

# Essays on Change Proficiency: The Dollars and Sense of Agility <sup>1</sup>

Rick Dove

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He has organized and chaired various commercial, defense, and consortia initiatives in Agile enterprise strategy, deployment, research, and development efforts; and writes monthly Agility essays published in Automotive Production Magazine. Currently he has two books in process.

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Previous to his interest in Agility and change proficiency, Dove led companies, raised venture funding, and founded and fixed companies in the systems integration, manufacturing software, computer manufacturing, office products, and food processing industries. Since 1985 he has focused on enterprise competitiveness issues.

<sup>1</sup> This series draws from collaborative-learning industry workshops which analyzed the nature of change in business practices and processes, and formulated frameworks and metrics for capturing and explaining the essence of adaptability. This material, along with the subsequent essay series, forms the base for a book scheduled for publication by Wiley in the Fall of 1999.

# The Meaning of Life & The Meaning of Agile

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The Agile manufacturing concept is gaining considerable interest, even though it is hidden in a mass of confusing explanations and interpretations.

Agile is a very seductive word. One that finds immediate and personal definition for almost everyone. It can capture cycle time reduction -- with everything faster. It can encompass mass customization -- with customer responsiveness. It can embrace virtual enterprise -- with streamlined supplier networks and joint ventures. It can echo reengineering -- with continual process transformation. It can demand a learning organization -- with systemic training and education. It can build on Lean production -- with high resource productivity.

As a descriptive word, Agility can embrace almost any of our current competitiveness interests with considerable intuitive appeal.

Agility is presented by some as an amplification of one of these concepts, and by some others as a superset of many. Casual investigation of Agility can easily lead to greater fuzziness as a greater number of sources are heard from.

Confusion is evidenced in many ways. Some people ask for the difference between Agile and Lean, Agile and TQM, Agile and Mass Customization.

Others say that Agility is their next priority after completing their transformation to Lean production, or whatever else they are currently embarked upon.

It is time to crystallize the understanding of this very useful and important concept.

Agility was born in 1991 when an industry group observed that the increasing rate of change in the business environment was outpacing the adaptability of traditional manufacturing organizations. Dominant organizations

were suddenly failing when continuously changing markets and customer interests found new sources of satisfaction.

Though some of these organizations were simply late to wake up, many could see a need but were unable to institute internal change quick enough.

Agility is the word that describes the missing characteristic in these organizations. They could not adapt at the same pace as their changing environment -- neither to counter a threat nor take advantage of a major opportunity.

This adaptability idea for organizations is not anything new, however. Organizations have always existed in a changing environment and have always had to adapt -- ever since the first humans banded together for purpose.

Organizational adaptability is a core viability requirement -- just like profitability. In order to continue as a viable entity an organization must meet two conditions for existence: it must satisfy some purpose (profitability) and it must continuously adapt as necessary to changing environmental conditions. When either of these conditions is not met the organization is threatened with extinction. In this sense an organization is just like an organism - both lead a transitory life in a hostile environment that requires the consumption of energy and constant vigilance.

In the life metaphor we talk about evolution and mutation as ways to accommodate a changing environment. We look for the mechanics of this characteristic in the genome of life. Equivalently in the organization we must look to see how the organization is organized -- both statically and dynamically.

To mix metaphors, Agility is a plumbing issue first and foremost. Operating strategies like lean production, and transformation strategies like process reengineering are all facilitated by an underlying proficiency at change. If the organization is "proficient" at change it can and will adapt to take advantage of unpredictable opportunity as well as counter the unpredictable threat.

Being Agile means being proficient at change -- and allows an organization to do anything it wants to do whenever it wants to. Thus, an Agile organization can employ business process reengineering as a core competency when transformation is called for. It can hasten its conversion to Lean production while that is still useful. And importantly, it can continue to succeed when constant innovation becomes the dominate competitive strategy.

