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A Question of Context - The Promise and Peril of Applying Manufacturing Concepts to Product Development Effort

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Abstract

Management practice has been revolutionized by the combination of rigorous process definition and collection of detailed performance metrics. These changes have produced a virtual "miracle cure" for factory ills, and reset expectations for competitive efficiency throughout nearly every industry worldwide. There is understandably great pressure to apply the same remedy to every other part of the business life cycle.

The promise is obvious, and pervasive in literature. The peril, however, is subtle, and too often an unwelcome topic among those seeking simple change and immediate benefit. The secret to success lies in understanding *why* these methods are so effective within the manufacturing subset of the business, and then using that understanding to apply them, *in context*, to other places where the same underlying conditions are present. Attention can then be focused on using those methods in situations where there is potential for benefit, while simultaneously prohibiting their application in areas where harm is a likely result.

This question of context is a topic every manager should consider before making process-related decisions. It underlies every successful implementation, can be used to confidently forecast the success or failure of any proposed initiative, and provides protection from the often dangerously narrow manufacturing-derived tendencies most organizations now exhibit.

Introduction

Over the last fifty years the mass manufacturing portion of the business model has undergone enormous improvement, largely as a result of recognizing that variance from a defined target can be measured and used as a critical guide to improving efficiency. After all, if you have total agreement on what “done” looks like, have made a thousand and plan to make thousands more, any drift from that defined objective is guaranteed to lower your efficiency.

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Clearly, then, variance is the natural enemy of modern mass production. But what happens when you want to make the very first one of something entirely new? In this case, variance, the enemy of manufacturing, turns out to be *exactly what you are looking for*.

The Roots of Misunderstanding

The goal of manufacturing is to make as many *exact copies of a 100% pre-defined article* as possible, at the lowest possible cost. Product cost and quality are easily quantified, and the manufacturing sequence can be absolutely defined in advance. Even the most beneficial changes are unwelcome within a given production batch, since fixed costs are amortized across the number of units produced. *Value is associated with product, and everything else is considered a cost to be minimized*.

However effective modern manufacturing methods may be, their *success depends upon a very delicate and artificial set of conditions found only within manufacturing*.

Unlike the manufacturing process, product development begins with questions and nearly infinite possibilities, not a "build to print" solution. There is *no exact definition of "done"* which can be used to establish detailed plans and schedules; instead they must be extrapolated from the currently accepted definition of requirements and project scope.

The design process involves *a mixture of fixed and variable elements whose ratio shifts as the maturity of the design increases*. Iteration is an essential tool, not an admission of error. Procedures alone cannot be trusted to match output with expectations, instead a high degree of carefully managed interaction between evolving goal and emerging solution is required to ensure success. Expenditures of time and money on planning and requirements definition are an *investment whose return must be maximized, not an overhead cost to be minimized or eliminated*.

In short: *The power of product development resides in dimensions that have no precedent in the manufacturing subset of the business life cycle.*

In a world that thinks of revenue volume, market share, inventory and other costs of goods sold, it is difficult to introduce a value argument for spending more resources before sale to understand a customer's true requirements, or for additional resources after sale to smoothly conclude the project. Furthermore, manufacturing builds large quantities of *products*, whose sales generate enormous *revenue*, which in turn propels *careers*. Therefore, a disproportionate percentage of middle and senior management personnel are likely to have emerged from that subset of the business.

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The Systems Underground

For simple products, *in fact for all products with a 100% degree of definition at time of sale,* the manufacturing business model holds up reasonably well. Even more complicated products can be manufactured without consideration of the overall system environment *so long as the customer is willing to act as the integrator.*

This leads to the dangerous illusion in growing companies that the additional expense of services such as Product Development, Systems Engineering and Project Management would simply increase overhead and reduce profits. Ironically, the end result is that costs and risk are transferred to the Customer who then passes them back to the manufacturer either directly or through long term market influence.

Sales Managers divert time to explaining alternatives and filling in the gaps. Engineers get phone calls from the Customer asking for information. Changes haunt the entire production process. Project Managers find closeout complicated by a lack of common expectations. Marketing reports with alarm that a competitor is now offering integration services. Products become interchangeable commodoties and the only remaining competitive dimension, price, is quickly exhausted.

