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Business Execution Series...

Organizational Performance Measures

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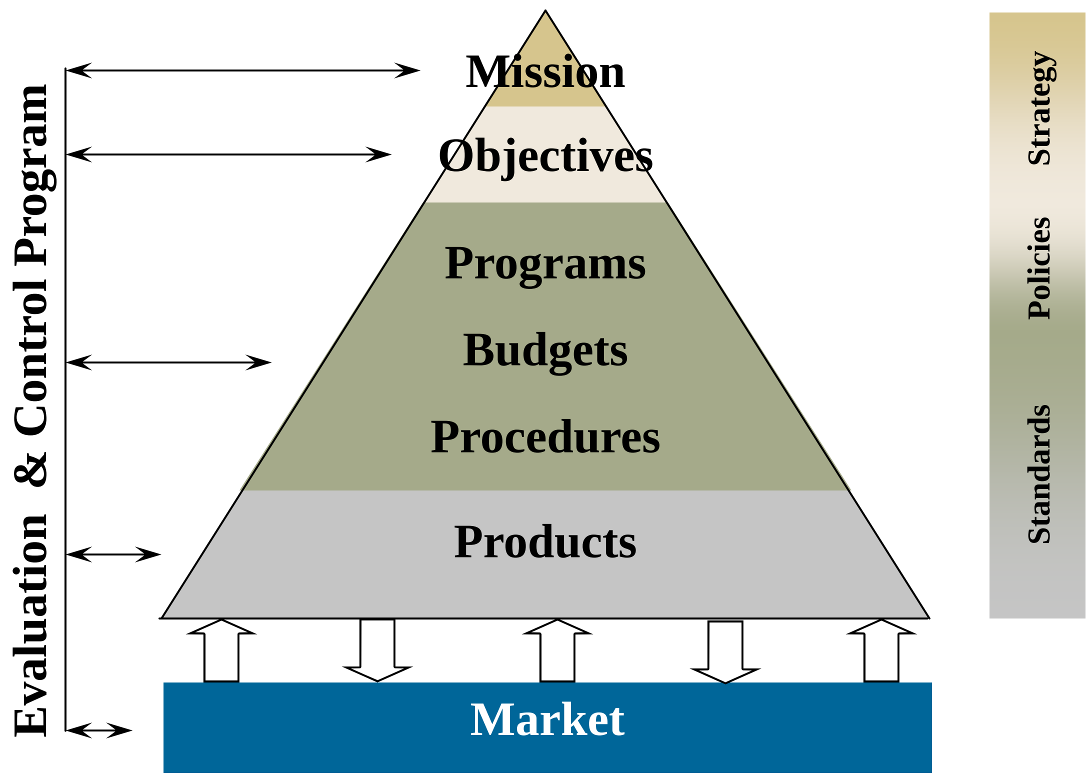
Organizational Performance Measures

Performance measures serve to align an organization's efforts to the achievement of its mission. As part of a company's evaluation and control program (see Figure 1), they quantifiably monitor important characteristics of the company's products and services and the performance of the individuals and processes creating them. Performance measures support managerial decision-making by providing useful information regarding:

- how efficient and effective are the company's processes and the individuals implementing them
- if product or service improvements are necessary
- if the company's customers and stakeholders are satisfied
- if the company is meeting its stated goals (corporate, divisional, operating unit, department, and individual levels)

Performance measures best serve an organization when they are understandable, broadly applicable, uniformly interpreted, and economic to apply. They should cascade through and organization's hierarchy such that achievement of lower tiered performance goals support higher tiered goals that in turn ultimately support achievement of the company's mission.

Figure 1: Strategic Pyramid



Construction of Organizational Performance Measures

Constructing organizational performance measures addresses the practical side of building vertically cascaded and horizontally shared measures based on the principles discussed in earlier documents. Because performance measures facilitate decision-making within an organization, their construction is highly influenced by the needs of executives and managers in making decisions regarding the parameters being reflected by the measures. Therefore the qualities described herein focus on enhancing performance measure interpretation to speed condition recognition and promote appropriate, proactive response.

This document does not address the complex statistical properties associated with some performance measures. Knowledge of these principles is best obtained through formal training.

preparation...

