: Common pitfalls in dashboard design, Stephen Few

Example of poorly expressed measures

- If dashboard viewer only needs to know difference between actual (\$76,934) and budgeted revenue (\$85,000):
 - Instead of displaying the two numbers (and leaving it to the viewer to calculate the difference)
 - Better approach is to directly display the variance amount
- In many cases:
 - Instead of displaying the variance amount as -\$8,066
 - Express the variance as a percentage (like -10%)

Benefit of using percentages

- Focuses attention on the variance itself, rather than the raw difference (such as in dollars).
- Makes it easier to compare variances of multiple items when their actual values differ significantly in scale:
 - Example: Variances of actual from budgeted expenses for several departments, each with its own budget
- Small department's over-budget amount of \$5,000:
 - Can be more troubling than a large department's over-budget amount of \$50,000
 - This can become obvious if the variance are expressed as a percentage

Presentation media and variety mistakes

Unappealing visual display

- Some dashboards are just ugly or unappealing
- When a dashboard is unattractive or unpleasant to look at, viewer is put in a frame of mind that is not conducive to its effective use

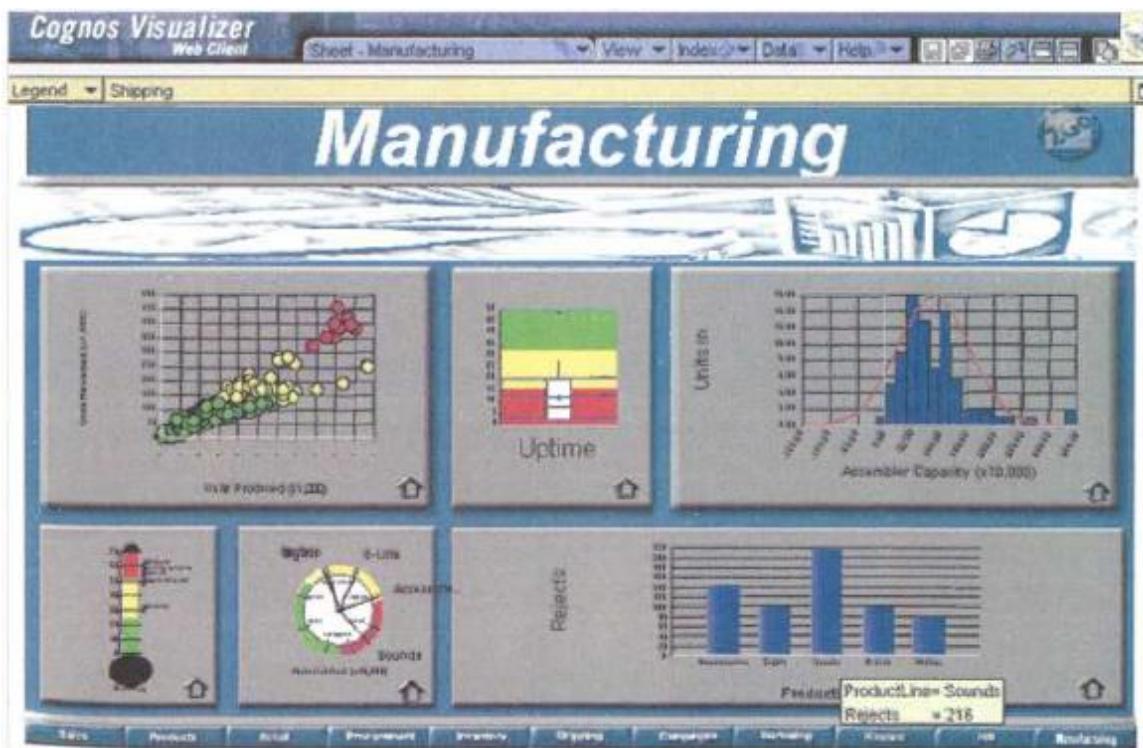


Figure 99: Unattractive dashboard (Source: Information Dashboard Design, Few)

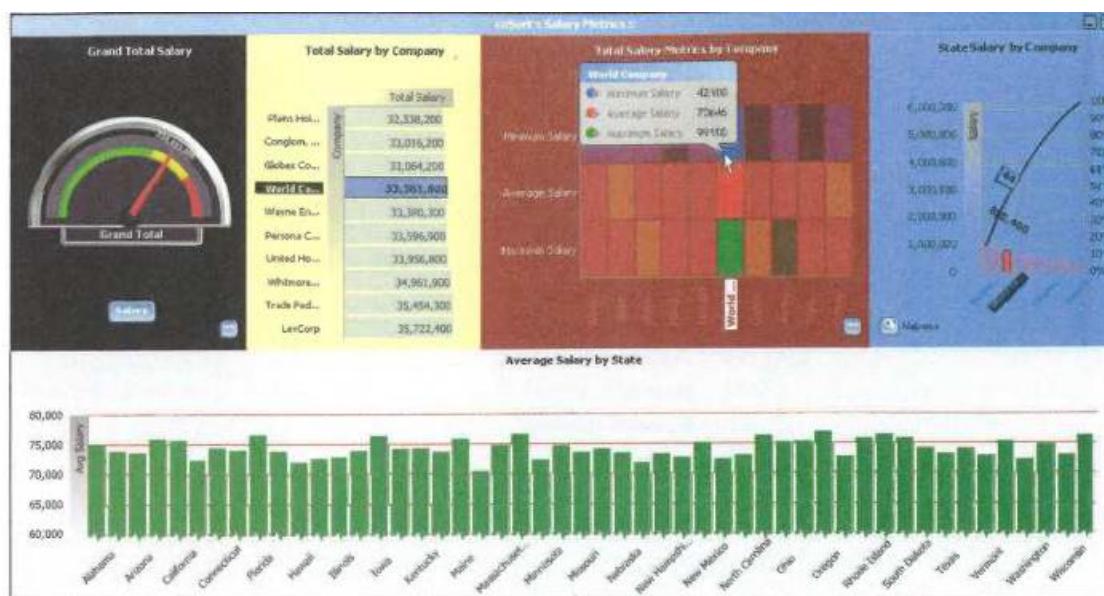


Figure 100: Ugly dashboard (Source: Information Dashboard Design, Few)

- Interactive Infographic extends tendency to merge information and art

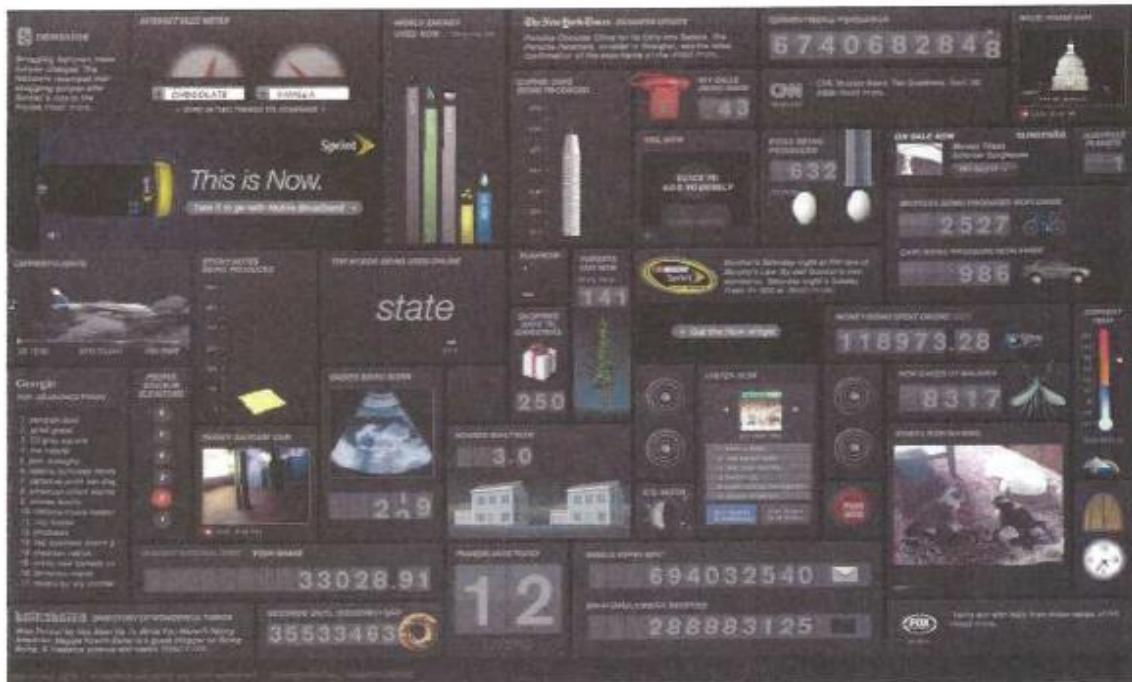


Figure 101: Infographic (Source: Information Dashboard Design, Few)

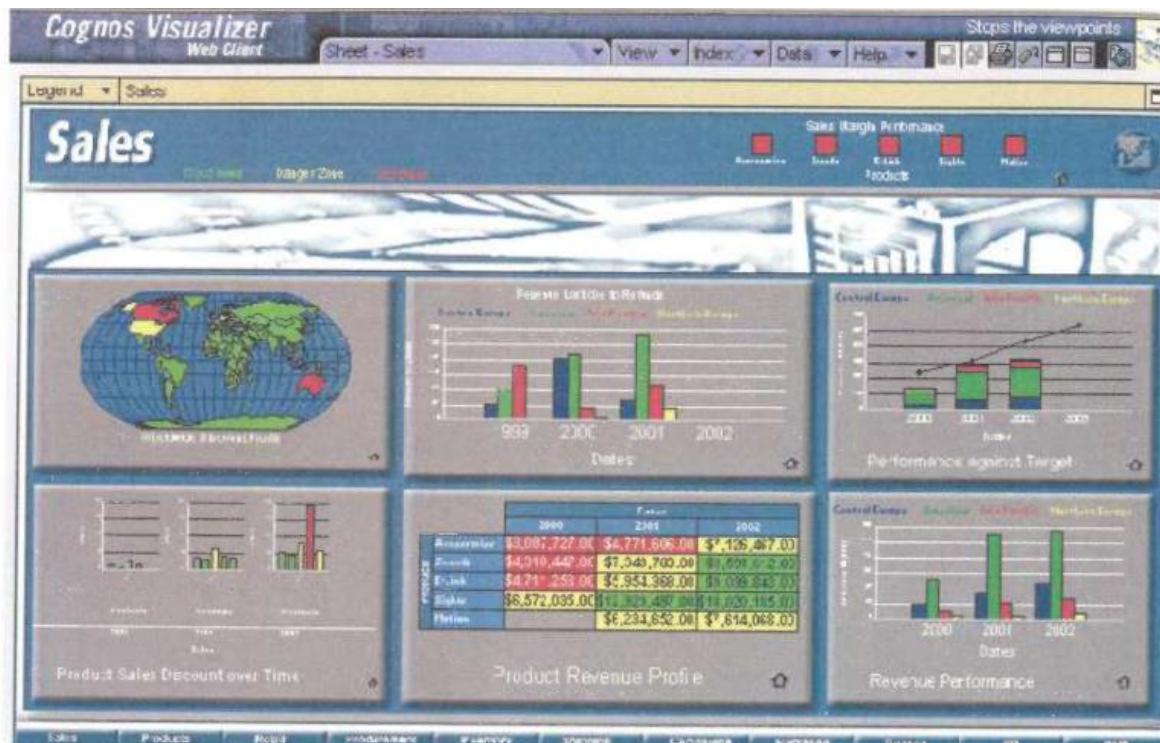


Figure 102: Dashboard with table + 5 graphs (emphasizing graphics)

Source: Information Dashboard Design, Few

Usage of inappropriate presentation media is a common mistake

- Is one of the most common design mistakes—not just on dashboard but in all forms of data presentation
- Using a graph when a table of numbers will work better, and vice versa, is a frequent mistake
- More common is using the wrong type of graph for the data and its message
- If slices of a pie cannot be interpreted in a useful way without reading the associated numbers, what use is the picture?
 - If numbers must be read to determine how pie chart slices relate to one another, might as well use a table instead
- Use graphs when the picture itself reveals something important, which cannot be communicated as well by a table of numbers