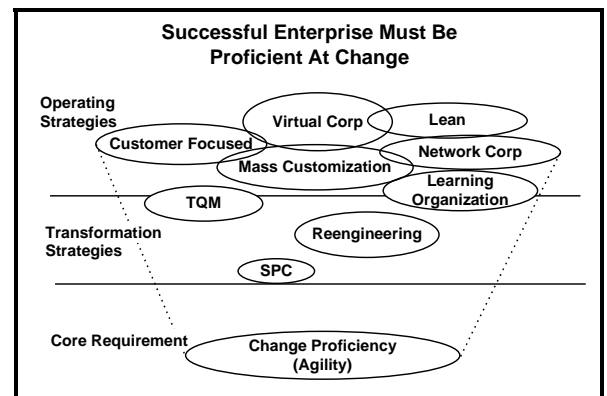
Trying to differentiate mass customization or Lean from Agile miscasts all as operating strategies. And asking for the differences between TQM and Agile misclassifies both as transformation strategies.

Holding off Agile programs until a transformation to Lean production is completed incorrectly assumes that these are sequentially dependent concepts. Rather than close the barn door after the horse has left, a transformation to Lean production will happen faster and with less expense as the organization becomes more Agile.

Agility is a core fundamental requirement of all organizations. It was not interesting as a focused concept when environmental change was relatively slow and predictable. Now it gains considerable attention and a growing number of proponents.

Confusion in this early stage of understanding is introduced principally from two sources: indiscriminate use of the word to promote narrowly related technologies, and a seductive focus on the business strategic advantages and manifestations. The nature and reality of an Agile organization is determined by how it is organized -- it is a systems and structural issue. And we will talk more about this next time.

Being Agile means being proficient at change, and allows an organization to do anything it wants to whenever it has to."



# Plumbing the Agile Organization

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Adaptability in a living organism is built into its genes and expressed in a system of separate interacting organs. Adaptability in a living organization is also determined in its plumbing.

Though Agility is a broad enterprise issue, looking at the production impact of product realization will provide some fundamental insights into these plumbing issues that we can generalize later.

Decreasing innovation cycles in all market sectors are increasing the product introduction frequency.

The process of bringing new or improved products to market involves changes in the production area. Whether these changes are fairly small or quite sweeping, there is usually a transition period of adjustment and settling-in.

During this transition period two principle sources of turmoil are at work: 1) as changed items are put to the test of actual use, some fine-tuning is required before they satisfy their purpose, and 2) the interaction of the changed item with its environment has some undesirable side affects that need to be resolved.

We speak of change here in the total production-environment sense. Thus, we do not limit a change to the modification of some item that exists, but include both the addition of something new and the elimination of

something old as these too are changes in the total production environment.

Simply stated, after a change is designed, built, and installed, there is a transition period that must be dealt with before we have what we want, or decide to settle for what we got. In the Agile ideal we strive for, this transition period takes no time, incurs no cost, is not artificially terminated, and is not an inhibiting factor on the latitude of change we are willing to consider.

A closer look is revealing. Introducing a new product requires that we change the production environment. Making this change incurs cost and takes time. Some of this cost and time is pure design, acquisition, and development; and some is transition turmoil from integration and shakeout.

In the past these changes occurred infrequently and the transition costs were easy to ignore. But product introduction frequency in all markets continues to rise, and in many markets has already passed the point where continued transition cost and time ignorance is tolerable.

A new machine or production cell introduced into the production environment requires shakeout of the machine itself, integration of the machine into its interactive environment, operator training, maintenance training, and service training, to name the easy parts of the turmoil. Then we have the operational idiosyncrasies and failure modes that get learned the hard way with surprises and experience.

We've been talking about production machinery so far; but everything we've said applies to changes of any type: new procedures, new personnel, different personnel, introduction of teaming concepts, a change in work instructions, etc. All incur a transition period of integration and fine-tuning before the turmoil is settled.

And the toll of the transition period for each of these changes affects product cost, product quality, and market responsiveness.

An obvious way to reduce the toll of transition is to reduce the quantity of things in transition. If we want to do this while accommodating more new product than ever before, we have to learn how to build new product with old proven process -- reusable process, reconfigurable for a new purpose.

Reusability and reconfigurableness are construction concepts -- they have to do with the way things are built - no matter whether these things are manufacturing cells, work procedures, production teams, or information automation systems.

To bring a new or improved product to market we want to introduce as little new process as possible. For instance, instead of designing and building a completely new welding cell we might duplicate and modify an existing well-understood cell. This cell will surely have some new elements in it to accommodate the variations of the new product, but a good bit of the cell will be time tested and familiar. It may not be as technically appealing as a completely new design -- but it will be up and running a lot faster, a lot cheaper, with less scrap and rework, and more predictably.