The performance measure construction process assumes that organizational performance measures have be largely identified and their types established. These two activities are needed to ensure selection of construction variables enhancing the graphic representation and comparison of information can be accomplished.

construction...

Performance measure construction begins with defining the type of graphic representation to be used. This often appears to be a natural fallout of the preparation process. Having defined the parameter, the sampling frequency and the refinement or intelligence to be applied, the most appropriate graphic type seems obvious. However, another key factor should be considered. Because performance measures ultimately serve the decision-making process, the graph type selected must be timely, easily read, and readily convey the need for corrective or proactive action based on the indicated condition and/or trend. Finally, considerations of esthetics should be subordinated to those features that drive decision-making and proactive action needs.

When selecting a performance measure type, it is important to understand what information is needed by decision-makers. Two key pieces of information commonly used by decision-makers are parameter values and trends. Some graphs lend themselves to more readily representing either a value or a trend in some cases to the exclusion of one or the other. Therefore, careful consideration as to which of these two needs is more important and if both are required should be given when selecting the graph type. Several graph types, including their ability to present values and trends, are described below:

- *Pie Graphs* – less frequently used than other graph types, it is the representation of choice when making snapshot (monthly, quarterly, yearly, etcetera) comparison of things totaling 100 percent. Pie graphs have moderate strength in presenting current condition information and provide no trend data.
- *Window Indicators* – represent status roll-ups combining dissimilar data sets when knowing only present, overall conditions is important for decision-making. Unlike pie graphs, these periodic performance measures are not directly comparative in nature. Depending on the format used, window indicators may or may not provide trend information.
- *Bar Graphs* – commonly used performance indicators, typically representing count data for longer periodic time spans (weeks, months, quarters, etcetera). For this reason, bar graphs have moderate strength in presenting both current condition and trend data.
- *Line Graphs* – another commonly used representation typically displaying value related or value driven data that is continuous (by second, minute, hour, etcetera) in nature. They are often used when it is important to show condition and trend data over a shorter time periods. Line graphs are less frequently used in a periodic case with time spans of greater than one month in data sampling.

- *Combination Graphs* – often used when two data sets are needed for decision -making that don't lend themselves to combination within an index or best serve the process when characterized individually. To enhance readability, these data sets are represented in different manners. In one example, value driven data represented by a line graph is combined with count data represented by a bar graph, such as when a stock's price (value driven data) is combined with share sales (count data) over a commonly defined timeframe.

By defining the type of representation to be used, the variables requiring definition for the graph's construction become obvious. These variables include:

- data characteristics
- units
- scaling
- update frequency
- thresholds

Data Characteristics

While this document is not about statistics or statistical analysis, basic data qualities must be clearly understood and properly used when making effective performance measures. These qualities include data types, aggregation of index data, and data quality.

Data Types

Two frequently used data types are numeric and category data. Numeric data sets can represent both continuous and periodic parameter or count data whereas categorical data represents count data only. Examples of numeric and category data include:

- *Numeric* – system operating parameters (pressure or temperature), stock price
- *Category* – project status, performance ratings

When using either numeric or category data, it is important to clearly define the parameter to be measured. Numeric data is the easier to define, often representing directly observable occurrences or values. Categorical data is more difficult to define as each typically represents a range or combination of conditions. When specifying the parameter to be measured, differing rules apply to each data type as follows:

- *Numeric*

  a. identify the instrument or computer point from which the data is to be taken
  b. define the specific unit of measure
  c. establish the time and periodicity of measurement

- *Category*

a. identify the instrument or computer point from which the data is to be taken

b. define the specific units of measure

c. define the upper and lower parameter limits or the combination of conditions for each category

d. establish the time and periodicity of measurement

Index Data Integration

Indices are composites of several performance indicators into a single unit of measure. Because they are composites, the data sets must be logically relatable. In their simplest form, they are a summation of the data sets. More complex indices, however, use various weighting scales in order to combine dissimilar measures.

Aggregating data sets to create complex indices is extremely challenging. After identifying the data to be combined, it is important to recognize the differing impact each contributor has on the overall performance outcome being portrayed. A weighting system is used to combine the dissimilar data sets and account for their impact differences.