Display variety need not be encouraged

- Designers often hesitate to repeat display medium (like bar charts) on a dashboard:
 - Assumption is that viewers will get bored
- Variety might be the spice of life, but if introduced on a dashboard for its own sake, the display suffers
- Always select display type that works best, even if that results in a dashboard filled with multiple instances of the same graph type
- If users are provided information that they desperately need:
 - Data won't bother them even if it is displayed without display variation
 - They will be unhappy if they are forced to work harder than they should to obtain the information they need, due to unnecessary variety
- Display consistency, whenever appropriate:
 - Allows viewers to use the same perceptual strategy for interpreting data
 - Saves users valuable time and effort

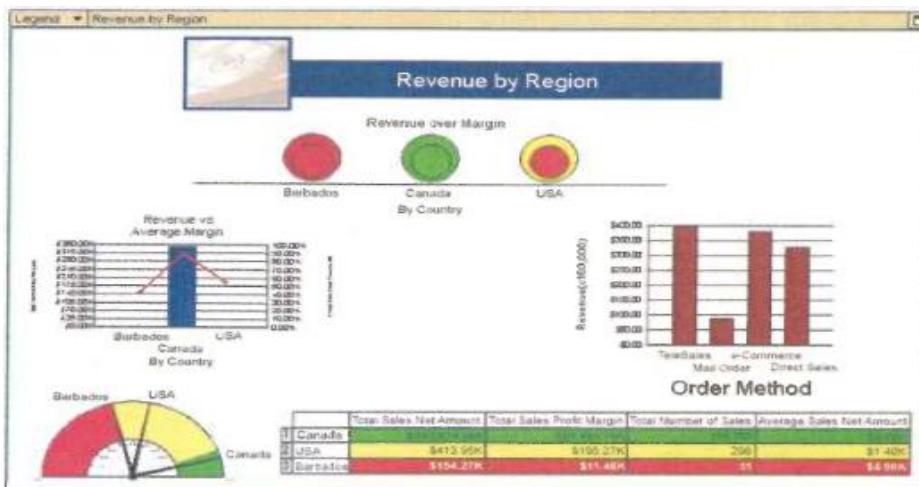


Figure 103: Dashboard exhibits an unnecessary variety of display media

Source: Information Dashboard Design, Few

Hindering communication due to design problems

- After deciding how the information and message are displayed, components of that display need to be designed so that communication is clear and efficient without any distraction
- Several design problems can hinder communication:
 - Distracting bright bar colors
 - 3-D effect that can make the bars hard to read
- Simple design mistakes like these can undermine the dashboard success

Data issues

Excessive detail or precision on dashboards

- Dashboards should never display information more detailed or precise than necessary to support their objective of rapid monitoring:
 - Avoids forcing viewers to process levels of data irrelevant to the task at hand
- Too many details or measures expressed too precisely slow down users without any benefit:
 - Example: \$3,848,305.93 rather than \$3,848,306 or perhaps even \$3.8M
- With a dashboard, every unnecessary piece of information results in wasted time and is unacceptable when time is of the essence

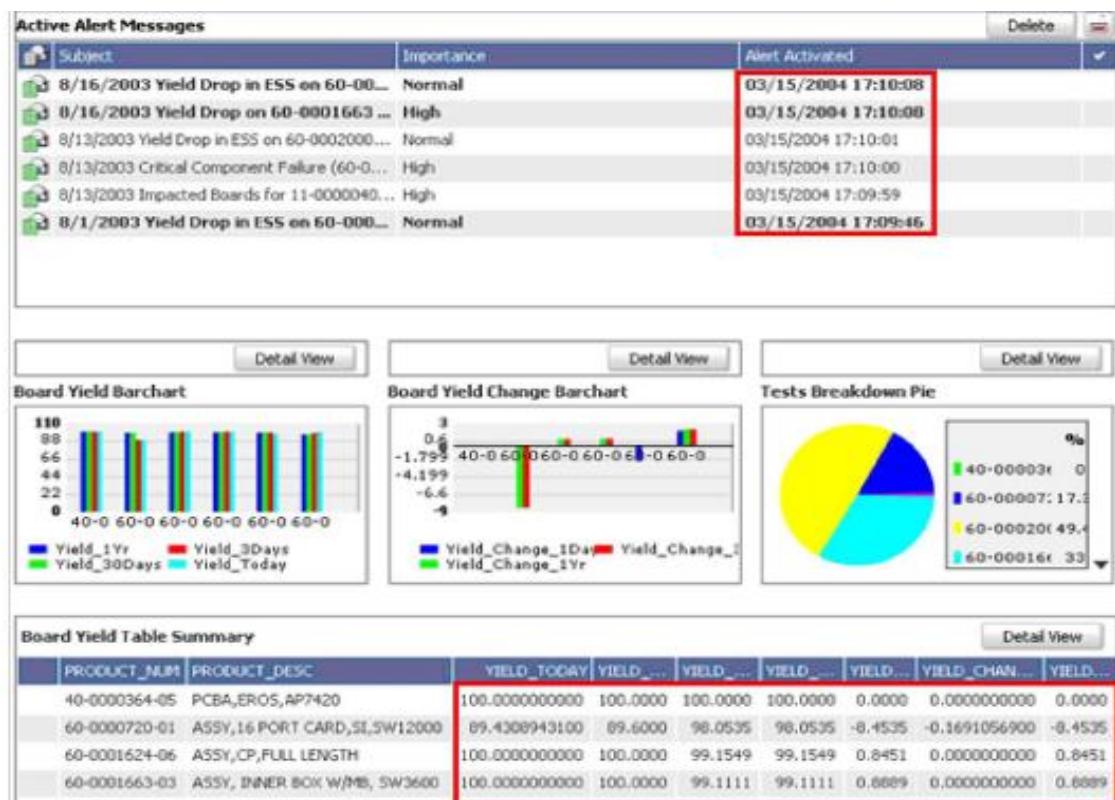


Figure 104: Dashboard displays excessive levels of detail and precision

Source: Common pitfalls in dashboard design, Stephen Few

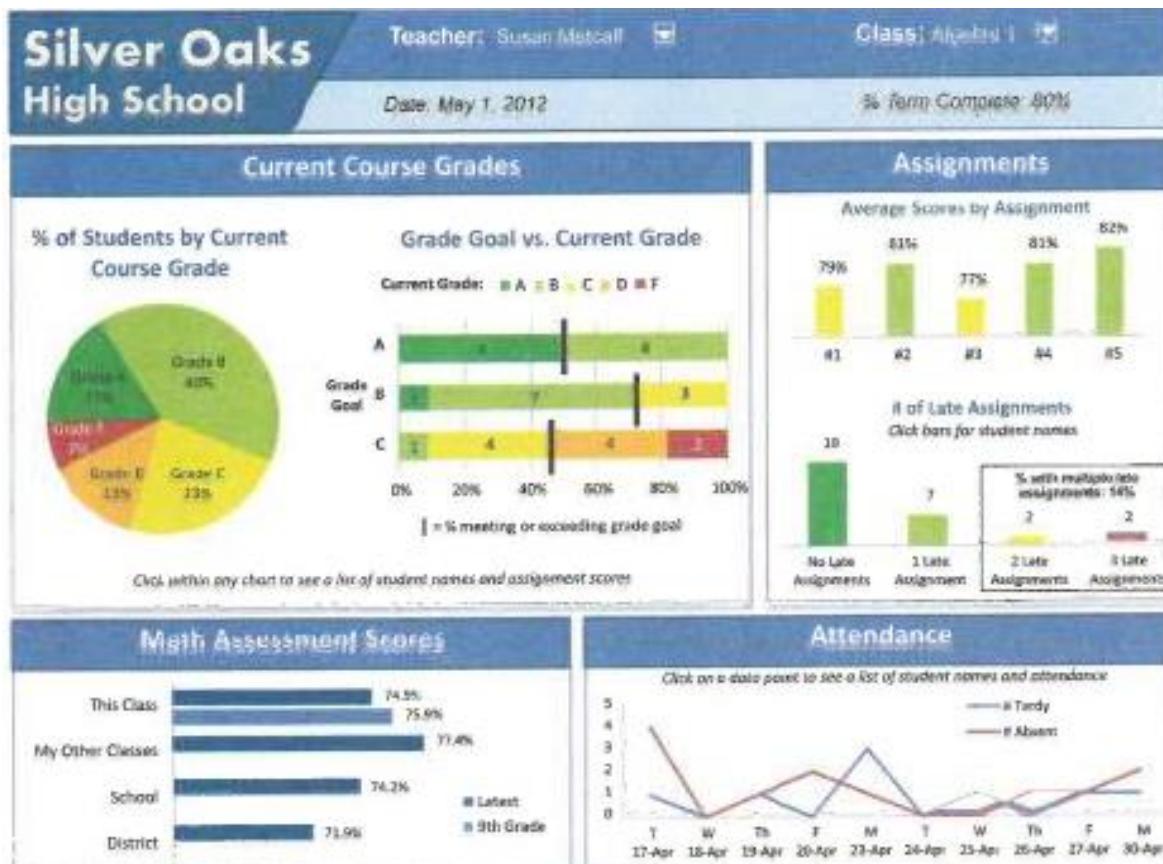


Figure 105: Too high level data (Source: Information Dashboard Design, Few)

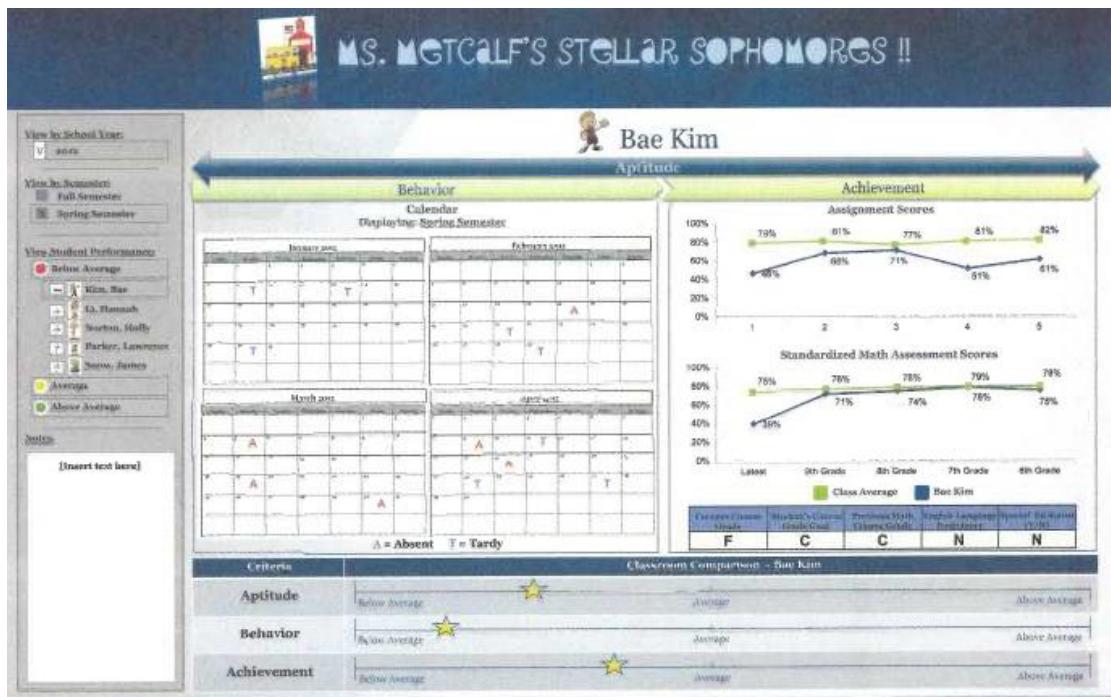


Fig. 106: Too focused data: Single student (Source: Information Dashboard Design, Few)

Visual objects encoding

- When a graph is used to communicate quantitative data:
 - Values are encoded in the form of visual objects, such as the bars on a graph
- Visual objects should accurately encode the values so that they:
 - Can be compared to one another
 - Enable understanding of relationships
- Sometimes graphical representations of quantitative data are poorly designed—in ways that display quantities inaccurately:
 - Example: Improper scales when comparing costs and revenues

Poor arrangement of data on the dashboard

- When designing a dashboard, do not arbitrarily cobble together information or the result will be a cluttered mess
- Dashboard should be organized:
 - With appropriate placement of information
 - Based on the importance and desired viewing sequence
 - With visual design that segregates data into meaningful groups without fragmenting it into a confusing mess
- Goal is not simply to make the dashboard look good; rather to arrange data so that it fits the way it is used:
 - Most important data should be prominent
 - Data requiring immediate attention should stand out
 - Data to be compared must be arranged and visually designed in a way that encourages comparison
- Do not waste prime real estate
- Ensure that the dashboard does not lack an appropriate visual balance based on the nature and importance of the data

