

EXECUTIVE SUMMARY

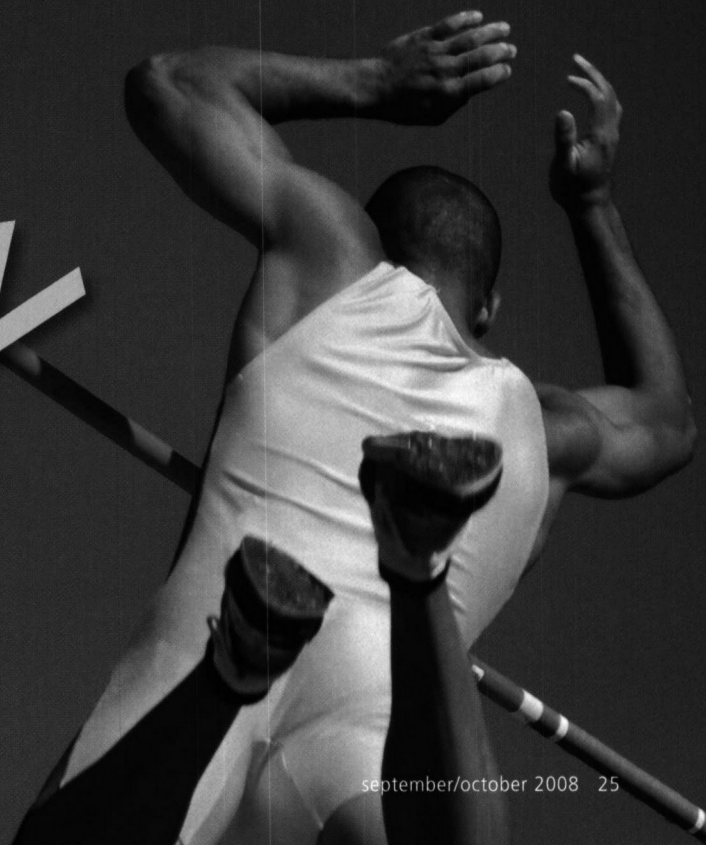
Selection of the right set of performance metrics plays a vital role in ensuring organizational focus for driving superior business results. However, metrics alone offer minimal value without the inclusion of associated goals. Goals should consider both business and human psychological aspects. Business-vital metrics and associated goals are selected based on strategic intent, organizational alignment, customer and business requirements and return on investment. Improved business results can be attained by also considering psychological factors embodied in goal-setting theory.



NEW GOAL - SETTING

THEORY

BY BILL LYCETTE AND JOHN HERNIMAN



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Metrics must be in alignment with high-level business objectives. Operational performance metrics must lend themselves to clear linkages to high-level business objectives. Selection of a few business-vital metrics can be the difference between a dust-gathering dashboard and business execution. Metrics at all levels must have clear ownership and accountabilities, and they must provide lines of sight to the overarching metrics provided in the business's balanced scorecards and performance dashboards.

Setting effective goals can be a tricky and contentious affair, and it usually requires the combined energies of art, science, diplomacy and political savvy. But focusing alone on the pure business side of goal setting can lead to disappointing behaviors and results. Improved results can be achieved by giving consideration to the psychological aspects of how an organization sets its goals. It is instructive to develop an understanding of the psychological aspects that are documented in literature, including goal-setting theory. These theories describe what drives human motivation to achieve performance goals, enabling astute management to tailor goal-setting strategies on a situation-by-situation basis to drive operational results.

Human psychological aspects are one factor when establishing effective goals. A second consideration comprises strategic intent, customer requirements and historical performance of the business. Past performance should be considered as an initial reference point. Current and future needs of your customers must be understood. Decisions need to be made to determine if the goal reflects strategic intent to maintain current levels of performance or if larger investments should be made to improve business results either incrementally or discontinuously. As with any measure, business performance metrics contain an element of measurement uncertainty and normal random variation. This margin of error can be calculated using

statistical methods and included in the goal to assure that costly responses to false alarms are avoided and that credible expectations are set.

Agilent Technologies provides high-quality performance products that serve the electronics and life sciences test and measurement markets. Many of the concepts and methods described in this article are employed by Agilent to select meaningful performance metrics and goals for driving superior customer experiences and business results. Examples are given where these concepts have been applied.

Aspirational and inspirational metrics

There are very few organizations in business today where metrics are not present in great numbers. There are different levels of contribution that metrics can provide to an enterprise.