When choosing the weighting system, it is important to first establish the overall importance or impact each data set has on what is being represented. In some instances, historical performance data exists which, when examined, will yield the sensitivity and therefore impact of each contributor to the overall index. In these cases where historical data does not exist, consideration should be given to using weighting factors developed from the available data of similar industries or circumstances.

Index weighting systems share the following characteristics:

- combine dissimilar data in a manner that yields a logical, meaningful, and accurate indicator of performance
- convert each data set's units of measure to a common, combinable unit of measure
- weight each data contributor consistent with its impact to the overall index value

Performance Measures Accuracy – Degree of Certainty

All performance measures are subject to one or more factors that inject a degree of uncertainty into the information being presented. Because performance measures drive organizational decisions their subsequent actions, the amount of uncertainty which can be tolerated for each measure should be defined for each measure. Causes of inaccuracies include, but are not limited to:

- time delays in gathering and presenting data
- statistical variation associated with the sampling method used
- instrumentation errors

Compensatory measures can be implemented to appropriately limit a performance measure's uncertainty. Actions to limit uncertainty should directly address the root cause of the measure's uncertainty. Methods to alleviate the causes listed above might include:

- more frequent parameter sampling and display updating

- increased sample size or population sampling
- use of redundant instrumentation

Like unit ambiguity, the higher the level of performance measure uncertainty, the greater the time required to evaluate the information presented before taking action. Thus, as uncertainty increases, so does the delay time in taking action in response to an observed condition or trend. Therefore, conditions or trends requiring rapid response require highly accurate performance measures.

One Source of the Truth

In order for performance measures to be comparable, they must possess consistency in data input and manipulation. This suggests that data should be gathered from either a single source or using a single method and the same calculations applied to all compared data sets. In the special case when redundant measures are used to qualify or validate information presented about a single or highly integrated condition, data should be gathered, transmitted, manipulated, and displayed using similar equipment and methods.

Units

The purpose of unit selection is to provide clarity of meaning and enable performance measure comparison and translation across the organization. Selection of units of measure are critically important to the decision-making process as unit specificity or ambiguity directly correlate to the length of time executives and managers have to make decisions based on the parameters and trends of the given indicator. Considerations when selecting performance measure units include:

- recognizable

- scalable
- comparable
- translatable

One unit of measure commands examination before exploring the four key considerations of unit selection. This unit of measure is time.

Time is the unit of measure that is associated with all performance measures. Selection of the time unit is critically important because it impacts the ability of responsible managers to make decisions based on performance measure information. The time unit associated with a performance measure is largely determined by the measure's sampling frequency which in turn is driven by the needs of decision-makers. Sampling frequency is discussed in greater detail later in this document.

Time is often represented in one of two ways. When dealing with frequent and some periodic measures, units of time will be expressed across the graph's x axis. In other periodic indicators, and always with representations such as pie graphs and window indicators, the time unit will be a general statement associated with the indicator's update frequency (monthly, quarterly, etcetera).

Selection of other units of measure seeks to balance the four key, competing factors.

Recognizable

Like time, the units of measure must be selected to enable timely condition and trend identification to support decision-making. In this instance, it is the specificity of the units that ultimately impacts the decision-making process.

Unit specificity or the degree of ambiguity directly relates to the amount of decision-making time allotted managers with respect to recognizing conditions and trends. The greater the unit ambiguity, the longer the time needed for causal analysis, thereby delaying action implementation. Thus, the degree of unit ambiguity directly relates to the decision response time associated with the parameter being monitored.

Scalable

Scalable units enhance readability of a performance measure in two ways. First, appropriately scaled units help the interpreter relate to the performance measure. In this instance, it is often difficult for an individual to perceive 1,000,000 different objects (scale of 0 to 1,000,000 with units of 1 object), relating to 100 units scaled by 1000 objects each (scale of 1 to 100 with units of 1,000 objects) is much easier to envision. Second, proper scaling enhances visual distinction of the conditions and trends that should trigger an action response. Here, too large a scale tends to flatten the graphic depiction and too small a scale creates overly sharp, indistinguishable changes. An appropriate scaling selection will enable the performance measure to be meaningful to the interpreter while providing a visual representation where actionable conditions are readily observable.