Highlighting, décor and color mistakes

Do not make everything prominent on a dashboard

- Ineffective highlighting is a common issue
- If everything on a dashboard is visually prominent and vying for attention, nothing in particular will grab a user's attention:
 - When this happens, the dashboard has failed
- When a user looks at a dashboard:
 - Eyes should immediately be drawn to the most important information
 - Everything should be visually prominent, nothing should stand out (except the exceptions or items to be highlighted)
- All data displayed on a dashboard should be important, but not all data are equally important
- When monitoring the business, eyes must be drawn to items that need the most and immediate attention

Avoid screen clutter

- Due to their visual nature:
 - Dashboards tend to get dressed up with unnecessary decoration
 - Decorative flourishes are unnecessary
- Even those who enjoy the decoration upon first sight will grow weary of it in a short time
- User must not need to process to get to the data
- Do not clutter the screen with useless decoration

Avoid misusing or overusing color

- Color can be used in powerful ways to:
 - Highlight data
 - Encode data
 - Create a relationship between individual dashboard items
- Color is frequently overused and misused:
 - Use of too many colors can be visually assaulting
 - When overused, color loses its power to highlight what is most important
- Example of color overuse:
 - No reason to assign different colors to bars if they are already labeled along the axis
 - Wastes user's time, whether consciously or unconsciously, in the search for the non-existent meaning of the differences in color

Selecting colors

- Choices must be made thoughtfully, based on:
 - Understanding of how people perceive color
 - Significance of color differences
- Some colors are hot and demand attention, while others are cooler and less visible
- When any color appears as a contrast to the norm:
 - Eyes pay attention
 - Brain attempts to assign meaning to that difference
- Keep in mind that 10% of males and 1% of females are color blind
- Common problem is the use of too many colors, especially bright colors
- Since dashboards are often densely packed with information, visual content must be kept as simple as possible
- Keep colors subdued and neutral, except when using color to highlight something important

Module 12: Design problems for real-time operational dashboards

Problems associated with real-time operational dashboards

- Too much complexity
- Too many alert conditions
- Alerts that cannot be differentiated
- Overwhelming visuals
- Distracting visuals
- Inappropriate visual salience
- Mismatch between information and its visual representation
- Indirect expression of measures
- Not enough context

These will now be described in more detail in the following sections.

Information overload or complexity

Impact of too much information or complexity

- Most dashboards can display a lot of information without overwhelming users through information overload or complexity
- Real-time dashboards must be:
 - Monitored frequently
 - Responded to quickly at a moment's notice
 - Somewhat simpler
- Lot of information can be quickly assimilated from a properly designed dashboard; however:
 - High level of information density works differently for different dashboard types
 - What works well for dashboards that are viewed once a day, and responded to without urgency, will exceed the practical perceptual limits of real-time monitoring
- Besides the amount of information, the level of complexity that works for a dashboard depends entirely on the expertise of its users:
 - Chart that can overwhelm and confuse some users might seem simple to others, because it is familiar and they know what to look for
 - Appropriate boundaries for level of complexity cannot be established arbitrarily or generalized
 - Where the lines are drawn depends entirely on the audience

Information that should not be displayed

- Do not display more information than can be quickly scanned and understood
- How much is too much depends a great deal on how it is presented
- Some poorly designed displays cannot be scanned and understood in any amount of time, even though they contain only a few measures
- If a chart is difficult to read, no reduction in the amount of information will change that fact
- When properly designed, numerous values can sometimes appear on a single chart in a way that is easy to scan and understand

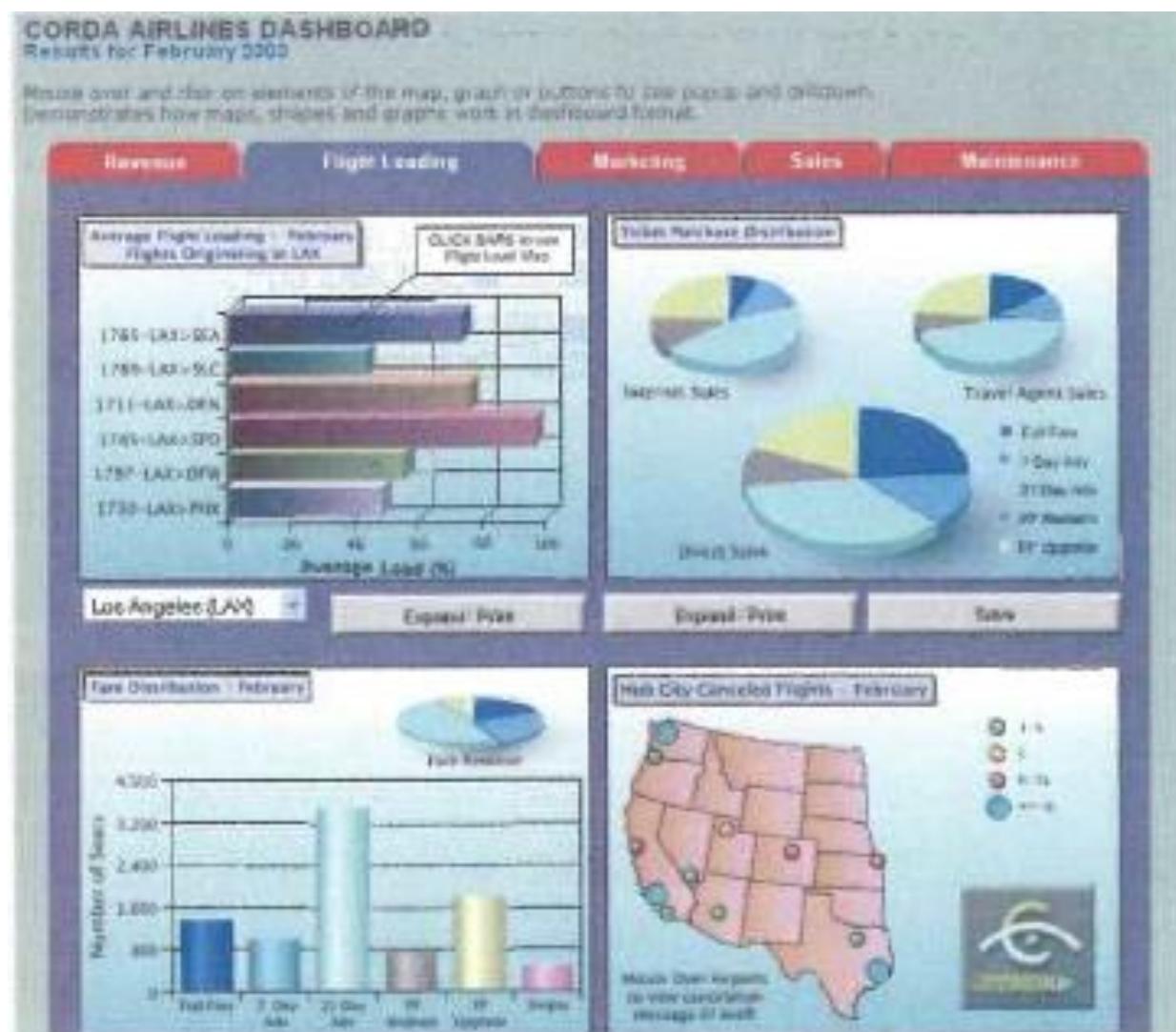


Figure 107: Dashboard with clutter of instructions
Source: Information Dashboard Design, Few

Alerts

Avoid too many alerts

- If alarms go off frequently but rarely require a response, users soon learn to ignore them
- Dashboard alarms should not be like car alarms that are routinely ignored
- Be conservative when determining the conditions that trigger alarms
- Do not demand immediate attention to circumstances that can wait
- Use visual or auditory means only to draw attention to information that requires an urgent response.
- If status is fine, it is not advisable to draw attention to the fact; for example:
 - Many dashboards that use color coding, score every single item on the dashboard as good, satisfactory, or bad
 - When this is done, abundance of color makes the few items that really need attention much harder to pick out from the rest
- Alerts need not be restricted to conditions that are bad; they can also be used to highlight good conditions
- Whether attention is required should be determined:
 - By the requirement for a response
 - Not by something being in bad or good status

Differentiating alerts

- Colors most frequently used in dashboards to assign qualitative assessments to data are green, yellow, and red:
 - Despite being prolific, they have limitations
 - 10% of males and 1% of females cannot distinguish between green and red due to color blindness
- Only reason that traffic lights work for people with this perceptual deficiency:
 - Their meanings are encoded by their position
 - Top for red, middle for yellow, and bottom for green
- Mistake to qualitatively encode too many items on a dashboard:
 - Abundance of colors makes it harder to spot exceptional items really needing attention
- If possible, stick with a single visual means to draw attention to specific items on the dashboard, such as a simple icon like the red circle
- On a real-time dashboard for situation awareness:
 - Do not use more than two types of alerts
 - Instead of using different hues to differentiate them:
 - Use a single hue but vary its intensity from light to dark or pale to bright
 - Even color blind users will have no problem distinguishing them

Overwhelming and distracting visuals

Avoid overwhelming visuals

- Prevalent problem associated with the use of color on dashboards:
 - Often too much of it
 - Experts in the use of color for graphical communication tend to use it sparingly
- Too many colors or colors that are too bright:
 - Are visually overwhelming
 - Result in displays that are hard to look at—definitely not the desired reaction
- Use differences in color:
 - Only to indicate differences in data, and
 - Only when some other visual means will not work as well
 - For example, if the dashboard information naturally falls into four different groups:
 - Use a different color in the background of each section to delineate them
 - Alternatively, light borders or perhaps even white space alone will do the job without an unnecessary abundance of color

Best use of color on a dashboard

- Make specific items stand out from the rest
- Red dots in Figure 107 appear next to items requiring attention:
 - Assuming that the color red has not been used elsewhere, and
 - General tone of the dashboard is neutral in color, then
 - Such items can be easily spotted
- Notice how much easier it is to identify the items needing attention in the display in the right figure, compared to the same items in the display on the left

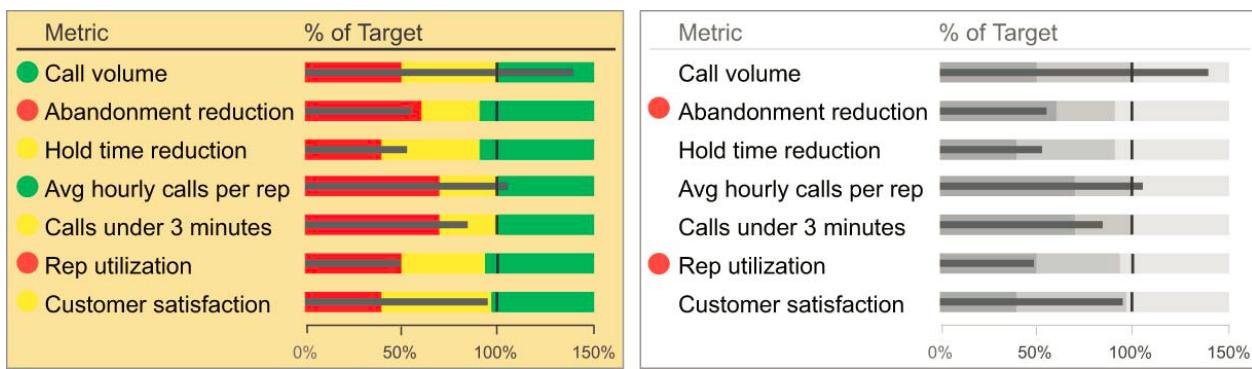


Figure 108: Appropriate versus excessive use of color

Source: Dashboard design for real-time situation awareness, Stephen Few



Figure 109: Appropriate versus excessive use of color

Source: Information Dashboard Design, Few

Avoiding distracting visuals

- Partly due to their visual nature, people have a tendency to dress up dashboards with all sorts of visual nonsense
- Any visual content that does not express data or is not necessary to support the presentation of data in some useful way is a distraction
- Dashboards are not an appropriate venue for artistic expression:
 - They are displays used to monitor important information

- Dashboard information should stand out clearly without competition
- Figure 110 shows a dashboard dressed up to look like something that it is not: some sort of electronic control board