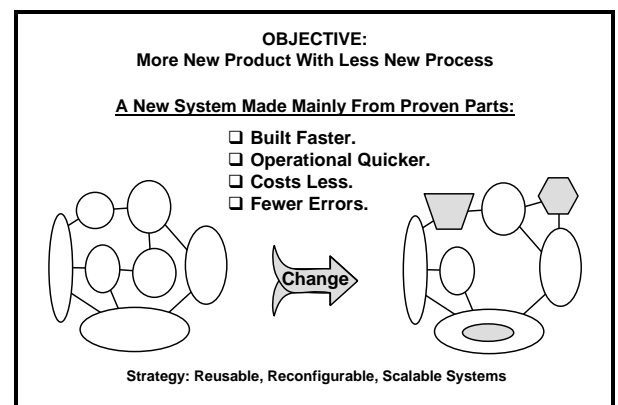
This does not mean an end to capital investment or a continuous cannibalism of used equipment. It means an important new focus on the structure of the production elements which must be reconfigurable. And it is physical reconfigurableness we need, not programmed reconfigurableness. We need the ability to make unanticipated new things from reusable pieces, not simply select some predefined subset of flexible capability or imbedded options.

Reconfigurable structures, whether they organize sub-units in a piece of equipment, equipment relationships in a cell, cell relationships in a production area, or production areas in a plant require some form of module reusability.

For maximum change proficiency these structures must be scalable as well as reusable and reconfigurable. Scalability eliminates size restrictions imposed by the structure, allowing any number of reusable modules to be included or omitted as desired.

Our objective of change proficiency has led us to an organizational strategy of reusable, reconfigurable, scalable systems. The engineering principles for this strategy must contribute directly to the objective. Before we can evaluate candidate principles we need to understand the nature of change proficiency in the business sense. We will talk more about this next time.

“Learn how to build new product with old proven process -- reusable process, reconfigurable for a new purpose.”



# Metrics and Measures for Agility

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The Agile enterprise has been defined as one that is proficient at change, and Agility defined as change proficiency. Very interesting word, this proficiency -- Webster says it means "highly competent".

Competency is one of those umbrella words that we often use to encompass qualities that are hard to quantify. Nevertheless, a practical measure of Agility is needed before we can talk meaningfully about getting more of it, or even getting some of it.

Naive discussions of Agility often confuse it with quickness -- which reduces simply to cycle-time reduction. Time, as the metric for Agility, shows its inadequacy when we test it and other candidates against extreme conditions.

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Would you call it Agile if a short-notice change was completed in the time required, but at a cost that eventually bankrupted the company? Or if the changed environment thereafter required the special wizardry and constant attention of a specific employee to keep it operational? Is it Agile if the change is virtually free and painless, but out-of-synch with market opportunity timing? Is it Agile if it can readily accommodate a broad latitude of change that is no longer needed, or too narrow for the latest tricks thrown at us by the business environment?

These questions help us tease apart this thing called Agility into four change-proficiency metrics: time, cost, robustness, and scope.

Exploring the interrelations of these four shows a need to score sufficiently well in each.

Completing a change in a timely manner is the only effective way to respond at all in an environment of continuous and unrelenting change. After all, we do need some time in-between changes for a little value-added work. But the **time** of change alone does not provide a metric for agility.

You can change virtually anything if **cost** is no object. However, if your cost of change is too much relative to your competitor's costs, there will be a steady erosion of working capital, or at least a higher tax on shareholder profits. Change at any cost is not viable, else we need not restructure anything ever - we can simply throw out the old and buy a new capability; assuming, of course, that we can bring something new to the operational level quick enough.

Quick, economical change, however, is still not a sufficient profile for proficiency. If after a change the result is balanced on the head of a pin and requires 24-hour-a-day baby-sitting to remain functional, the change process was insufficiently **robust**. If we cut corners in the process of changing in order to do it quickly and economically, we end up with a fragile, spit-and-bailing-wire result.

Finally, something is considered Agile precisely because it is prepared to thrive on unpredictable change. This unpredictability might be with when a known change will occur, or with what an unknown change will look like. Change is a transitional term that implies a starting point and some new ending point. How far away can the ending point be from the

starting point? The dimension of **scope** addresses this question. Are we Agile if we can accommodate any change that comes our way so long as it is within 10% of where we already are?