Comparable

Horizontally shared performance measures require equivalent units of measure to provide a comparable basis between products, business units, or individuals. This allows for direct, one-for-one comparison across the organization.

On some occasions, the units of measure associated with each entity are of such differing scale or the entities themselves appear so dissimilar that comparison seems inappropriate or unnecessary. When these circumstances exist, a percentage value can often be useful in providing the comparative basis.

Use of percentages as a unit of measure helps bridge the gap between dissimilar entities, whether the result of differences in product, size, or job function, because it establishes a common frame of reference through which the comparison can be made. This frame of reference is often based on the goal established by the performance measure, such as percent of capacity, percent of market share, or percent of profit.

Translatable

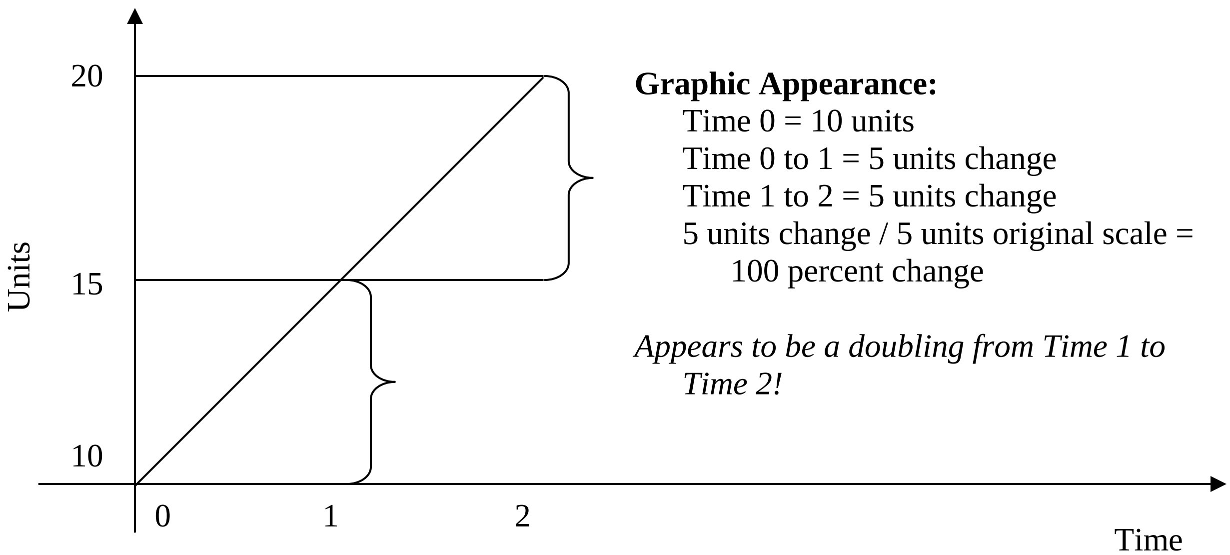
Interpreters should be able to see the direct relationship between vertically related performance measures, therefore, selected units need to be either the same or translatable. An easily translatable unit is one in which simple linear factoring can be applied to one measure to get another, such as multiplying hours worked in a set of lower tiered measures by average compensation rate to get the labor cost contribution to an overall budget metric in a higher tiered indicator.

Similarly, translatable units support the creation of aggregated measures such as indices and window indicators. Besides being translatable, the units should be logically related to each other; enabling meaningful aggregation of data such that the final grouping is understandable to the indicator's user.

<u>Scaling</u>

Proper scaling is highly important to the creation of performance measures because inappropriate or inconsistent scaling can distort the reader's perception of the data being presented. This occurs when conclusions are based on the shape of a curve, size of a bar, or other graphic feature which is highly influenced by the scaling selected.

Figure 2: Misleading Scaling



Graphic Appearance:
Time 0 = 10 units
Time 0 to 1 = 5 units change
Time 1 to 2 = 5 units change
5 units change / 5 units original scale = 100 percent change

Appears to be a doubling from Time 1 to Time 2!