Figure 110: Inappropriate design for a business dashboard
Source: Dashboard design for real-time situation awareness, Few

- Looks like an actual dashboard, down to the sunshine glare on the surface of the gauges, which requires squinting to read them
- When glare is encountered in the real world, it is annoying, so what possible purpose could it serve on a computer display?
- Such graphical design, which requires talent:
 - Is suitable for video games and training simulators
 - Not suitable for information dashboards
- Strive to display each piece of information in the way that communicates directly, clearly, accurately, efficiently, and comprehensively

Visual salience

Avoid inappropriate visual salience

- Visual salience: Degree to which it stands out
- All information that deserves space on a dashboard is important (or should be); however:
 - Not all information is of equal importance
- On a call center dashboard:
 - Some items are always more important than the rest
 - Example: Among performance measures tracked, perhaps the 3 most important are:
 - Current call hold time
 - Call duration
 - Abandoned call ratio
 - Due to their importance:
 - They deserve a prominent location on the dashboard and need to stand out
 - Perhaps through a dark border surrounding them

- Other items not routinely important could be of utmost importance when something goes wrong and, therefore, demand attention:
 - Example: Not always a need to know how many agents are currently working; however, if their number drops below a critical threshold:
 - Measure takes on immediate importance; hence,
 - Attention needs to be drawn to it
 - On such occasions, visual salience should be increased

What to keep in mind when designing a dashboard

- Think hard about the relative importance of each item of information
- Control visual salience of the information to support each item's relative importance
- Incorporate ways of increasing visual salience of items when conditions demand that they stand out
- If everything on the dashboard is eye-catching, result is that nothing stands out
- Items can only be effectively highlighted if one begins with a fairly neutral and balanced display—except for the few items that are always important
- If color is used sparingly:
 - And reliance is mostly on soft, natural, and relatively neutral colors for most items (such as gray), then
 - Stage is set for using bright and dark colors to draw attention when needed

Example of inappropriate visual salience

- What is visually salient in the Figure 111 dashboard?
 - Everything
 - Therefore, nothing!

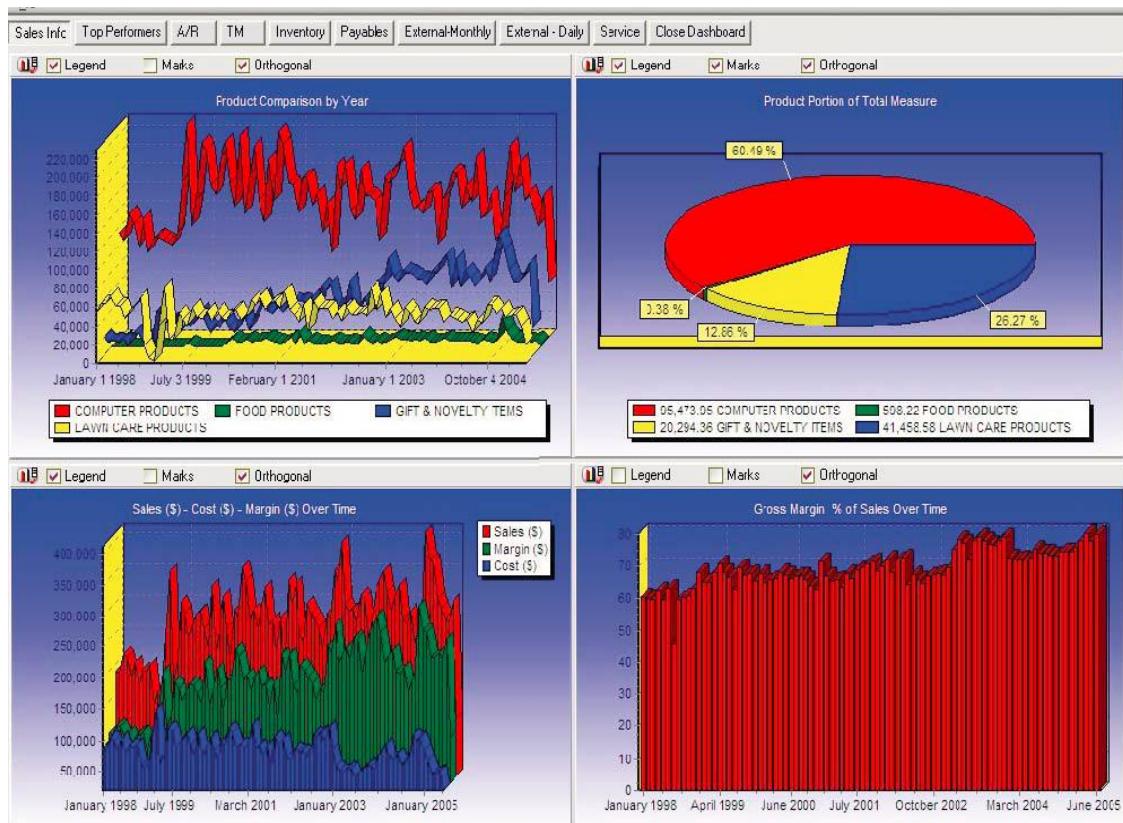


Figure 111: Inappropriate visual salience

Source: Dashboard design for real-time situation awareness, Stephen Few

Information and its visual representation

Avoid mismatch between information and its visual representation

- Information and its visual representation on a dashboard often become disconnected in two ways:
 - Visual medium of representation is inappropriate
 - Visual representation of values does not match the values themselves
- When information is displayed on a graph:
 - Any type of graph cannot be chosen at random
 - Different types of graphs are designed to display different types of information and to emphasize different features of the information
 - Figure 112 shows mismatch between the data and its graphical representation.

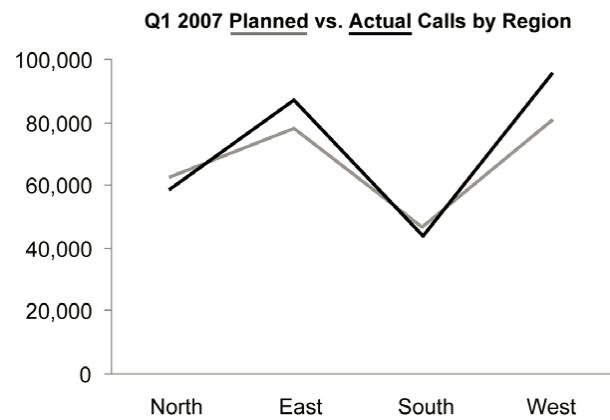


Figure 112: Mismatch between data and its graphical representation
Source: Dashboard design for real-time situation awareness, Stephen Few

- Figure 113 is another way to represent the same data

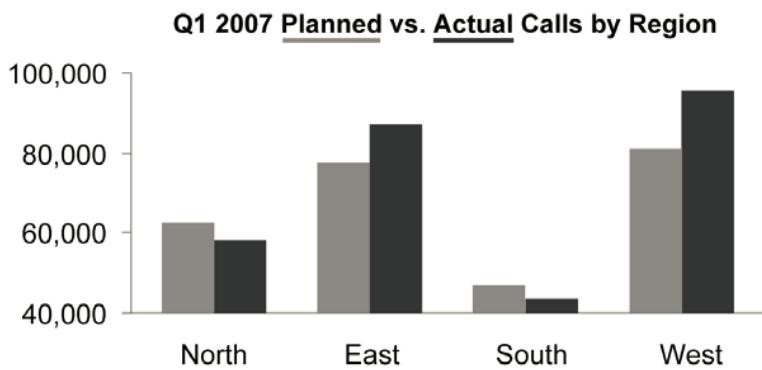


Figure 113: Another view of planned versus actual data
Source: Dashboard design for real-time situation awareness, Few

- Figure 114 is a bar graph that represents the same data but starts with a zero scale

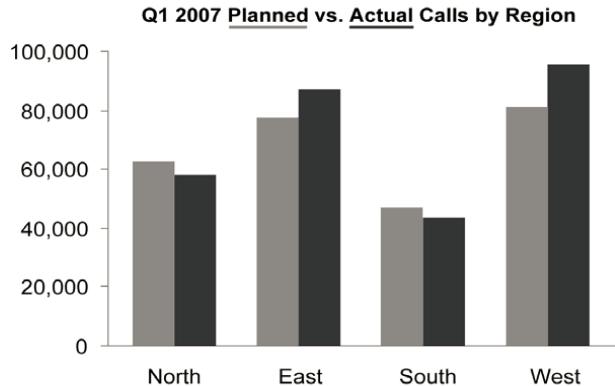


Figure 114: Bar graph starting with a zero scale

Source: Dashboard design for real-time situation awareness, Few

- Graph has a quantitative scale that begins at zero and extends upwards from there
- In Figure 113, scale started at 40,000
- Not necessary that quantitative scales on all graphs should begin at zero:
 - Suggested for bar graphs
 - Only when the scale begins at zero do the bar heights accurately encode their relative values
- When the bars begin at 40,000 (Figure 113):
 - Actual calls in the South region appear to have only reached about 50% of the plan
 - However, actual calls are roughly equal to 90% of the plan

Measures and context

Expressing measures indirectly

- Previous example displayed useful information; however, a better way to track performance would be to express it as a percentage deviation

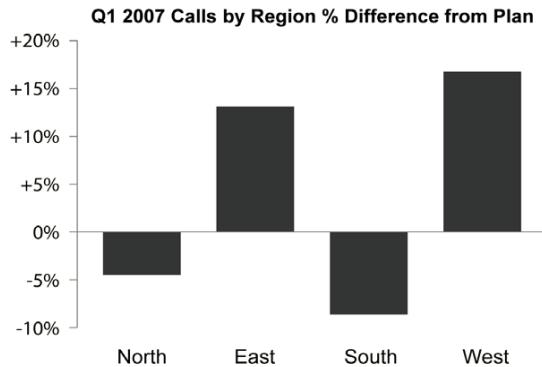


Figure 115: Performance expressed as a percentage

Source: Dashboard design for real-time situation awareness, Few

- On a dashboard, especially one used for real-time monitoring:
 - Determine how information will be used
 - Present it in a way that most directly supports that use

Provide context

- Numbers by themselves are not very helpful for monitoring performance
- Provide enough context so that it helps performance monitoring
- To be useful:
 - Results must be seen in context
 - Should be compared to other related numbers such as:
 - A target
 - Same measure a year ago
 - Historical measures at equal intervals of time (such as monthly)
- Many dashboards fail when they provide too little context for understanding presented numbers
 - For example, Figure 116 provides no context for understanding the measure



Figure 116: Chart with no context

Source: Dashboard design for real-time situation awareness, Few

- Gauge appears on a dashboard that was designed for monitoring supply chain performance:
 - Provides only one item: Value added earnings before interest and tax is \$8.00
 - Position of gauge needle means nothing because there are no values to label the scale
- In the next example, Figure 117, some context is provided



Figure 117: Chart with context

Source: Dashboard design for real-time situation awareness, Few

- Gauge provides qualitative context through the use of colors (assuming user is not color blind):
 - In most cases this is still not enough
- It can now be determined that total cost (% of sales) is 15% and satisfactory:
 - Useful for performance monitoring, but even this is rarely enough
- At what percentage would the total cost be considered bad?
 - In this gauge, it cannot be determined because the quantitative scale is not labeled
- Based on which standard is 15% satisfactory? Compared to a target?
 - If so, what is the target value?
 - How is performance compared to last month or last year?
 - Is current performance part of an upwards trend, a downwards trend, or perhaps erratic ups and downs?