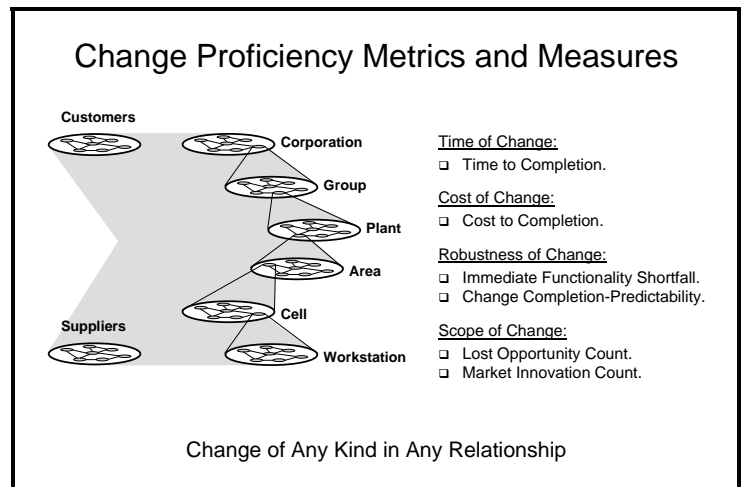
Scope is the principal difference between flexibility and agility. Flexibility is that characteristic you fix at specification time. It is the planned response to anticipated contingencies. Agility, on the other hand, repostures the fundamental approach in order to minimize the inhibitions to change in any direction. The frequency and unpredictable nature of required change has reached the point where contingency lists are outdated virtually as soon as the ink dries.

At the heart of scope is the architectural issue: rather than design something that anticipates a defined range of requirements, or ten or twelve contingencies, design it so it can be deconstructed and reconstructed as needed. Design it with a reusable, reconfigurable, scalable strategy.

Scope captures so much of the essence of Agility that it would appear to be the principle differentiation of this concept from others, and be a sufficient metric for change proficiency. But we must remember that scope is only a statement about the magnitude of change that can be accommodated. The amount of change that can be accommodated is useless if it can't be done in time to matter, at a cost that is reasonable, and with a surety of robustness.

Thus, for any element to be truly proficient at change, it must have a balanced capability across all four dimensions of time, cost, robustness, and scope.

To measure proficiency at change we need quantified statements for each of the four proficiency metrics. Ideally, in order to analyze existing situations, we want to find quantities that are already in our books, or can be constructed



from historical records.

The time of a change can be likened to the time-to-market of a new product. In this case we are talking about the change activity associated with creating a new cash-generating customer transaction. Time-to-market is that time associated with product and process design and implementation that results in a deliverable cash transaction with a customer, and includes the formation and management of effective customer and supplier relationships.

Similarly, cost-to-market of a change is the cost required for completion; or in our new product example, that first cash transaction.

Continuing with our new product metaphor, though new products may be rolling off the line, we all know that neither the product nor the process design is rock solid in the early days of delivery. There is some rework and scrap beyond our desired levels. During this early period we often have a functionality shortfall from our targets, and generally have a difficulty in quality-level predictability.

Robustness measures the strength and competency (quality) of our change process. It can be measured in the same ways that we measure quality of anything: by customer satisfaction polls, by degree/amount of shortfall, etc. Robustness is a statement about our ability to predict the satisfactory completion of a change activity. How often have we been on time, on budget, on spec? Or at least within acceptable variances of our original predictions. If we are generally correct then we probably have a high robustness to our change process.

Of course, we might have a good predictability record simply because we pass over anything that looks too difficult. Scope measurements will counter this effect as they measure both “opportunities lost” and “innovations”. Scope is an indication of how much latitude for change we can competently accommodate. If it is too little, we are

perhaps just flexible and have not really entered the realm of Agility. Scope can be difficult to measure precisely, especially if you have no history, as you never know where the edges really are.

Lost opportunities are those occasions when a change could have provided some useful advantage but was declined. Opportunities are presented to producers by prospective customers. An opportunity must fit within the producer’s vision and mission to qualify as an opportunity. A refusal to go after the opportunity is akin to a no-bid. Going after the opportunity and failing to secure it is basically a bad-bid, and is considered equivalent to a no-bid, as the producer is unable to capitalize on the opportunity.