Real Change:
Time 0 to 1 = 5 units change
Time 1 to 2 = 5 units change
5 units change / 15 units original existing = 33 percent change

There is a 77 percent difference between what appears graphically and the real change!

Numeric Scaling

Optimally, all graphs will have a zero reference point to minimize data distortion. For example, if a particular performance measure had a y axis value starting at 10 (end of period 1), anchoring the first data point which over equal time periods progressed to 15 (end of period 2) and then to 20 (end of period 3), it may appear that there was doubling between periods two and three when the measured value went from 15 to 20. In reality, there was only a 33 percent increase in the actual value but because the y axis was anchored at 10 rather than at 0 the relationship is not immediately obvious (see Figure 2).

X Axis

The upper scale anchor of the x axis should be that at the highest point that is expected to be reported. For a graph that has time shown on its x axis reporting on an annual periodicity, demarked by months, then it is anchored by the twelfth month or December.

Y Axis

The y axis is more difficult to scale as a measured parameter might exceed the maximum range in a given monitoring period. Ultimately, y axis scaling should result in the maximum plotted value being between 75 and 100 percent of the scale selected. To determine the scale's upper limit, consider historical data altered by any factors that might change future outcomes. Select a value representing the highest, most likely, reasonable outcome. Set upper y axis scale limit such that this highest reasonable outcome would be to be plotted at a point equal to 75 percent of the maximum scaled value. This selection method applies to y axis scaling values above and below the x axis.

In the special case were performance monitoring is not needed above or below an absolute threshold, the absolute threshold should represent the upper y axis scaling limit.

Unit Spacing and Axis Sizing

Like numeric scaling, improper unit spacing can distort an interpreter's perception of an indicated condition or trend adversely impacting decision-making. Here, it is important that the spacing between unit increments be equal to prevent undesirable variances between the visual depictions of trends between different sets of data points. If a need for spacing differences exists, these differences should be demonstratively illustrated by symbolizing a break in the axis.

The physical length of an axis can alter the appearance of a performance measure. This becomes particularly impactful when the shape of a curve, height of a bar, or other graphic feature provided the basis for interpreting the data presented. Too long an axis tends to flatten the representation while too short often renders depicted changes indistinguishable. When selecting axis length, actionable conditions and trends presented should be obvious to the interpreter.

Finally, the axis of horizontally shared performance measures should be the same, ensuring a similar visual appearance thereby facilitating comparison. This may require several iterations to establish common axis sizing and may drive the need for use of percentages as units of measure.

Scaling Over Time

Graph scaling should not change between measurement periods to ensure continued comparability to historical information. If the scaling is changed, several actions should be taken to ensure continued proper interpretation of the performance measure including:

- indication of the point of change on the performance measure graphic
- inclusion of a description of and reason for the change included with the graphic and all associated reports
- addition of instructions regarding any changes to the method of results determination included with the graphic and all associated reports