When organizations set aspirational metrics such as "zero defects," these are often mislabeled as stretch metrics. In most business environments, zero-defect goals are not achievable but do provide for very visible quality goals. However, the low probability of ever reaching this goal makes it difficult to generate ownership and commitment around such metrics. Aspirational metrics do play a strong role in helping to create an end vision, but there is the key follow-up step that is critical to creating superior business results: turning aspirational goals into tangible and owned next steps — namely business vital metrics.

An alternate way of looking at aspirational metrics is to differentiate between aspirational versus inspirational measures. Oftentimes, aspirational goals represent a future state (e.g., zero defects or zero failures) that is emotionally compelling but unlikely to occur and be sustainable. In contrast, a subset of aspirational goals could be relabeled as inspirational goals; these are goals that represent significant changes from the current state as opposed to just an incremental change. An excellent example of such

a goal is outlined in John F. Kennedy's "Man on the Moon" speech in which not only is the aspiration of putting a man on the moon discussed, but the inspiration around the resources and commitment required to make such an aspiration possible is described.

The speech demonstrates how goal setting and metrics can be inspirational by creating a vision, emotion and a committed path on how to get there. In a business environment such an inspirational metric could be: "We are going to have the highest level of customer satisfaction in our industry within two years, and we will ensure the required initiatives are funded and actioned as a top business priority."

Effective business metrics are highly linked to goals and objectives. As Peter Drucker outlined in his 1954 seminal work, *The Practice of Management*, goals and metrics should be specific, measurable, achievable, relevant and timed (SMART).

For metrics to drive superior results, SMART is not enough. Metrics should also exhibit the following characteristics:

- Have a single owner who takes accountability for the metric.
- Be clearly articulated in an easy to understand and reusable format.
- Be applicable to all levels of the organization.

How can a single-owned metric be applicable to all levels of an organization? Consider the metric of on-time delivery to the date that the customer was promised. Such a metric may be owned at an enterprise level by the vice president of operations; however, a site manufacturing manager may own a component of this for their site, a supply chain manager may own a derivative of the metric (e.g., all parts are available within six hours of trigger to build), and a call center may own a component where all telephone orders are configured and entered into the enterprise resource planning system within 15 minutes of taking the order.

Setting effective goals can be a tricky and contentious affair, and it usually requires the combined energies of art, science, diplomacy and political savvy.

All components contribute to creating the top-level business vital metric, but each organization has a cascaded metric of its own with a single owner. The critical work here is ensuring that each of the drill-down metrics unambiguously links to the higher level metric.

Continuing the example still further, if it makes no impact on delivery timeliness that parts are available in 12 hours rather than six, then the metrics should be set differently. This is really where business irrelevant metrics come into play. Modern data systems facilitate the creation of large numbers of performance measures; however, these metrics frequently have no direct relationship to higher level business improvement. Allowing business irrelevant metrics to consume organization mindshare is often well-meaning, but it results in very inefficient utilization of scarce resources within the enterprise.

Monitoring metrics are focused on areas of the business where there is no critical need for driving improvement, but rather there is a desire to maintain existing performance levels. These metrics should act like process control measures where drift in business

performance is highlighted when results move outside of some preset control limits. The critical aspect here is when one of these control limits is breached, organizational action takes place with urgency and high priority. If there is never a real intent to take action when triggered, then the monitoring metric should be removed.

Straightforward solutions

The effectiveness of a business's goal-setting process can be enhanced by understanding psychological factors that drive human responses to goals. This is not merely an academic exercise but good business practice. Numerous psychological studies have demonstrated that specific, challenging goals drive higher levels of employee productivity. A 1994 study of U.S.-based companies by David Terpstra and Elizabeth Rozell found that across all industries, organizations that used goal-setting processes achieved significantly higher profit and profit growth than organizations that did not.

Building a Practically Useful Theory of Goal Setting and Task Motivation, by Edwin Locke and Gary Latham, states

that conscious goals affect action, and conscious motivation affects performance and job satisfaction in work settings. Goal-setting theory also holds that specific goals produce greater effort than do more general goals, difficult goals produce greater effort than do easier goals and performance feedback produces results superior to lack of feedback.

In contrast to goal-setting theory, management by objective strategies differs in that it places greater emphasis on the participative approach to setting goals. The effective ones also require hierarchical alignment, drill-down and shared organizational goals using tools such as strategic planning tables and Hoshin methods that are popular in total quality engineering. Goal-setting theory is somewhat contentious and interpretation varies depending on the research study conducted. Still, it is instructive to consider key process factors and the implication on employee behavior and business results as shown in Figure 1.