Opportunities exist independent of any action or recognition on the part of the producer - resulting in a growing score of bad points for any producer who simply ignores or is deaf to the realities of the market. Thus, opportunities require successful response or extract a point payment.

An innovation is a self-initiated change on the part of a producer, and is presented to the customer. It might be in the form of a new product, a lower cost product, a higher quality product, or a faster product. Some innovations are bigger than others - a 20% cost reduction is twice as big as a 10% cost reduction. The customer

provides the “innovation points” according to how innovative they feel it is. There is no incentive to leak out three successive innovations that are equivalent to one leaping innovation which encompasses all three if somewhere in the succession a competitor establishes a new benchmark. Catching up is not innovation - and should score as negative innovation points.

Making use of these metrics in practical situations requires the establishment of a set of accounting rules appropriate to the enterprise, to the organizational level within the enterprise, and to the nature of the functional unit that is being measured.

This general metric framework is applicable to any change in the relationship of interacting units: workstations in a production process, suppliers in a supply-chain network, talented personnel in an IPD team, even clauses in a partnership agreement.

For instance, a workstation is a producer with a customer up the line in the production area. When the workstation accepts an opportunity to make a change it will have a time- and cost-to-market for that change, and will exhibit the robustness of the change when it begins production again.

Outside of the production hardware category, a team of people defined by their collective task interest will undergo a change when they agree to accept a new team member with additional skills. There will be a period of turmoil as this new team member and skill set is absorbed and put to productive use. The Agility

of an organization’s teaming methods will figure importantly in its overall viability, but this is a subject for considerable discussion later.

As Agility increases, the turmoil caused by change-transition decreases, approaching an ideal where it takes no time, incurs no cost, is not artificially terminated, and is not an inhibiting factor on the latitude of opportunity and innovation we are willing to consider. Developing metrics for change proficiency has led right back to the key performance metrics of any corporation: the toll of change-transition is directly reflected in product cost, product quality, and market responsiveness.

#### **Important Definitions**

1. Change Proficiency - the competency in which an adaptive transformation occurs.
2. Change Proficiency Metric - the performance item(s) to be measured in order to assign a comparative competency value to change-proficiency: Time, Cost, Robustness, and Scope.
3. Change Proficiency Issue - the item that the metric will be applied to (eg formation of partnership).
4. Change Proficiency Measure - Time is measured in units of time, cost in units of money, robustness in predictability and shortfall, and scope in lost opportunities and market innovations.

# Loose Change Adds Up To Big Money

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Big money is being spent today on loosely managed change activities. Downsizing and reengineering are two of the more visible and unpleasant examples. Unpleasant because they are painful, cost too much, take too long, and the results are often disappointing. Though there is a lot of both going on, there is very little proficiency at either being shown.

This lack of proficiency is equally true in many more types of current change activities; all adding up to real big money. We will look at a few examples to develop a working model of change and its currency. In the process, we want to show that Agility has significant advantages today, and is not a paradigm restricted to the custom configured products of tomorrow. We will also introduce a classification for types of change that will help us benchmark proficient practices later.

The current wave of downsizing is a technical adjustment that recognizes a decade or two of productivity gains; but that doesn't mean it won't happen again. On the contrary, fluctuations in a company's workforce capacity, both up and down, will be more frequent under Lean operating strategies as demand for any one product fluctuates. And demand fluctuation is on the increase -- old market drivers of seasonality and economic cycle are joined with new market-share drivers of technological obsolescence and customer opportunism.

Meeting production demand variation is another major issue today, whether we are talking about short term surge capacity or the ability to track longer term market demand changes. In the auto industry, for example, a high fixed break-even point for a car plant is an example of a downside barrier to capacity change, and the inability of one plant to make another plant's product is an upside

barrier.

Business reengineering is another high profile change activity with poor general proficiency. Recent studies indicate that about 20% of these activities achieve desired ends, even though billions of dollars are involved on a national scale. Generally a company that is unsuccessful with a reengineering project will try again, and again, until it gets it right. Studies explain that this is part of the learning process; but the principle lesson seems to be that you can't stop until you're done, whereas a better lesson is the knowledge that you are never done. Unfortunately, companies feel successful when they have migrated from an old mode of operation to a new entrenched position.