Update Frequency

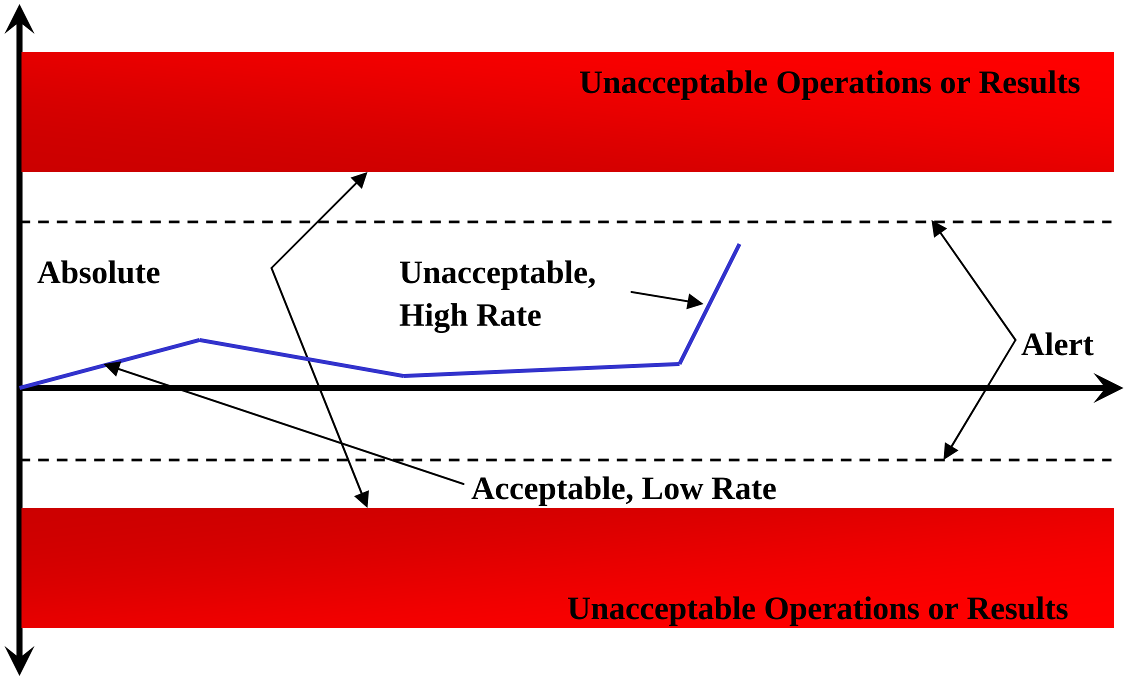
Measure update frequency is largely determined by the response time associated with actions driven by the performance measure. The data sampling frequency, which establishes the time basis of the performance measure, must be short enough that actionable conditions or trends can be identified early enough for action to be implemented prior to realizing adverse consequences or foregoing business opportunities. Conversely, sampling frequency must be long enough not to overburden the organization with the administration of collecting and interpreting the data. For this reason, frequent or trend measures are often automated and action responses proceduralized to reduce both the administrative burden and action response time.

Thresholds

Properly selected thresholds alert managers to adverse conditions with sufficient time for them to recognize and react to causal issues. To achieve this, performance measure thresholds should have the following characteristics (also see Figure 3):

- *absolute thresholds*: the conditional value above or below operations or results are unacceptable
- *alert thresholds*: the conditional value above or below which timely action is needed to prevent exceeding an absolute threshold. Alert thresholds should be high enough to accommodate normal, acceptable operational variation without unnecessary organizational distractions while low enough to alert managers to adverse conditions with sufficient time for problem identification and resolution prior to the realization of unacceptable consequences
- *trend threshold*: a rate of conditional change above which managers would not have sufficient time to recognize and resolve problems prior to realizing unacceptable consequences

Figure 3: Performance Measure Thresholds



<u>Presentation</u>

Performance measures are of greatest value when they are easily read and interpreted. Below are some rules of thumb for enhancing performance measure graphics including:

- use of color
- line thickness
- font sizes
- graph sizing
- use of plotted values

Use of Color

While it will be seldom said that a performance indicator is riveting or that it grabs and holds the attention of its audience because of its lively color, there are some color rules that should be followed to provide clarity and enhance readability of a performance measure. Similar to any graphic representation, performance measures are often best presented on a light background with dark lettering and graphics. Additionally, colors should be distinctive or contrasting one to another. An effort should be made to not use highly similar colors that blend into each other as this makes the graphic image more difficult to discern particularly between different data sets. It is also a typical practice that there be uniformity in color between performance measures of a particular workgroup or organization so readers don't have to reinterpret the meaning of colors when going from graphic to graphic. This enhances the comparability of the graphics when comparing both horizontally or comparing up or down vertically.

Readability can be further enhanced by color when the colors selected compliment or mimic the indicator coloring used by other bodies, namely regulators. In some cases, an organization will be subject to government oversight and as a part of that oversight, will have certain aspects of its monitored performance represented graphically. These representations typically use a particular color coding which the affected organization becomes familiar. Subsequently, selecting colors aligned with these regulatory measures leverages the established coding familiarity enhancing adoption and recognition of the parameters being conveyed.

If a more riveting look is still the goal, elegance is often achieved by using darker primary colors, blues, reds, and greens, with shadowing on the leading edge when creating representations such as bar graphs.

Line Thicknesses

There exist a few simple rules for when to alter line thicknesses from the graphing tool's default values.

