EDITORIAL

"Must be Able to Multi-Task" ... Perhaps the Real Key to America's Business Decline

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There is nothing that endangers American industry more than managerial incompetence. There is no more manifest evidence of unguided managerial thought than the insistence that subordinates must deal with multiple complex tasks *simultaneously*. You don't need to be a genius to understand the economic danger in this. Even the most misguided MBA understands the worth of material passing through his business.

Raw goods are worth what you paid for them. Finished goods are worth what you can convince a customer to pay for them. Work in process is worth nothing – you can't sell it to a customer, and you can't return it to a supplier. The same distribution of value applies to human thought and energy. Only a fool would insist that his employees dilute and disperse their expensive work hours into valueless "stuff in process," but that seems to be exactly the advice proffered by today's American business schools and their published drones. If you have not yet lost the cerebral stuff between your ears, it may be time to stand up and announce that "modern" management is long overdue for an influx of "old" thought and value judgments. At the end of the day, it's what you *finish* that is worth something, not how many things you have started.

Very few of us get the opportunity to lead a business initiative. Should that opportunity fall upon you, don't squander the mental energy of the people who look to you for leadership. There is no logical business purpose served by immersing people in a chaotic work environment that constantly distracts them from finishing anything by requiring them to start additional tasks. It makes far better sense to seek and/or develop subordinates who know how to prioritize the tasks before them and consistently work to complete the most important of these.

If you have the good fortune to have a subordinate who consistently "takes ownership" of an assignment and follows it through to completion, encourage such focused and single-minded behavior. Bolster the driven innovator who falls within your purview.

As engineers, we are frequently involved in various aspects of product development. Designing a new product is invariably a difficult and complex task with a multitude of subtasks that must all be accomplished successfully for the whole to be finished. Today's product designer is faced with an almost insurmountable mission: do more with less and do it better and faster than anyone has ever done it before. We can get a lot of "help" in trying to discharge this task from people who are entirely incapable of approaching the problem to begin with. Business bookshelves abound with tomes that reflect the wisdom of the pundits of Harvard, Stanford and Wharton. They would have you and the chaps who run your company believe they have recipes to legislate innovation and regiment creativity. They are wrong.

There are no magic methods of directing people that will assure the creation of saleable products on an unrealistic schedule. There are simply no "blister pack" solutions; you cannot evolve a profitable product in timely fashion without deploying all of the necessary resources to accomplish the work. It is not possible to innovate without taking risks. Having stated the glum and the obvious, it is incumbent upon me to point out that the situation is not entirely dismal. There are many simple steps you can take to improve your odds of success. All of these hinge upon simple concepts such as modeling, feedback and efficiency; terms long familiar to any engineer but often foreign to the professed professional manager.

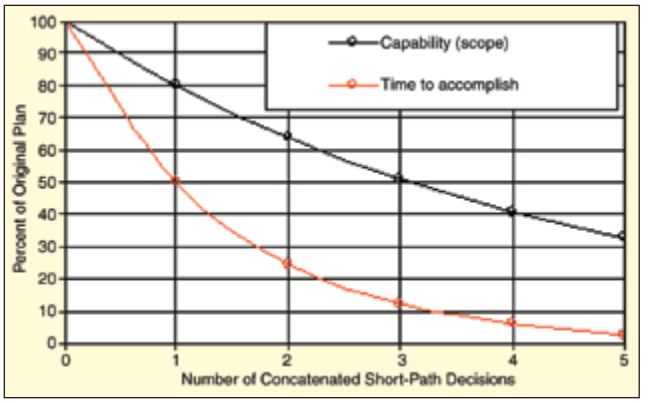

Figure 1. Effect of recursive short-path decisions on end capability of your product and time it will take to provide these capabilities.

I would like to add one more tool to the arsenal of the young engineer faced with leading a new product development effort: constructive compromise. There is an old maxim well circulated in technical design circles:

> *Fifty percent of the effort is expended in developing eighty percent of the required functionality; the other half of the effort is directed at providing the remaining twenty percent capability.*

As with most truisms, there is more than a passing grain of truth in this humorous observation. One may take issue with the specifics of the phrasing or with the exact percentages involved; however, it is impossible to deny its underlying truth. The return on technical investment is invariably nonlinear. A complete and all-encompassing solution is invariably much more elusive and expensive than one which covers most but not all situations that might be encountered. This provides a trap into which most product development efforts fall. It also provides a simple axiom that will serve the developer well if rigorously applied at every decision junction:

> *Choose the simplest means to accomplish the bulk of your assigned mission, and resist more complex approaches that only offer a small performance differential.*

This guideline is the watchword of constructive compromise.