Level of context to be included

- Any context that will help the dashboard viewer determine whether or not action needs to be taken should be included:
 - If the needle were pointing to the red region of the gauge, perhaps this dashboard can allow clicking on the gauge to obtain additional information
 - But why make this extra step necessary if this information can be included on the dashboard in a manner that does not complicate its use?
- In Figure 118, the same cost as a percentage of sales data has been displayed more meaningfully:

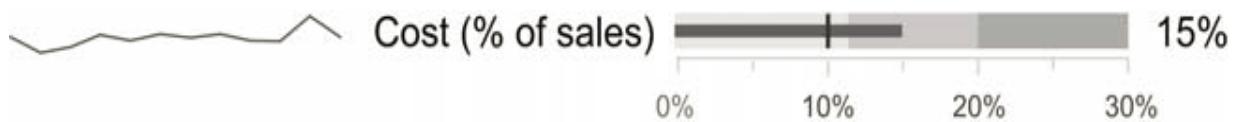


Figure 118: Bullet graph

Source: Dashboard design for real-time situation awareness, Stephen Few

- Graphic that appears to the right of the label is called a bullet graph

- Bullet graph:
 - Is more informative and less space-consuming replacement for a typical gauge
 - Dark horizontal bar represents the primary measure—in this case cost as a % of sales
 - Short dark vertical line represents a comparative measure—in this case, cost target
 - Varying shades of gray in the background assign qualitative ranges of performance:
 - Good on the left
 - Satisfactory in the middle
 - Poor on the right
- From this display, it can be determined:
 - Performance is satisfactory, and
 - Just how satisfactory it is by seeing how far the bar extends into the range
 - To be considered poor, costs must be 20% or above
- Squiggly line to the left of the label is called a sparkline:
 - Provides an abbreviated view of the past leading up to the present—in this case the prior 12 months
 - At a glance, it is possible to observe the ups and downs of costs; for example;
 - Last month's costs jumped way up; however,
 - Costs have come down again in this period
- Bullet graph variations: Horizontal and Vertical (Figure 119)

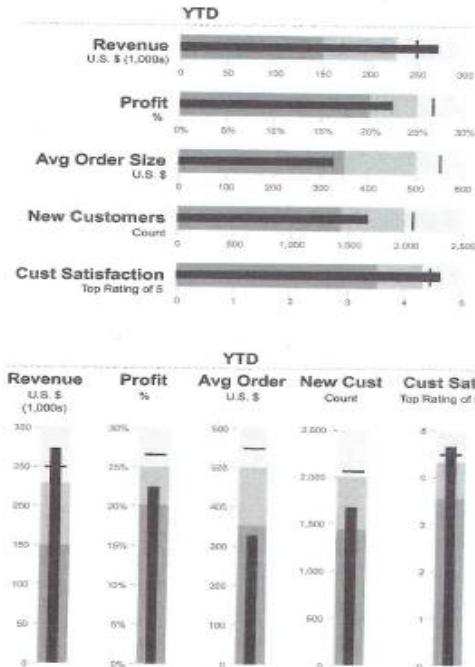


Figure 119: Bullet graph: Horizontal versus vertical
Source: Information Dashboard Design, Few

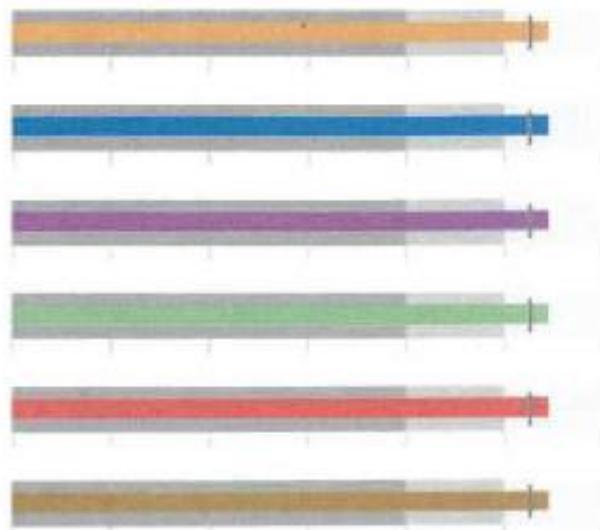


Figure 120: Bullet graph using colors
Source: Information Dashboard Design, Few

Module 13: Best practices: Dashboards and Scorecards

Dashboard best practices

Provide an effective dashboard

- Effective dashboards:
 - Are not designed to wow people upon first sight
 - Inform people:
 - With precisely what they need
 - In the way that they need it
 - Will actually get used and continue to be appreciated long after the initial wow
- Designing the layout for a dashboard is half art and half science
- For all types of dashboards, there will always be a battle between form and function
- No standards committee has formally endorsed best practices for designing dashboards
- Winning dashboard: See Few book

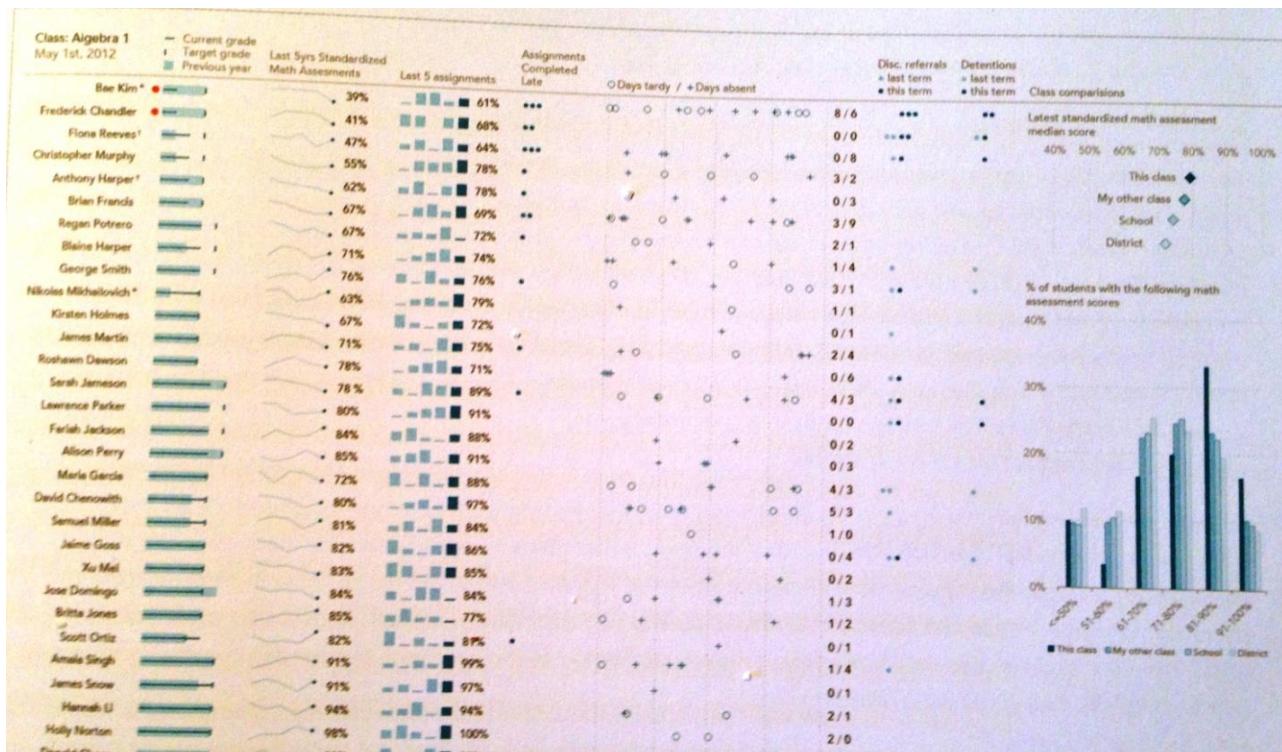


Figure 121: Winning dashboard (Source: Information Dashboard Design, Few)

Display only what is necessary on the dashboard

- Do not clutter or distract
- Even instructions for how to use it should be:
 - Inconspicuously positioned (such as the legend in the lower right corner), or
 - Placed on a separate page that can be accessed by pressing the Help button

Use a single screen dashboard

- Single page dashboards provide the best results
- If dashboard is not limited to a single screen, then it is more like a report
- Single page is the best practice due to its advantages:
 - Helps dashboards present data in an efficient manner (with only the required data)
 - No overflow of data
 - Data presentation is easier
 - Easy to understand
 - Makes it portable
 - Forces hard work required to choose a few critical metrics

Begin at the high-level when designing the overall dashboard layout

- Start from a high level of visual abstraction
- Then drilldown to specific details (such as how to physically integrate data into the dashboard)
- Understand user thinking:
 - Not enough to know what data dashboard users require
 - Designer must understand how they think about their business
- Just as a nuclear engineer won't feel comfortable in an airplane cockpit, or vice versa, not all dashboard users will be happy with an out-of-the-box layout that fails to provide a level of visual customization suited to their business view

Dashboard should immediately convey business reality to the users

- After a few seconds of interaction, users should be able to objectively assess the most mission-critical measures of their business
- Not possible to quickly convey an organization's state of affairs if data is presented in too granular of a format from the outset
- Place the most important items in the prominent position of the screen—the upper left
- When deciding whether or not to show more information on a dashboard screen:
 - Best to err on the side of not directly showing the data
 - Instead, enable a click-through so that the users can "drill into" desired results for more details
- If dashboard is cluttered with too many KPIs or gadgets, user's focus will definitely suffer

Pick critical metrics

- Too many metrics makes it difficult to analyze and take action
- Identify top few key metrics that are significant for the business
- Successful identification of metrics will make the dashboard very valuable
- Rule for selecting key metrics:
 - Should be less than 10
 - If number is higher, will make them less effective
- Dashboard is the central conduit through which information flows to the decision makers
- If the right metrics are not presented in the right form at the right time, users can end up making the wrong decisions

Balance usage of leading and lagging indicators

- Learn to recognize whether or not data visualizations are leading or lagging in nature
- Leading indicators:
 - Usually anticipate a future business condition
 - Example: “Average daily water level of the Mississippi River,” which will directly influence a lagging indicator, such as the “monthly transportation cost per unit of crop yield”
- Far too common for even seasoned dashboard designers to misplace or improperly combine leading and lagging visualizations
- Recognize reactive and proactive nature of each type from the outset of dashboard design

Display context on the dashboard

- No metric can exist in isolation without context:
 - If only numbers are provided, it will be difficult to understand them in isolation
 - If metrics are placed in context, then insight will be provided
- Easy to show context on a dashboard, which can include:
 - Internal and external benchmarks
 - Goals
 - Prior performance
- Express measures with enough context for their meanings to be clear (such as comparisons to targets, averages, and previous periods)

Limit the text or content to be displayed

- As much as possible, limit the amount of text or content on the dashboard that is truly static:
 - Labels for data and visualizations can be attached to supporting metadata that describes exactly what the label or text means from a business perspective

- For instance, a KPI (such as “number of units processed per hour”) can display the description or explanation when clicked or when the cursor hovers over the label
- Decide early in the design process how a solid metadata repository or metadata layer will lend support to the data and visualizations on the dashboard
- Display each item of information so that it can be quickly examined to assess performance, both in terms of:
 - An appropriate graphical medium, and
 - Direct measure of performance (such as percentage of target)

Continue to evolve

- To stay relevant, do not stay static
- Dashboards should not be made into a permanent outdated display
- Metric should be eliminated as soon as it loses its relevance
- Plan the dashboard evolution or it will start losing value

Best practices for creating effective dashboards

Choose metrics that matter

- Choosing metrics to include in the dashboard is a critical task
- Metrics should matter and be relevant:
 - Every available metric does not need to be included
 - Be highly selective in determining which metrics earn a spot on the dashboard
- To find the right set of metrics to include:
 - Consider the following:
 - How the dashboard metrics connect to the bottom line?
 - Does everyone understand the metrics that matter?
 - Ask pertinent questions
- Questions to ask:
 - How does each metric contribute to the objectives?
 - Is data available, either internal or external, that can shed light on the objectives?
 - Can a meaningful metric that measures those contributions be designed?
 - Is the metric truly necessary for contribution to the objectives?
 - Can a systematic and routine means of measurement be built?
- Start with a clear understanding of executive objectives:
 - If organization is in growth mode and new customers are key:
 - Then measure new customer acquisition rates
 - If operating in a highly competitive market:
 - Then incorporate third-party market share metrics

- Select other metrics that are leading indicators of overall corporate goals:
 - Metrics should be included only if their relationship to the corporate goal is clear
 - For example, if users understand that the number of daily transactions is a leading indicator of growth, include it in the dashboard
- Ensure that an explanation is provided regarding how every dashboard metric connects to the organization's objectives

Make it interactive

- Dashboard will put everyone who sees it on the same page:
 - Once there, viewers will have their own questions and areas where they want to know more
- Dashboard should enable viewers to customize it so that they can obtain the needed information
- Interactive, highly visual dashboards enable audiences, with little or no training, to perform basic analytical tasks such as:
 - Filtering views
 - Drilldown and examining underlying data
- Viewers need to be able to:
 - Literally get the big picture from the dashboard, and, subsequently
 - Drilldown into a view, which tells them what they need to know to get their job done