The effectiveness of a business's goal-setting process can be enhanced by understanding psychological factors that drive human responses to goals.

Goals can be assigned by management, participatively set by management and the individual, or self-set by the individual. Locke, Latham and Gerard Seijts note that when goals are self-set, people with high self-efficacy (confidence in one's ability to successfully complete a task) tend to set higher goals than do people with lower self-efficacy. People with high self-efficacy are also more committed to assigned goals, find better task strategies to achieve their assigned goals and respond more favorably to negative feedback than do people with lower self-efficacy. Clearly it is in the best interest of the organization to increase levels of self-efficacy of individuals who are responsible for setting goals and achieving them. Strategies to increase self-efficacy include training, use of experts, top-notch tools, praise, encouragement and reward.

It is generally accepted that specific goals drive superior task performance.

Feedback cycle

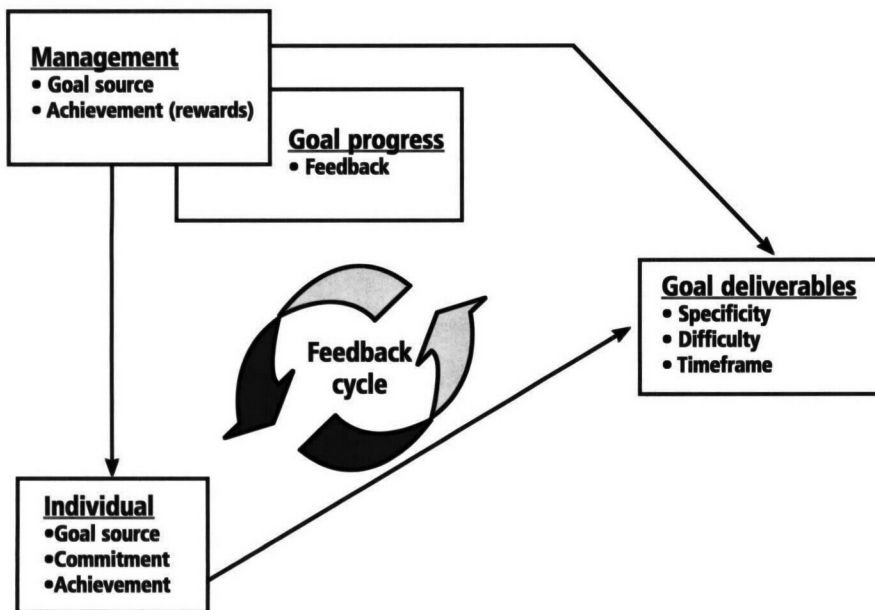


Figure 1. Employee behavior forecasts business results.