- *Horizontal and Vertical Axis*

  Typically the default settings, which use a fine point line for the vertical and horizontal axis along with their associated tick marks, is appropriate.

- *Condition and Trend Lines*

  Condition and trend lines can be particularly difficult to read, especially when using color to denote different data sets. Therefore, it is often advisable to increase the thickness of a condition or trend line to a 3 point setting thickness from the typical default setting of 0.75 points. This will enhance the readability of the graph from a distance and allow of the color selected to be more vivid.

Font Sizes

Font sizes should vary depending on the overall size of the graph being portrayed. General rules of thumb for graph sizes 3.5 x 5 and 4 x 6 inches are as follows:

- *title line*: 16 point font, bold

- *x and y axis unit labels*: 12 point font, bold
- *x and y axis tick labeling*: 10 point font
- *on-graph data point value labeling*: 10 point font
- *on-graph notes*: 10 point font
- *legend labeling*: 10 point font
- *descriptions and discussions accompanying the graph*: 10 point font
- *footnotes*: 8 point font

Font sizes for overhead presentations are often miss applied. Rules of thumb for overhead graphics are:

- *title line*: 28 to 32 point font, bold
- *x and y axis unit labels*: 24 point font, bold
- *x and y axis tick labeling*: 18 point font
- *on-graph data point value labeling*: 18 point font
- *on-graph notes*: 18 point font
- *legend labeling*: 18point font

Note that overhead presentation fonts should always be of 18 points or greater to ensure readability at the back of a room.

Graph Sizing

Graphs should be sized to ensure readability at the most common distance from which the observer view the graph. When using 8.5 x 11 inch paper, it is most comfortable to place two 4 x 6 inch graphs vertically in the portrait orientation. For high density depictions, graphs no smaller than 3.5 x 5 inches placed in a two by two matrix in the landscape orientation should be used. These normal and high density plotting rules apply when using larger sheets of paper up to poster size. Remember, in all cases, graph sizes may need to be increased to accommodate greater viewing distances.

Use of Plotted Values

Whereas most performance measures use graphical representations to convey the intended message, there are some instances where it is difficult and necessary to discern the difference between data points on a graph. In these cases, it is advisable to plot the value of the data point on the graph. Plotted values should be placed immediately adjacent to their associated data point and spaced so as to not interfere with the graphic representation or each other.

Summary

Thoughtful construction of performance measures helps create a vivid picture of organizational performance and accelerates decision-making. Alignment of measure characteristics enables vertical cascading and horizontal sharing which in turn focuses individuals on the achieving the organization’s goals and increases accountability.

About the Author

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Nathan A. Ives is a highly successful manager with over fourteen years of energy industry and consulting experience. During that time, he has served as a trusted advisor to senior managers at numerous Fortune 500 companies; helping them define organizational needs and develop and manage the complex, mission critical projects needed to improve operational effectiveness and lower costs. Mr. Ives is currently responsible for development and execution monitoring of a mid-size consulting firm's long-range and annual business plans, annual budget, and resource and project management programs.

Previously, Mr. Ives held the position of manager, strategy and operations at a big four consulting firm. During his tenure, he lead teams of experienced utility professionals at Fortune 500 and mid-sized, regional utilities in the design of integrated fleet asset management processes including strategic asset and resource planning, online and outage work management, engineering change and configuration management, document and records management, and corrective action programs. Prior to this role, Mr. Ives served as a trusted advisor to numerous Fortune 500 companies providing senior managers with actionable recommendations in the areas of organizational alignment, managerial decision-making, plant operations, and risk management.

Mr. Ives attended the United States Naval Academy in Annapolis, Maryland, earning a bachelor of science degree in physics. Later, he received a master of business administration degree from Kennesaw State University and was elected to membership in the Beta Gamma Sigma and Phi Kappa Phi honor societies.

Mr. Ives served on the Nuclear Energy Institute's New Nuclear Plant Executive Taskforce and the Graduate Student Advisory Board at Kennesaw State University's Coles College of Business. He is a member of the Project Management Institute and the American Management Association.

Mr. Ives received national recognition for business planning including the AT&T *Best Use of the Internet* award in 2003.

questions...

For questions regarding this topic, please contact Mr. Ives at:

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