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The Missing Link

Continuous improvement relies on a balance between well-defined strategy and effective execution.

PICK UP ANY industry trade magazine or attend any conference and you invariably are exposed to the current slate of "hot topics": Consolidation. Merger. Acquisition. Vertical integration. NADCAP, AS9100, ISO 13485 certification. New materials, new processes, new equipment. Reliability and quality. Low-cost geography. Quick turn. Intellectual property.

All are valid and valuable strategic elements. Yet, it has been said that vision – or in this case, strategy – without action is nothing more than dreams. But when you thoughtfully merge vision and action, the result is real, meaningful progress. So in today's wild and changing environment, how do we turn these important strategic initiatives into world-class progress by effectively merging this vision and urgent action? What is the execution plan?

This author believes there are three key components to this vision/action merger: the growth of an effective Lean Six Sigma methodology forming the foundation of a culture of continuous improvement, the embrace of a vital and vibrant employee development program, and the presence of an effective leadership structure and system.

The various Lean methods and Six Sigma problem-solving techniques have been well documented, and need not be discussed here in great detail. But to any degreed engineer, a large part of the Six Sigma toolkit is what was originally taught to us as "The Scientific Method." The Scientific Method was the cornerstone of every science class in high school and college. So, if these methods are so common and so well known, what's the big deal? It is that the methods are not followed due to a fundamental lack of problem-solving discipline and the quest to put out the latest fire. Often, these fires are only superficially solved, left smoldering, waiting to flare again, since the true root cause was never identified and subsequently extinguished. Human nature is to deal with what will get you shot today, and a problem that went away will not get you shot (at least not today). That being the case, the Six Sigma structure and methodology is genuinely valuable because it drives a set of problem-solving methods and disciplines that value true root cause analysis, and thus prevents problem recurrence. These tools and techniques foster a data-based decision-making culture via broad use of statistical process control, well designed experiments, automated statistical analysis tools, and the use of Ishikawa fishbone diagrams and the "Five Why's" for root cause analysis. Once a problem is solved, the proper controls are put in place, and that specific problem should never happen again. You never want to buy the same real estate twice.

Lean methodology is also critical, especially in manufacturing settings where a constantly changing product mix will quickly obsolete run rules aimed at maximizing efficiency. The variable product mix issues are amplified by new product introduction and their aggressive schedules. As such, setup reduction and lot size optimization are constant challenges and critically important, perfect applications of the Lean tools, including manufacturing associate-driven kaizen events. Lean methods, including 5S and work cell standardization, will always help improve factory efficiency, optimize overall throughput, and set the stage for effective Six Sigma tool use.

One of the beneficial improvements driven by Lean implementation is cycle time reduction. Cycle time reduction obviously is desirable to customers; shorter lead times are regularly used as a competitive tool in the sales force arsenal. But the operations team loves cycle time reduction too. A shorter build cycle time means more cycles of learning available per quarter, which accelerate iterative yield learning. Similarly, in the event of the unavoidable process problem, shorter cycle times reduce mean time to detection, and minimize the amount of work in process that may be affected. (Of course, reduced cycle times also are attractive to the CFO, for cash preservation reasons.)

Many of these initiatives start with a flourish, but then settle into a business-as-usual approach, especially if the initiative is treated as a program, rather than a new way of life. To cement these tools in the organization, one needs a comprehensive training system to proliferate these tools, with a situational delivery method to accommodate different incoming skill levels. A haphazard education system that results in a cultural backslide will be exceptionally discouraging to those who enthusiastically volunteered a few short months ago. Manufacturing teammates *want* to do a better job and *want* to be more involved, and if education and problem-solving participation is dangled in front of them without a sustainable system for 100% inclusion, the result will be far worse than before the start of the initiative. I'll reiterate: this is not a program, but a process aimed at sustainable, continuous improvement. The employee development program cannot simply offer single-ended Lean or Six Sigma training. A truly effective program will address a wide variety of topics within the three skill sets: job content skills, transferable skills and self-management skills. All three must be collectively addressed with the individual's personal readiness taken into account, and the resultant training must be immediately put to use on the production floor so that the skills are not merely theoretical in nature, but

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could be OK, provided the design is simple and can permit this variation. Complex designs usually mean less design headroom and lower tolerance for change.

Let's say you have a design that incorporates several fine-pitch BGAs connected by an address/data bus that requires impedance A, and you have a few RF traces that require impedance B that route to antennae fabricated right on the PCB. The PCB complexity is now at six to eight layers, and the designer has the option to specify each "important" trace on the PCB and its impedance (controlled impedance), or specify the trace widths and PCB stackup (designed impedance). With controlled impedance, the fabricator would be responsible for the impedance and would measure it to verify and put the data on the first-article inspection. With designed impedance PCBs, the designer could ask the fabricator to measure the impedance as reference only, and include the data on the first-article inspection. The latter permits more design control with the same check and balance in place to ensure proper impedance has been realized.

The point here is that a good designer will take full responsibility for the design. No one, for any reason, should alter that design except the designer. The designer knows why everything is the way it is. Changing a design without the designer will usually result in unforeseen failures. Example: The PCB manufacturer removes nonfunctional pads around a via on innerlayers because they are electrically nonfunctional. Result: The structural integrity of the via is compromised when the end-product is subjected to stress testing. How would the fabricator know that the little bit of extra structural integrity of the via is needed for the product to pass HALT (highly accelerated life testing)?

A fabricator that can provide its "secret sauce" is great, BUT BE READY TO LOCK INTO THAT SUPPLIER, BECAUSE EVERY FABRICATOR'S RECIPE IS DIFFERENT. Is that a risk you want to take?

We work on products every day that are successfully subjected to thermal shock rates of 50°C per minute temperature change, between -40° and +85°C, while experiencing random vibration levels of 30G. The best solution in this situation is Note 23. This forces the fabricator to consult with the designer. Feedback from the fabricator then gets incorporated directly into the design. This process makes the design better and hopefully minimizes any room for error. The designer must be in total control of the design.

It is great to have a fabricator that can provide its "secret sauce" to make the design work, but be ready to get locked into that supplier, because another fabricator's recipe will be different. As a designer, is that a risk you want to take? Is that a risk you want to take with your product? Is that a risk you want to take with your business? PCD&F

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have been reduced to practice in a meaningful way. Employee development is a long-term investment too often sacrificed during tough financial times. This is a mistake.

Strong, vibrant leadership is the last key component, the glue that holds all this together, as well as a catalyst to make the organization more effective. Great leaders show their mettle under fire. There is a marked difference between leading and managing. Managers, by definition, manage, or react to situations after they arise. In stark contrast, leaders exercise a more predictive, anticipatory approach to their responsibilities, which always has the team moving forward in sync with the overall organizational strategy. All too often, people are put into leadership positions because they had historically been a great doer, a great problem-solver. But are they a great problem avoider? The leader is truly a catalyst, employing an effective organizational structure that fosters timely, penalty-free communication and has interlocked and cascaded SMART goals: specific, measurable, attainable, realistic and timely. Since people respect what you inspect, these goals link directly to a handful of bellwether metrics, from which the pulse of the operation can always be taken.

Many strategies can be incorporated into an organization's operating plan. Execution and the tools to enable execution are the missing link. The proper balance between a well-defined strategy and an effective execution plan will form the foundation for a culture of continuous improvement. One without the other is counterproductive. Once this culture takes root, however, and the entire organization's efforts are synchronized and catalyzed, the result is unstoppable. CA