System-level annualized failure rate

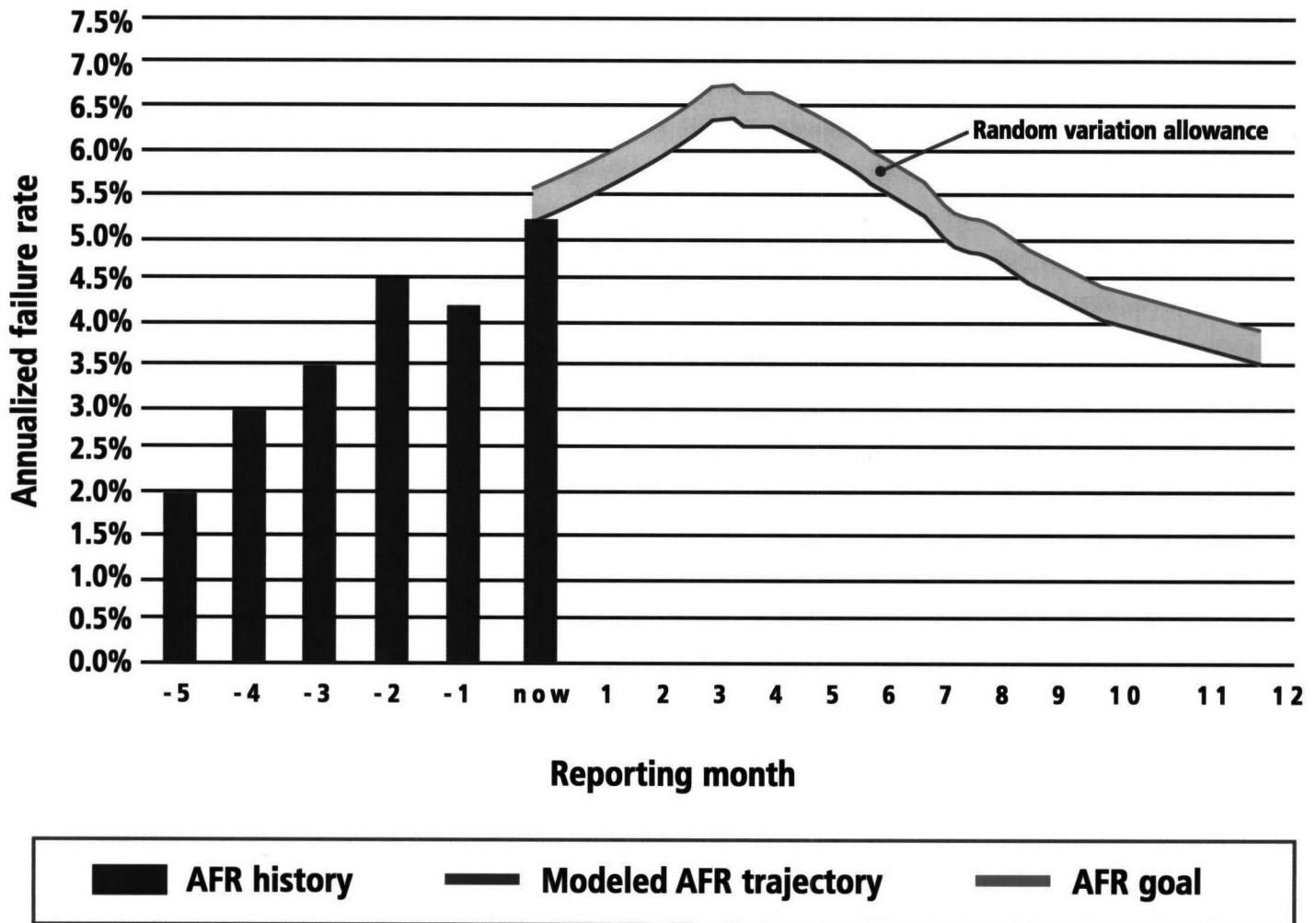


Figure 2. Sample AFR data to be combined with goal-setting theory

Interestingly, a 1989 research study conducted by Christopher Earley, Terry Connolly and Goran Ekegren found this effect reversed itself when unfamiliar tasks were assigned that allowed for multiple approaches to a solution. This suggests goal specificity can also hinder peak performance by stifling creativity when there are numerous plausible approaches. Locke and Latham reported that goal specificity did not necessarily guarantee higher performance, but it does reduce variation in performance.

The following are key factors in goal setting and execution:

Difficulty. It is generally agreed that superior results are achieved when goal difficulty is perceived as challenging and attainable. Locke and Latham

found that consistently higher levels of performance occurred when moderately to highly challenging goals were employed. By contrast, when people were asked to "do their best," they did not do so because there was no external reference point for comparison.

Timeframe. Optimum performance occurs when a combination of proximal (short-term) goals and distal (long-term) goals are used.

Commitment to goals is a critical factor to goal-setting theory. While commitment can take on a multitude of forms, it is highest when goals are made public rather than private, task owners have a great deal of control in setting and owning the goals, and task owners are driven by high levels of self-achievement, as emphasized by authors

John Hollenbeck, Charles Williams and Howard Klein. Outstanding results are more likely to occur when the organization's goal-setting approach is in alignment and in support of personal needs of the individuals.

Achievement and satisfaction. Research by Klein, Locke and Anthony Mento showed striving for difficult goals leads individuals to experience higher levels of valence (anticipated satisfaction) and instrumentality (belief that performance will lead to rewards). It behooves management to acknowledge these human needs with support and rewards so that employees will continue to seek out difficult goals.

Feedback plays a critical role in facilitating achievement of high performance relative to stated goals.

Researchers conclude that in order for goals to influence performance, individuals involved with the task must be kept continuously aware of their progress relative to the stated goal.