Software is a major element, if not *the* major ingredient in today's high-technology products. It is also the ingredient we seem to have the least success in managing. The promise of an open-ended solution has led to many open-ended developments, a tragically long list of fine products that failed to get to market on time. Some would paraphrase our 80/50 maxim by saying:

> *It takes eighty percent of the time to write fifty percent of the software. The other half of the software is written in the **other** eighty percent of the time!*

It doesn't have to be that way.

Let's consider an important ramification of the 80/50 maxim: it is recursively applicable to product development. Every product development faces a series of decision points; for illustrative simplicity, assume each of these to be a dichotomy offering an opportunity to accomplish the whole of the objective or an 80% subset of the objective in half of the time. While real projects face a nearly infinite number of detailed decisions, we will simply examine the result of n major junctures. If we invariably choose the complete solution at every decision point, we will accomplish 100% of the objective. Should we consistently choose the 80% subset, we will only accomplish 0.8^n of the objective but will do so in 0.5^n of the time.

If we are absolutely certain that the original objective is the minimum requirement for a successful product, our course is clear. It is also clear that in such circumstances we cannot make a decision that will shorten the course of the project. But if we are not absolutely certain that the original objective was, indeed, the bare minimum required for success, then we have the opportunity to improve our performance/cost ratio by as much as $(80/50)^n$. That is, if the diminished (0.8^n of original goal) accomplishment satisfies the real need, it can be done in 0.5^n

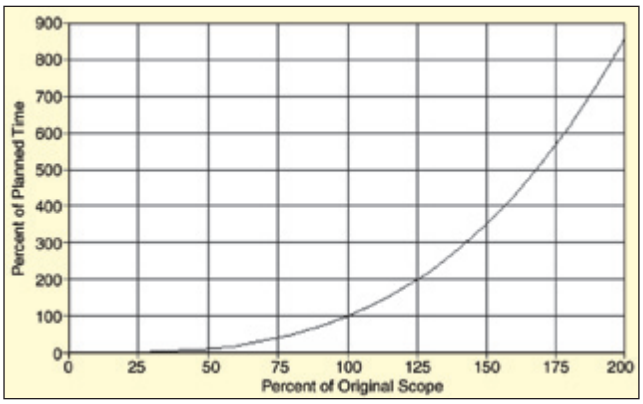

Figure 2. Effect of scope creep on execution time of your project.

of the time.

The ability to previsualize a nonexisting product with any real clarity is not widely distributed within the human population. While clear product hindsight is widespread, and appreciation of the nuances of the existing is common, few people have the gift to imagine what might be with precision. Products are rarely initially conceptualized with absolute accuracy. The feature set of any successful product is arrived at iteratively. That is, the design is subject to a sequence of decision points, and at each of these, the opportunity to inject simplification exists. These are opportunities that you cannot afford to ignore.

Consider this very common scenario. A salesman identifies an opportunity to sell a new "widget" to an existing customer. He describes these needs to his manager in a brief letter, hoping to obtain something that he can sell in the very immediate future. Such input is rarely tempered by the realities of time and resource; after all, nothing is impossible for the man who doesn't have to do it!

The letter becomes the focus of much discussion among marketing and sales executives; its content may well be melded with similar input from other sources, and the scope is almost invariably expanded in proportion to the number of people involved in this discussion. Someone takes it upon himself to translate these needs and wants into a preliminary product description. This pontifical act is the first decision point and is normally that undertaken with the greatest myopia. The preliminary product description is reviewed and refined from both a technical and business standpoint. What is wanted is rephrased in terms of what is possible and practical.

The outcome of this effort is some form of a product requirement specification. The process of generating this may be viewed as a second decision point. Enlightened organizations test the feasibility of such proposals by passing them before the initiating customer and a reasonable sample of his peers. Less enlightened enterprises fear this step and substitute review by the initiating salesman. (Note that this is a paranoid rather than productive substitution.)