Keep it visual

- Dashboards are meant for quick analysis:
 - Report and text-based tables are neither fast or easy to read
 - Remember: Picture really is worth a thousand words
- Since the human brain processes a number, visualization, or picture as individual “chunks” of information:
 - Report or data table filled with numbers requires the brain to store and remember multiple chunks
 - Visualizations or pictures require a single chunk; hence,
 - Process of comprehension and insight is dramatically faster with visualization
 - Instead of thinking of how to read and interpret views, if visualizations are shown with data, users can actually focus on what the dashboard views are conveying
- Well-designed, highly visual dashboard is more widely adopted by audiences
- If metrics have been carefully mapped to corporate objectives:
 - Visualization will be useful in speeding understanding, and
 - Potentially help cross inevitable gaps between departments
 - Colleagues will notice direct translation of a department's objectives into the broader company-wide business objectives

- When designing a dashboard:
 - Include colors, shapes, lines, thicknesses, degrees of shading, and any other tools that leverage visual perception
 - Avoid overly cute widgets, 3D graphic treatments, and graph types not commonly used
- Visualizations like bar graphs, line graphs, heat maps and scatter plots are popular because:
 - They are clear
 - Everyone knows how to read them
- Resist temptation to show off PowerPoint charting skills by adding as many shapes and colors as possible, as the end result may be that nothing is understandable
- Easier and more intuitive the process of customization, more likely the dashboard will be used

Keep it current

- Ensure that the dashboard's:
 - Underlying data is current
 - Selected metrics reflect current business challenges
- Data can be from the current quarter, current week, or current hour:
 - Select the appropriate timeline for the business
- Outdated data can lead to:
 - False sense of confidence in decisions
 - User incorrectly thinking s/he is making fact-based decisions, even though data may no longer be representative of or relevant to the current situation
- Almost as important as having current data is having the ability to change and update displayed metrics, due to changing business:
 - In the current quarter, number of new customers might matter the most
 - In the next quarter, as users become familiar with using the dashboard and its data, focus may shift to:
 - Customer satisfaction
 - Most profitable products
 - Growth this year compared to the prior year

Make it simple to access and use

- Making dashboards easily accessible is critical
- Web distribution is ideal, especially if dashboards can:
 - Routinely pull current data
 - Adhere to IT protocols and security standards
- If publishing to the web is not possible in a way that is easy to maintain and update, consider alternatives like posting files on websites, Wiki's, and blogs
- Be realistic about the creation and distribution plan
- Create a prototype, distribute it through the planned methods, and request feedback

- Just like any other successful project, the key is to test, test, test
- As more experience is gained and it becomes apparent what users are using, enhance the dashboard, and the means of distribution

Scorecard best practices

Scorecard implementation issues

- Problems listed by managers in companies that have implemented new scorecards:
 - Time consuming
 - Costly
 - Complicated
 - Misleading
 - Mechanistic
- All are certainly avoidable

Following section lists tips for designing and implementing scorecards.

Screen and remove flawed metrics

- Most prevalent problem with scorecards:
 - Putting old metrics on the new scorecards, even though it is well known that the performance measures can be easily manipulated
- Whenever an aspect or users' performance is measured:
 - Tendency is to select measures that can be achieved and show good performance
 - Objective external facilitator (consultant) can help minimize self-serving approach
 - Sometimes, it is easy to mislead or convince consultant that the proposed measures are valid
- Internal facilitators often get overruled by senior managers:
 - What ends up happening is that the new scorecard is no better than the old one
- Solution for this common mistake:
 - Use a separate group of inside or outside experts to:
 - Review the proposed metrics
 - Identify data integrity problems
 - Incorporate reviews that can go a long way towards weeding out bad metrics

Leverage consultants

- Using outside consultants to facilitate a scorecard project can:
 - Be useful
 - Help minimize many of the most common errors that organizations make

- Using consultants, however, does not provide any guarantee
- Most experienced consultants have had to:
 - Defer to their clients and put bad metrics on the scorecards
 - Implement new measurement system in a less than an ideal manner
- Ultimately, client needs to buy-in to the scorecard design and metrics, which often leads to a compromise in:
 - What the consultant thinks is best, and
 - What the client thinks is practical
- Since consultants are interested in getting more work from their clients, they often bend to the clients' wishes even if it risks the success of the project

Measure frequently

- No business measures financial performance once a year, in order to determine if they were successful and profitable
- Most managers and entrepreneurs measure financial and operational performance daily or weekly
- More often something is measured, the better it can be managed
- Annual metrics are:
 - Close to being worthless
 - More like a study than a performance measure
- More frequent the measurement frequency, the higher the cost
- Challenge is to come up with a way to measure performance frequently, while minimizing the cost

Keep it simple

- Scorecard:
 - Should have a logical architecture and a variety of measures that look at the past, present, and future
 - Such scorecards are vastly superior
- Many organizations:
 - Have failed to build most of the cool metrics they designed
 - Many gauges on their new dashboard remain gray – in other words, contain no data
- Overcomplicating the scorecard:
 - Seems to be more common in technical organizations that have lots of engineers
 - Is not always the case
- Two approaches work well when designing the scorecard architecture:
 - First approach:
 - Design using metrics that can be populated with data in the next 6-12 months
 - Realize that new measure can always be added later, as the organization becomes more adept at metric design and implementation

- Inform users that the scorecard will evolve and change with time, as no one gets it exactly right the first time
- Second approach:
 - Design the ideal scorecard with all the measures that management wants and needs to look at
 - Build it gradually over several years

Do not over analyze

- Scorecard projects often tend to experience analysis paralysis:
 - Everyone wants to review the scorecard design and add, delete, or change the metrics
 - Most opinions are valid and worth considering
- Good approach is to communicate that the scorecard:
 - Is just a first draft
 - Will be enhanced each year as the organization becomes more sophisticated
- Users are comfortable with such an approach:
 - Recognizing that mistakes will be made
 - Knowing that the measures and scorecard design will be improved each year
- Approach of just getting on with the project is vastly superior compared to months of review and revision cycles (to the scorecard architecture and metrics design)
- Minimize changes during the design phase
- Change the metrics that lose their usefulness

Best practices in deploying dashboards and scorecards

- Much of the advice in this section can be applied to all IT projects
- Includes targeted tips and techniques for deploying dashboards and scorecards

What you get is what you pay for

- Dashboard or scorecard that delivers real and lasting business value cannot be deployed without spending money
- Rare scenario:
 - Company has already invested in a BI and data management infrastructure that delivers:
 - Right information
 - To the right user
 - At the right time
 - In the right format
 - Company has modeled and loaded bulk of the data required for the dashboard or scorecard
- Organizations that have successfully deployed a data warehouse and BI tools have an edge, while those that have not incur greater costs

- Costs are involved in:
 - Cleaning, integrating, and modeling the data
 - Building a reliable system that delivers timely and detailed data
- Many inexpensive commercial products provide some data integration capabilities
- When success is broadcast, there will eventually be a need to:
 - Replace the inexpensive product
 - Scale up to support more users, more sources, more detailed data, and more frequent updates without compromising performance and response times

Perform long term planning

- Always plan for success because the alternative is disaster:
 - Word about successful dashboard and scorecard solutions spreads like wildfire
- If a successful solution has been delivered:
 - Expect to be bombarded with requests from other departments
 - Scope and scale of the existing system will need to be rapidly expanded
 - In the interim:
 - Number of users may grow rapidly, placing undue burden on processing power, networks, and databases
 - Response times will plummet and hard-won reputation can suffer irreparable damage
- Advice from an experienced implementer:
 - “Unless you prepare for 20% growth in users, 15% growth in queries, and 4-5 new data sources every year, you will not meet customer expectations”
 - “Initial footprint of your solution should be 15% more than your most optimistic forecast”

Plan for real-time

- Value of a dashboard or scorecard increases exponentially with the current status of data:
 - Does not mean that those updated monthly do not deliver business value—they can
 - Many successful Balanced Scorecards, for example, are only updated monthly
- Augmenting a dashboard or scorecard with more timely data increases its value
- Performance management system populated with more timely data lets executives and managers:
 - Keep their fingers on the pulse of the organization in ways they never could previously
 - Work much more proactively to optimize performance
- Even if the business does not ask for more than daily updates, be prepared to deliver them
- Build in hooks to feed data into the environment

- Alternatively, select commercial dashboard solutions that can:
 - Support event-driven processing
 - Prove their scalability across users, sources, and data volumes

Develop on a single platform

- Easy for managers to build or buy their own solutions, independent of each other
- Dashboard silos eventually:
 - Compete with each other for resources
 - More importantly, undermine an organization's ability to get a unified picture of what is going on in the enterprise
- To avoid the disruption of switching to a new platform, develop all dashboards and scorecards on a single platform which leverages a unified data integration infrastructure
- Dashboard platform should provide:
 - Support for team-based development with check in/out and version control
 - Seamless support for deployment of development, testing, and production environments
- Data infrastructure should ensure the delivery of trusted business data using data integration, data quality, and metadata management tools:
 - These technologies enable business users to examine the lineage of any data element before making critical decisions
 - Administrators can assess the impact of changes to source systems or applications, as well as data integration workflows and reports

Module 14: Common problems and mistakes

Challenges and pitfalls

Realize that dashboard implementation is different

- Implementing a dashboard is not the same as setting up operational IT systems
- Dashboards are often new and unfamiliar to many business users
- Also, few organizations have standardized the way they use BI solutions
- Dashboards must be iteratively customized to fit different individual business needs

Organizational challenges

Common organizational challenges

- For dashboard implementation, some common challenges exist, which are not necessarily difficult to overcome, as long as they are properly identified
- Six common organizational challenges when implementing a dashboard are:
 1. Standardization challenge:
 - There is little standardization when working with BI applications, which can sometimes result in a lack of common business language
 2. Communication challenge:
 - There can be poor communication between different units
 - Common business language is lacking
 3. Power user challenge:
 - Few power users are comfortable leading the work around the BI application
 4. Strategy challenge:
 - Strategy is not clear on what is expected from the dashboard solution
 5. Cost challenge:
 - Narrow minded focus on expenses often blurs the vision of the true value of dashboards
 6. Political challenge:
 - Office politics can be a big issue
 - Reinforced in organizations with relatively strict boundaries between business units
 - Boundaries get challenged when implementing dashboards as business critical information becomes more widely available
- Challenges must be solved with a project management approach that emphasizes change-management activities

User acceptance

- When implementing dashboards, change management is essential for achieving user acceptance
- Dashboards may not be the only solution for analyzing and acting upon key business information:
 - Users can feel more comfortable with other older systems, frequently spreadsheets
 - Users may not feel that dashboards are essential since there are other ways of getting the job done, even if the older methods are actually more time-consuming and inefficient
- Accordingly, flexibility and follow-up, both from the IT and the business standpoint, are imperative to ensure dashboard implementation success

Pitfalls

Common pitfalls

Relate more to the behavior and attitudes of the individual business users and IT; common pitfalls include:

- “Cool” trumps useful pitfall:
 - Easy to get seduced by dashboards; however, their actual business value must always be kept in mind
 - Looks must coexist with function
- Believing users will come automatically:
 - Just because the tool is cool is not sufficient
 - Any new solution needs marketing, which requires change management aspects
- Believing that more advanced means more useful:
 - Can be true
 - Is it really worth the extra effort to train users on an advanced solution, where they may not use more than a small fraction of available features?
- Believing that more is better:
 - More KPIs is not better
- IT driven implementation:
 - In such cases, many user needs are underestimated or ignored when IT leads the implementation
- User driven issues:
 - Arise when business users do not take technology constraints or technology standards into account when pushing for a dashboard
- Little relationship between strategy and action:
 - Many business facts presented cannot be directly acted upon by the users
- Little understanding of how dashboards are implemented, because the project approach is different compared to other operational IT applications

- ROI expectations:
 - Are sometimes grossly exaggerated to overcome resistance
 - Even though dashboards usually have a good ROI when used correctly, ROI will not come automatically
- Data quality issues:
 - Is constantly underestimated
 - Usually, data quality is much worse than anyone thinks
 - If this issue is not addressed, it can and will break the confidence in the dashboard
- So how can a dashboard be made valuable?
 - Wrong perceptions and expectations must be managed

Mistakes and problems

Common mistakes

Starting off with too much complexity

- Easy to get overly ambitious
- Do not try to provide highly detailed, real-time dashboards, covering each and every business challenge, which also allow users to customize extensively
- Instead of spending weeks or months working through the first iteration:
 - Work through several short cycles of prototype
 - Test and adjust