Here and there, though, the spark will take hold and a Systems Engineering skill set begins to emerge among people who recognize unmet process needs and step up to fill them. Far too often that skill set must hide in whatever gaps remain between accounting categories, function by influence instead of authority, and develop informally instead of being carefully nurtured as a valued element of the overall business engine.

Even when formal development organizations are introduced, the challenge of operating within a fundamentally manufacturing process set limits success and causes a large portion of the work to be accomplished by informal methods. Note that it is exactly this “off-book, non-value added activity” that efficiency advocates seek out and eliminate.

As a result, far too much critical system analysis and support takes place by people who are scared to be caught doing it, and continuing cost and staff reductions have increased the base workload to the point where essential activities commonly go uncovered.

Product Development Impact

The benefit that comes from variance reduction, as well as the logical family of methods that compare current performance against predefined targets, are dependent to a large degree on conditions that only exist within the artificial business state we call manufacturing.

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All products start out as an idea and evolve into solutions. One way to think of that transition is that the task shifts from a purely creative endeavor (Idea) to a purely compliant one (Product). Along the way, effort exhibits the characteristics of both.

Design is referenced against something that will occur in the *future*. In contrast, Manufacturing is always referenced against something that was defined in the *past*.

In fact, it's this "past-referenced" characteristic that gives variance reduction methods so much power for good in the manufacturing environment. If you know *exactly* what "done" looks like, anything that doesn't take you on a straight line towards that goal is clearly wasted effort and an opportunity for efficiency gains.

As might be expected, this fundamental difference in cultures results in a starkly different view of appropriate managment metrics. Zero variance makes no sense during design, just as brainstorming isn't a logically applicable tool for achieving mass production efficiency. The secret is to divide larger, amorphous tasks into discrete packages that can be matched to appropriate measures, methods, incentives, and rewards.

The unstated challenge is that Management must first recognize that two discrete types of work exist, create the rules by which work gets subdivided and later reassembled, and then keep these competing methods from killing each other in practice.

This is a central reason why many companies that used to excel at both design and manufacturing now specialize in one or the other, and must then create external partnerships to complete the project life cycle.

So, if manufacturing-derived methods aren't the answer, what do you do within the "creative" task subset to gain efficiency and secure competitive advantage? Here's a partial list of some essential keys:

- Keep in mind the idea that the target is also a variable, and that the definition of requirements and functions serve as essential "scaffolding" around which the target is established.
- Master the art of dividing large tasks into smaller parts, introducing as few new boundaries, of the simplest possible type, that allow independent effort to be performed.
- With independent effort comes the responsibility to guide the pieces towards a common outcome, and that outside of manufacturing both the targets and emerging solutions require confirmation.

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Conclusion

Forget the notion that manufacturing people aren't "system thinkers". Of course they are! Running a factory requires great skill and insight. *The problem is that the system they think about is different than yours.*

Even if you can get them to *acknowledge* how different it is to design a product instead of build it, don't be fooled into believing that admission will translate into a full *understanding* of the difference. After all, where within the manufacturing experience is the logical model to draw upon in order to reach this understanding?

The central concept that the desired outcome is also a variable and thus needs monitoring just as much as the emerging solution, opens up a rich domain for discussion and is key to eliminating the disfunctional imposition of purely manufacturing derived concepts.

RELATED REFERENCES

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BIOGRAPHY

Mr. Iliff has over 30 years experience working on developmental projects ranging in size from a few thousand to well over a billion dollars, and has participated in all phases of project execution from proposal to close out. He has held Proposal Manager, Project Manager, Systems Engineering Manager, Engineering Manager, and other related titles in multiple industries, and is now the Director of Strategic Innovation and Senior Systems Engineer for Bjorksten | bit 7 in Madison, Wisconsin. He earned his B.S. in Engineering / Industrial Design from Michigan State University, holds an M.S. in Systems Management, Research and Development from the University of Southern California, and received Honorary Fellow appointment at the University of Wisconsin Antarctic Astronomy and Astrophysics Research Institute when he served as the Systems Engineering Manager for the ICECUBE project. Mr. Iliff is a charter member of the International Council On Systems Engineering (INCOSE), founder / prior Chairman of the INCOSE Commercial Practices Working Group, and a member of the Project Management Institute (PMI).

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