In either event, a third decision point is passed as the requirements are invariably edited. Engineering is charged to produce the widget and given a series of constraints including time, budget and facilities. Since we are dealing in the abstract and philosophical, assume these to be reasonable. In such an ideal world, the requirements seed a preliminary design that constitutes a fourth decision point. Work progresses smoothly without any problems and the effort produces a final design, the fifth decision point, which is passed to manufacturing where it is produced without a hitch.

So in the absence of any difficulties, n is at least equal to 5. That is, we have had an opportunity to produce a performance/cost ratio anywhere between 1 and $(1.6)^5$. Restated, taking the 80/50 "short" path at each of five decisions results in providing 32.8% of the capability defined by the salesman in 3.1% of the time required to meet his specification in full. Were the short path only chosen three out of five times, the result would still provide over half of the capability in one-eighth the time required to implement the original myopic vision in its entirety.

This model is admittedly simplistic, but it makes a telling point. Every time you make a decision regarding a product's feature set, the method of implementation, or future expandability, you have an opportunity to take the long road home to a complete solution or a short cut to a lesser answer. It is not inherently evil to take the short road. Doing so does not indicate stupidity, timidity or irresponsibility; it is the essence of getting your product to market on schedule.

Every product description contains a combination of wants and needs. While the needs are "show stoppers," the wants are merely nice-to-have appendages. It is a recurring truth that satisfying the wants often absorbs a disproportionate share of a project's total effort. Recursive amputation of such appendages is a small price to pay to allow the needs to be realized on schedule. Product definition evolves during successful developments. No one has all of the answers at the onset. The initial definition is a painting in broad strokes; the design process refines the details of this vision. The real art of good product design is to fill in these details with small strokes of insightful passion while remaining faithful to the original sketch. This must be accomplished without running out of paint, expanding the size of the canvas or requiring a brush that has not yet been invented.

Make no mistake about it: if your product is to come out a timely winner, you will have to fight for it. This will happen to a greater or lesser degree at every decision point and meeting both the necessary and intentional ones you have planned for and those foisted upon you by the environment in which you function. While you may embrace the $(80/50)^n$ proposition, there are others who cannot see the world with such clarity.

These less visionary folks are your project's worst enemies. They are the carriers of an industrial disease known as *scope creep*, an infectious malaise that causes end dates to drift from the present into an uncertain and hazy future that may never come to pass. At every review point, someone will propose extensions to your product's mission. On extremely rare occasion, such offerings will suggest a real and significant contribution to the product's odds of being an instant hit; this happens infrequently. More likely, you will be handed a wish list of potentially unrelated or untested additional basic functions or a series of suggestions for improving the convenience of operation. The cost of such late "improvements" is high, and the price for being late will be paid in your hide, not theirs.

A little algebra applied to our $(80/50)^n$ maxim allows us to express expected execution time as a function of increased scope. Specifically: Time = $(0.5)^{\log(\text{scope})/\log(0.8)}$; this function is shown in Figure 2. When viewed from this vantage point, the importance of containing scope creep becomes blatantly clear. Allowing a 25% increase in mission can be expected to double your execution time. Doubling your mission would cause a more than an eight-fold increase in your time to deliver.

The same people who are incapable of visualizing a product before it exists are totally unable to appreciate the highly nonlinear effect of mission extension on project execution time. In fact, during such discussions, they are quite apt to assume that small incremental "improvements" will come for free with no impact on your schedule. To some extent their view is justified, particularly during the infancy of development, when the detailed tasks and methods of accomplishing them are not clearly defined. In very preliminary meetings, you can, and should, adopt a receptive mind-set; it is at this stage that you may profitably become the recipient of one of those rare-jewel ideas that can really improve your product. However, recognize that your input impedance to such suggestions must increase rapidly as the product evolves if you are to be successful.

A rare jewel presented at Day One can have a positive impact on your work. The same gift at a later time can only have a disastrous impact on your timetable. The most important attribute of a successful product is that it be a timely offering; miss the aperture and you will almost certainly miss the business opportunity. Miss the business opportunity and you may find yourself an unemployed ex-product manager reading want ads that contain the hackneyed phrase, "must be able to multi-task." S&V

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