Using inappropriate metrics

- Using metrics no one understands:
 - Metrics are so familiar to the users that common terms seem obvious
 - Dashboard needs to use metrics or concepts that the broader audience understands
- Failing to match metrics to the goal:
 - Dashboards often showcase activities of a single department
 - Must connect a user's department's efforts to the organization's goals and objectives

Cluttering the dashboard

- Cluttering dashboard with unimportant graphics and confusing widgets
- Keep dashboard simple in its visual appeal
- Resist temptation to make the dashboard:
 - Too flashy
 - Over-designed with gauge-like graphics and widgets
- These can interfere with the dashboard's objective (providing rapid and easy information to the users)

Waiting for complex technology and big projects

- Traditional BI implementations often take much longer than originally anticipated
- Waiting for a traditional BI project to materialize may mean months or years of delay
- Use dashboard applications and strategies that can be implemented quickly

Poor estimates

- Underestimating the time or resources to create and maintain the dashboard
- Easy to believe that it will be quick to create and maintain
- Takes ongoing resources to:
 - Design
 - Launch
 - Maintain dashboards

Using ineffective poorly designed graphs and charts

- Carefully design graphs and charts:
 - 3-D charts offer no increase in viewer comprehension
 - Garish colors can interfere with interpretation
 - Choosing a pie chart for more than 6 values makes it very difficult to read
- Check out resources for designing good visualizations

Implementing dashboards quickly

- Some users don't want to involve IT and initiate a systems project, which will cost hundreds of thousands of dollars and take months or years to complete
- Most just want something quick, simple, and cheap to replace their:
 - Excel spreadsheet, or
 - Numerous reports they must comb through to make a decision
- What such users want is what can be called a "quickie dashboard"
 - Remember: "What you pay is what you get"
- Recently, many new and existing vendors have begun promising to implement a departmental dashboard or scorecard:
 - In a few days or weeks
 - Inexpensively (usually under \$50,000)
- What is typically implemented quickly?
 - Automation of the favorite Excel spreadsheet with graphical gizmos
 - Data is pulled from multiple systems
 - Data is displayed using multi-paneled web pages or compound reporting tools
- Such quickie dashboards can be quite attractive visually and potentially powerful; however, there usually is a long-term tradeoff for short-term gain

Problems with quickie dashboards

Too flat

- Offer limited capability for drilldown or interacting with underlying data
- If drilldown is not enabled to transaction-level detail or across dimensions, to explore the root causes of a problem, the dashboard or scorecard will:
 - Only serve to alert to a problem
 - Be unable to identify the source of the problem or help in fixing it

Too manual

- Many dashboards and scorecards:
 - Demo great
 - Require a lot of expertise and time to modify or change
- Best systems:
 - Let users add and modify metrics, targets, thresholds, alerts, charts, tables, and layouts without developer intervention
 - Automatically capture large data volumes from diverse source systems (not just local files)
 - Allow manual data entry, when necessary
- Bona fide performance management systems offer administrative tools for centrally managing security, access, versioning, metadata, and usage monitoring
- Dashboards and scorecards need to scale to support mission-critical requirements

Too isolated

- Big problem with quickie dashboards is that they may:
 - Meet immediate business needs
 - Undermine the organization's ability to obtain a single, consistent view of information across units, products, and customers
- Quickie dashboards:
 - Are almost always an information silo
 - Eventually, need to be integrated or consolidated with other performance dashboards or analytics systems to eliminate redundancy

Too inaccurate

- When a quickie dashboard displays information from multiple systems, or worse yet, merges this information into a single table or chart:
 - Probability of delivering inaccurate, incomplete, or inconsistent information is high
- Merging data from multiple systems requires experts from both business and IT to:
 - Analyze source data and systems
 - Create accurate SQL code that reflects the dashboard users' objectives
- Quickie dashboards may claim to automate this step, but do not:
 - Do not underestimate the task, or
 - Assume technology can easily solve it

Too cool

- Many dashboards use visually attractive displays that are perceptually ineffective
- Avoid 3-D look and feel, chrome plated gizmos, or displays with sound and motion
- Dashboard must display data dimensions required to make a decision, clearly and accurately
- Screen real estate should be utilized well in a format that the user is comfortable with

Module 15: Software tools and vendors

Software and vendor evaluation

General considerations

Selection considerations

- Items to consider when procuring dashboard software:
 - Vendor criteria
 - Tools criteria

Functionality requirements for dashboard tools

- Most dashboard tools are part of BI tools
- Incorporate functionality for:
 - Defining (key) performance indicators
 - Defining norms and targets
 - Visualizing the score in an easy to understand way
 - Traffic lights (red, orange, green)
 - Drilldown to details
 - Easy filtering
- Objective should be to find the right blend of software and service that suits specific needs

Organization's objective for a dashboard solution

- Is the fundamental and obvious question to ask, which rarely gets the attention and consideration it deserves
- In many cases, businesses feel that they lack visibility and transparency into their business performance:
 - Dashboards allow access to critical information via a single interface
 - Want to consolidate data from a series of disparate data sources
 - Objective of linking is to provide insights into how sales, supply chain, and employee performance link up
- Most companies want to monitor and manage KPIs and organization-wide metrics

Evaluate what is currently available

- BI and dashboard use differs within each organization
- Solution chosen will depend upon the existing BI infrastructure
- If organization has an in-house proprietary solution, their ability to integrate third-party solutions may be difficult or inefficient
- When replacing an existing system it is necessary to analyze the current tools and processes, in order to determine where the best integration points exist for a third-party solution

- For organizations evaluating a dashboard for the first time, sky is the limit in terms of offerings that can be considered, especially when sourced data is non-proprietary

Potential roadblocks

- Can be technical or business roadblocks
- As an extension of the current environment, technical stumbling blocks may exist that inhibit the consideration of certain solutions
- For example, it will need to be verified that the dashboard:
 - Solution works with the existing data sources, and
 - Software is easy to deploy and maintain

Other roadblocks arising from business requirements

- Operational dashboards:
 - May require ability to stream data or update information several times a day
 - Not all vendors can support these requirements
- Advanced analytics and the development of predictive models:
 - Many dashboard vendors do not support this functionality except as part of a broader BI offering

Long-term goals

- If the first stage of the dashboard project reflects a much smaller implementation than what is desired for the long-term:
 - Evaluate whether the vendor, as well as the software itself, supports upgrades without significant changes in hardware or pricing
 - This means developing a rollout strategy
- Though companies may be unable to identify specific questions that will be asked by end users in the future:
 - Based on historical performance and business pains, it may be possible to identify data that are causing potential issues
- A framework can be developed for long term dashboard needs, even though such requirements may fall outside the initial implementation goals

Visualization and data considerations

Data visualization

- Many organizations want their solution to look appealing
- Businesses require strong data visualizations that:
 - Adequately reflect the identified metrics, or
 - Convey their meaning without requiring an explanation or training

Data infrastructure requirements

- Any data requirements relate back to the technical requirements

- Solution providers can give IT staff advice and guidelines regarding what needs to be done to properly implement a solution
- Selecting the right vendor means aligning vendor requirements with what exists internally

Data integration requirements

- Data integration is an area that cannot be overlooked
- Consolidating information, maintaining quality, and managing data validity over time helps ensure a successful dashboard
- Ensure that the purchased software integrates easily with the existing data infrastructure or there exists the possibility of adding such functionality

Other considerations

Value added services

- Consulting or implementation services from solution providers may be required
- Alternatives in services including training, consulting and implementation—all at different price points
- In some cases, vendor added services that are provided tip the scales during the software selection process
- Expertise in a particular industry vertical can, overall, be more beneficial than the software features or the look and feel

Role of consultants

- Once there is a clear understanding of the business and technical requirements, organizations are ready to select vendors
- External consultants or online searches might be a good first step
- General guides are available on the web that can help create the final short list

Proof of concept (POC)

- POCs cannot be overlooked
- Solution providers tend to oversell their solutions because of their strong marketing skills
- Different dashboards will look different and require varying levels of expertise to implement and maintain
- By seeing company data within a dashboard, and walking through the process, it becomes possible to determine if there is a fit—in terms of development, design, and maintenance

Making the final choice

- Involves selecting the solution that best meets the organization's requirements
- Most businesses will be ready to make their final choice:

- After gathering POCs from each vendor, and
- Seeing their products in action
- By following the outlined steps, organizations can select a dashboard that can be aligned with the overall business goals and BI vision

Vendor evaluation

First step

- Identify which software companies have achieved success in implementing dashboard solutions in the same industry
- Bigger does not necessarily mean better with respect to BI vendors

Key considerations

- Viability
- Vision
- Trust
- Expertise
- Time to market
- Maintenance and licensing

Vendor viability

- Vendor should have a sound financial balance sheet
- Business is expected to be strong and stable far out into the future
- Review Gartner Group's Magic Quadrant:
 - It does not provide detailed information about how well a suite of dashboard tools perform tactically
 - Usually contains useful insight into the viability of software organizations by ranking them according to two main criteria:
 - Ability to execute
 - Completeness of vision

Vendor's vision

- For software vendors, sound vision is critical for the future success of their clients
- Determine vision of dashboard utilization and knowledge delivery:
 - Cloud computing
 - Open source
 - Data visualization/mashups
 - Virtualization
- Do they possess a complete and comprehensive BI platform and a well-socialized product strategy that will scale in tandem with the organization?

Vendor trust

- Pays huge dividends to ensure that the BI dashboard provider really understands the business
- Engage vendor in a proof of concept or prototype application, using real-life company data
- Relevant to understand how vendor has helped companies with similar business problems
- Ask for detailed case studies involving past clients, and other value-added documentation, which shows a steadfast commitment to customers
- Interview prospective service and software providers by:
 - Submitting a few high-level business use cases, and
 - Asking them to explain how they would best approach each case given the budget and time constraints

Expertise level

- Skilled resources are required after implementing a dashboard solution
- Are resources with adequate skills available to:
 - Maintain and enhance the dashboard
 - Support its infrastructure
- Care must be taken not to be completely locked-in and be at the mercy of the vendor's consulting services, which tend to be much more expensive than equivalent open market resources

Implementation time

- Ask for a detailed project plan, before the SOW phase, that captures the essence of the dashboard requirements
- Are expectations aligned with those of the vendor?
- Do both parties have the necessary resources, people and hardware, to craft an intuitive dashboard platform under tight budgets and deadlines?

Maintenance and licensing costs

- Complete transparency into the real cost of vendor licensing, and post-production consulting charges, should be required
- Is bulk of technical support to be provided onsite or over the phone?
- If phone support is included, will calls be routed to dashboard experts in North America or to an overseas call center, where it may not be as effective or accountable?

Dashboard vendors and tools

Dashboard vendors

Leading dashboard vendors

- Many vendors provide dashboard technology in one form or the other
- Most of these vendors:
 - Are big software companies
 - Charge a hefty license fee for their software
- List of dashboard vendors in no particular order (most of these vendors provide dashboards as just one component of their BI system):
 - Oracle (OBIEE, DBI for e-business, Discoverer + Portal)
 - Xcelsius (Now Business Objects --> SAP)
 - IBM Cognos
 - Business Objects (SAP)
 - Pentaho (Open source)
 - iDashboards
 - Visualmining
 - Dundas
 - Qlikview
 - MicroStrategy
 - InfoCaptor
 - Microsoft
 - Birst
 - LogiXML
 - Tableau Software
 - Tibco Spotfire
 - Information Builders
 - Domo Technologies (Corda technologies)
- Others include arcplan, Jaspersoft, Pentaho, myDIALS, GoodData, Indicee, Advizor Solutions, Endeca, eThority...