Control the ending

Agilent's business vital metric for hardware reliability is the *annualized failure rate* (AFR). It is calculated by dividing the number of warranty failures by the installed base of warranted units. AFR is continuously monitored and compared against the goal to ensure business objectives are being met and investments in engineering are being prudently made. With the approach of each new fiscal year, quality and business experts work together to establish new AFR goals for the coming year. The following paragraphs describe an example of this goal-setting process in action.

In this example, a new complex measurement system was released five months ago. While warranty failure data is now available and AFR metrics

can be calculated, the amount of data is insufficient to make any solid conclusions regarding where the reliability is likely to settle in. The new product is similar in architecture to another mature product and 70 percent of the component parts and subassemblies are either re-used or leveraged from existing designs. (See Figure 2.)

Division marketing experts, field sales people and quality experts engage to discuss customer requirements and expectations of product reliability. Other products are also discussed to estimate, to the extent possible, competitive forces and market trends. Criticality of the new system in the broader context of the business's total portfolio of products is reviewed and the impact of this product on the business's financial success in the coming year is discussed.

In this hypothetical case, the product is judged to be of critical business importance and thus an aggressive improvement strategy will be selected. Feasibility

of what can be reasonably accomplished from a technology standpoint is also discussed. Based on these conversations and analyses, AFR boundary conditions are set and an initial goal range is recommended to the business team.

Sound goal-setting practices also require a detailed cost/benefit analysis to understand the investments required to achieve the goal.

Reliability improvement involves breaking down the system fail rate into subsystem and component failure modes, performing failure analysis down to root cause and implementing changes in design, material and process to eliminate root causes. Sound goal-setting practices also require a detailed cost/benefit analysis to understand the investments required to achieve the goal.

A Pareto of failure modes is created based on warranty data, estimates of engineering costs to eliminate root causes are made and the expected improvement in reliability is calculated. It is common for expectations of improvement to be overly optimistic so an allowance for such errors should be factored in to the goal budget; review of historical data can be helpful here to



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estimate the "optimism error." Based on the cost/benefit analysis, top failure modes are selected for improvement action. Return-on-investment analysis generally results in more improvement projects than can be supported by scarce technical resources, so it is likely that the list of attractive improvement projects will have to be further pruned back. This problem can be mitigated by phasing improvement projects over a period of time.

At this point in the goal-setting process, we have warranted units, a forecast of future shipments, a list of known failure modes and associated AFR contributions, and a time-phased corrective action plan to eliminate critical failure modes. New unforeseen failure modes will likely present themselves in the coming months and while this is difficult to predict, historical data can provide insights into a suitable allowance for future problems. All of this data is then loaded into a model to calculate a predicted AFR trajectory for the coming year.

The modeled AFR trajectory could serve as the goal; however, it ignores

normal random (common-cause) variation seen in most process data. Failure to account for common-cause variation will lead to misinterpretation of results and possible false alarms. Responding to false alarms is wasteful and costly to the business. Such error can be quantified using statistical methods such as Monte Carlo simulation. In this example, normal expected variation in AFR has been estimated with Monte Carlo simulation procedures and an allowance has been added to the projected AFR trajectory.

Parallel with modeling the expected AFR trajectory, the human factors outlined earlier in the goal-setting theory should be considered. Given the complexity of the AFR metric and high self-efficacy of individuals involved in the process, AFR goals will be self-set by the team and then reviewed/approved by management. In addition to a system-level AFR goal, lower level AFR goals will be set at the subsystem and sub-assembly levels. This additional specificity will facilitate improved levels of

reliability performance by sharpening focus on higher levels of granularity.

By using a thorough modeling process that accounts for both controllable and uncontrollable factors, the team was able to set difficult inspirational goals that were embraced as challenging yet attainable. Commitment to achieving the goals is high because task owners played critical roles in setting the goals, team members are highly motivated individuals and final AFR goals are broadly communicated across the organization.

As the new year unfolds, progress toward achieving AFR goals is carefully monitored and adjustments in corrective action strategy are made if reliability performance lags stated goals. Successes are celebrated and contributions are publicly recognized to reward, reinforce and encourage difficult goal-seeking behaviors.

Business-vital metrics should undergo continuous review and revision to ensure that they are in alignment and in support of the enterprise's ever-changing business environment. ↔

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"OURS IS A TRADITIONAL COMPANY, SO NO THINK-
-ING OUTSIDE THE BOX!"

contributors

in this issue



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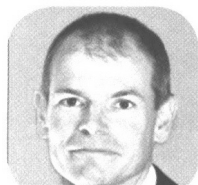
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