Additional lists of vendors

- Comparison of dashboard BI tools:
<http://business-intelligence-tools.entrepreneur.com/d/b/Dashboard>
- Listings for Digital Dashboards/Scorecards:
<http://www.dashboardinsight.com/catalog/data-visualization-specialists/digital-dashboards-scorecards/>

Dashboard tools

Application of dashboard tools

- Several BI companies have developed cutting-edge technology that enables business users, not just the IT staff, to create interactive, visually stimulating reports via dashboards
- Dashboard tools:
 - Are widely used to monitor information and KPIs from different perspectives
 - Provide a means for displaying information in a way users can easily determine if indicators need attention or not
- More advanced dashboard tools are also able to facilitate the communication process about the indicators between managers and employees

BI tools that include dashboard tools

- BI software, which include dashboard tools, were thoroughly examined on 169 criteria considered important for high productivity and dashboard systems that actually add value to a company
- These tools are listed at this URL in random order:
<http://www.businessintelligencetoolbox.com/dashboard/dashboard-tools/>
- The Dashboard Verdict (Eckerson/BARC), September 2011, analyzes 6 tools:
 - Domo Technologies CenterView
 - iDashboards
 - Information Builders WebFOCUS
 - QlikTech QlikView
 - SAP BusinessObjects Dashboards
 - Tableau Software
- These tools are listed at this URL:
<http://www.barc-research.com/index.php?id=570>

Highlights of some BI (dashboard) software tools

These tools are listed at this URL: <http://www.dmgfederal.com/bi-dashboards/>

- Birst:
 - Powerful BI tool focusing on Software as a Service (SaaS) concepts, as well as versatility to meet the needs of developers and business users
 - May be deployed in the Cloud, on premise, or in a hybrid of both environments
 - Provides visual dashboards that simplify data analysis
 - Since it is a virtualization appliance, the specifications for Birst rely solely on the virtual machine on which it is deployed
 - Need for hardware and software downloads isn't necessary
 - Updates for Birst are automatic

- LogiXML:
 - Somewhat smaller company than others
 - Has one the more powerful BI tools on the market
 - Provides only one product version
 - Makes up for lack of diversity with well-rounded functions and impressive scalability with a multitude of mobile devices
 - LogiXML's Ad Hoc is supported by all popular web browsers
 - Works with any data source, including SQL server, OLEDB, and even Google docs
 - LogiXML is licensed per server, concluding to an unlimited number of users
 - It is also "App store free," allowing any device to access reports without the need for application downloads or software installation
- MicroStrategy:
 - Has an in-depth approach to multi-faceted business intelligence
 - Supports all web browsers and export options
 - Is fast enough to meet most requirements through the use of in-memory processing
 - Decent dashboard and display options
 - MicroStrategy provides a mobile platform that:
 - Enables users to create mobile apps that connect directly to existing reports, projects, and dashboards
 - Allows users to extract and manipulate data from their mobile device.
 - Platform application is available in both the Apple App store and Android market
- QlikView
 - In-memory visual analysis tool which has emerged from nowhere to rival the established BI players in the space of seven years
 - Is a powerful competitor in the BI tool market
 - Can be used to quickly create visually appealing and interactive dashboards by following the instruction manual
 - Queries are made in QlikView by selecting field values, allowing the user to filter out data until only the relevant data remains
 - One of the features QlikView has that some BI tools seem to lack is a chart filtering feature that permits the user to drag selections onto the chart directly
- SAP BusinessObjects Dashboards
 - Excel-based development environment designed to generate Flash-based dashboards, which was originally geared for use by individual analysts
- Xcelsius:
 - SAP Crystal Dashboard Design, formerly known as Xcelsius, is a BI tool that has been developed and revised over decades
 - Provides crisp visualization tools, and a unique mobility application
 - Dashboards can be fully utilized on the Apple iPad and iPhone, but other mobile devices may only view and select information

- Rumored that SAP has been developing in-cloud functionality for its products, these services are unavailable; however, SAP has partnered with several businesses that provide cloud services
- Tableau Software
 - Affordable, state-of-the-art visual analysis and discovery tool designed for all types of business users
 - Web-based analytics tool that allows users to create visualizations and dashboards without the need for a programmer or programming experience
 - Tableau's "drag-and-drop" functionality enables real-time information updating and the ability to drilldown for more specific reports
 - Touch-screen interactions and dashboards can also be used on the Apple iPad
- Tibco Spotfire:
 - Through its multi-platform software and in-memory functionality, Spotfire boasts:
 - Near-instant analysis speeds, with
 - Ability to control data on a multi-dimensional scale
 - Also provides other applications, such as the networking tool, that permits more functionality for both developers and users
 - Spotfire is available on the iPad through an Apple Store Application that allows for full compatibility with the tablet
- Domo Technologies CenterView:
 - Previously owned by Corda Technologies
 - CenterView is a Java-based development environment for creating operational dashboards
- iDashboards:
 - Affordable tool with a flash-based interface for visualizing spreadsheets and other departmental data sources
- Information Builders WebFOCUS:
 - Long established enterprise BI platform delivers operational dashboards as well as report-centric dashboards with sophisticated prompting

Comparison of leading BI (dashboard vendors)

<http://www.dmgfederal.com/bi-dashboards/>

Software	Data Visualization Tools	Complete Mobile Versatility*	In-Cloud Capabilities	In-Memory Functionality
Birst	+	+	+	+
LogiXML	+	+	+	+
MicroStrategy	+	+	+	+
QlikView	+	+	+	+
Sap Crystal Dashboard Design (Xcelsius)	+		+	
Tableau	+		+	+
Tibco Spotfire Developer	+		+	+

Figure 122: Leading BI dashboard vendors

Source: <http://www.dmgfederal.com/bi-dashboards/>

Scorecard tools and vendors

Scorecard tools and vendors

Leading scorecards

Listing for Digital Dashboards/Scorecards is available at:

<http://www.dashboardinsight.com/catalog/data-visualization-specialists/digital-dashboards-scorecards/>

Balanced scorecard tools and vendors

Leading balanced scorecard tools and vendors

<http://www.balancedscorecard.ru/i2.htm>

Features of leading balanced scorecard products (26 tools)

<http://www.strategy2act.com/bsc-kpi-reviews/bsc-software-review.htm>

Cloud tools and vendors

Cloud performance dashboard

Impact of the move to the cloud

- Cloud adoption by enterprises is becoming more common
- Focus is shifting from justifying the cloud to identifying:
 - Best practices
 - Highest performing cloud providers
 - Performance monitoring

Challenges for cloud adoption

- Report published by IDC found that respondents ranked performance, security and availability as the biggest challenges and issues for cloud adoption

Evaluating cloud providers

- To give buyers visibility into the relative performance levels of different cloud providers, a number of groups have developed tools, which measure and compare performance under different scenarios

Tools available for evaluating vendor performance

- Individual vendors have begun to provide their own monitoring dashboards:
- Examples:
 - Salesforce has its Trust Dashboard
 - Amazon has its CloudWatch dashboard
- Buyers, however, are increasingly looking for third-party tools that provide a neutral insight into vendor performance

Leading cloud players

Leading cloud products

A brief overview is available at:

<http://gigaom.com/cloud/dialing-up-a-dashboard-for-cloud-performance/>

Module 16: Deployment and expected growth

Dashboard deployment status

Deployment status as per TDWI study

- 31% of 473 respondents used a dashboard or scorecard as their primary analytic application
- 28% had deployed a dashboard or scorecard elsewhere in the organization
- 24% were in the process of building one
- Almost three-quarters of organizations either:
 - Had deployed a dashboard or scorecard of some sort, or
 - Were in the process of doing so

Scope of implementation

- Most organizations that deploy a performance management system:
 - Do so on an enterprise basis
 - Scorecards have a slightly more of an enterprise focus than dashboards
- On average, organizations deploy:
 - Dashboards to 5.4 departments
 - Scorecards to 5.8 departments

Business functions implemented

- Department most likely to have a dashboard or a scorecard is operations:
 - Not surprising since organizations, motivated by competition and new regulations, are seeking greater transparency into business activities
- After operations, performance management systems are likely to be deployed in finance, sales, and marketing

Popularity of dual deployments

- Majority of groups surveyed have deployed:
 - Both a dashboard and a scorecard
 - Often within the same application
- For example:
 - One government agency purchased commercial software that supports both scorecard and dashboard views for its 1,500 employees
 - Application currently supports 60 scorecards and numerous dashboards, both of which run against nine years of historical data

Project initiation and funding

- Many performance dashboard projects—scorecards in particular—are initiated and guided by energetic business leaders with a vision for managing, their organizations or departments, by the numbers
- Survey indicated that dashboard and scorecard projects are overwhelmingly business-driven

Common process for implementing dashboards

- Bootstrapping performance dashboards is common
- In most cases, performance management visionaries empower a program manager to translate the vision into reality
- Program managers usually:
 - Don't get sufficient funds to start
 - Find a way to beg, borrow, or steal developer and hardware resources to deliver an initial solution in a few months
- Until recently, most solutions were homegrown:
 - Spate of inexpensive dashboard and scorecard projects (with total license fees under \$50,000) will change that
- Once the solution looks promising, executive usually:
 - Negotiates funds to turn the shoestring application into a more permanent solution
 - Allocates full-time development staff to the project, and
 - Purchases hardware and software
- Eventually, these quickie projects:
 - Must be re-architected
 - Put on a more substantial data infrastructure
 - Can incur a significant cost

Number of users

- On average, dashboards support 315 users and scorecards 493 users
- 72% of both dashboards and scorecards have fewer than 100 users; which means:
 - While most performance dashboards support small user bases, a minority of implementations support an extremely large number of users
- Usually a direct correlation exists between years of deployment and the number of users:
 - After a department deploys a dashboard, executives in other department's want one
 - Performance dashboards are very contagious

Types of users using dashboards

- Departmental managers are the biggest users of dashboards and scorecards, followed closely by top executives
- Corporate executives are usually served by financial analysts, who are more or less dedicated to delivering data on demand
- Mid-level managers are:
 - Often left to fend for themselves by cobbling data into makeshift spreadsheet reports
 - Often the best place to drum up support for a performance dashboard initiative
- Most users want online access via the web, but others want wireless or offline versions (to take with them while traveling—Excel or PDF)

Implementation time

- Once companies decide to implement a performance dashboard, most don't waste time
- Approximately one-third of performance dashboard implementations are deployed:
 - Within weeks
 - Larger percentage takes months or longer
- Quick deployments can happen when there already exists a consensus on measures that need to go into the dashboard
- Most industries and organizations already have a set of standard measures, which they reuse in a dashboard deployment:
 - Whether they have the right measures is a question

Leveraging a BI environment

- Quick deployments are also possible when an organization already has:
 - An established BI environment, and
 - Data management infrastructure
- These elements often reduce the time required to capture and deliver data:
 - At any level of detail, and
 - Within any time frame

Expected growth and mobile BI

What the future looks like

- Future of dashboards and scorecards looks bright
- Currently, many organizations have deployed performance management systems
- Size and scope of a majority of implementations is still small
- Will change as:
 - User organizations gain more experience with these systems
 - Vendors begin to offer robust commercial dashboard and scorecard solutions

Growth drivers

- Growth expected because dashboards and scorecards:
 - Provide users with all the information they need to make effective decisions and achieve strategic objectives without being overwhelmed
 - Deliver data on demand as users need it:
 - From visual displays that let users monitor KPIs at a glance
 - To dimensional and operational data for conducting analysis and taking action
 - Are key tools in a business performance management discipline that enables executives to:
 - Communicate business strategies in a customized way to each employee, and
 - Monitor execution of those objectives to fine tune the organization and keep it on track
- Due to the benefits, it is no surprise that executives and managers are rushing to deploy dashboards and scorecards

Current discussion

- Not regarding whether to build a dashboard, rather,
- What it will look like

BI moving beyond the three traditional domains

- Any BI strategy is incomplete without a mobile strategy
- Taking decision making outside the corporate walls is now moving past the three traditional domains of:
 - Person to person conversations
 - e-mail
 - Phone



Figure 123: Handheld display

Source: Information Dashboard Design, Few

Popularity of mobile BI

- According to mobile BI experts, Yellowfin:
 - Organizations introducing Mobile BI into their BI system experience doubling of usage
 - Organizations with Mobile BI can make critical business decisions 6 times faster than those without a mobile platform for reporting and analytics
- Mobile BI typically starts at the executive level
- Probable leader in mobile BI is MicroStrategy
- Executive dashboards:
 - Are some of the simplest to present on mobile devices as they have a limited number of KPIs and do not require a lot of drilldown layers
 - Have a user group that is limited compared to the whole organization

Core considerations for mobile BI

- Device used and the obvious limitations on screen size
- Daily data must be 100% correct and complete
- Environment in which the information will be used—bright sunshine, low light
- Speed at which the data will be read
- Context of the data must be retained
- Whole story must be told

Benefits for executives

- Often easier to access dashboards during meetings via the mobile device than logging into the corporate network
- Mobile BI is making decision making easier inside the corporate walls, as well as outside