Organizational learning is another vital but elusive capability today. It is the mechanism that develops new core competency. The knowledge base that is the substance of core competency is vulnerable to both personnel loss and rapid obsolescence. Captured and constantly renewed, an effective knowledge base will steadily migrate the organization's core competencies in synch with changing technologies.

Production changeover is a current issue in most industries. Major auto companies are moving from an 8-12 week plant shut-down for retooling to a targeted 1-3 week cycle over the next few years, driven by competitors who are already there. Semiconductor manufacturers with a higher frequency of new model introductions are trying to squeeze small prototype runs through their production facilities with minimal disruption to the

revenue stream. Defense manufacturers often win or lose contracts on the basis of changeover costs and times. In its best form, changeover is a reconfiguration issue; taking existing resources and configuring them differently for a different purpose.

We can look at technology diffusion within an organization as another reconfiguration issue. Examples of proven process and product advantages that never get leveraged company-wide abound -- too much hand-wringing and discussion but little else.

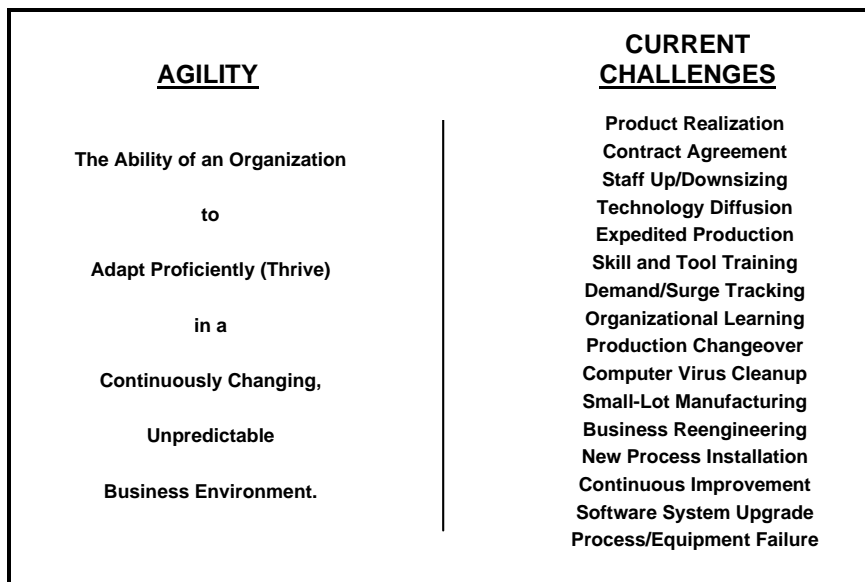
Virtually all companies talk about training and continuous learning -- some are even doing a little. The value of serious skill training is even evident in white collar ranks, where office

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mean it won't happen again. On the contrary, fluctuations in a company's workforce capacity, both up and down, will be more frequent under Lean operating strategies as demand for any one product fluctuates. And demand fluctuation is on the increase -- old market drivers of seasonality and economic cycle are joined with

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automation, decision support, and engineering tools offer new productivity advantages each year. Most companies are doing better at training than they were before they started talking about it, but few will claim proficiency. Serious difficulties are arising in production equipment maintenance where technologies change faster than service knowledge. Though some training is simply improvement of existing skills, most adds new capability.

Adding a new capability in production is another key current issue, and generally involves the installation and commissioning of a new piece of production equipment, as well as the integration of that equipment into a larger production system. And all of it done while an impatient market waits. With increasing complexity from technology and integration effects, seamless equipment insertion is becoming more difficult and more necessary at the same time.

At this point we have discussed eight major Agility issues that manufacturers wrestle with today. They are issues precisely because there is big money involved and competitive positioning at stake. They are Agile issues because they are change-based. In this discussion these eight examples have been used to emphasize four inherently different types of change: Expansion/Contraction (Capacity), Addition/Subtraction (Capability), Reconfiguration, and Migration. There are an additional four types of change that we find useful to distinguish, which we call: Creation, Variation, Augmentation (Improvement), and Correction.

Creating a contract that defines and fosters a functioning business relationship is a hot issue today. Contract procedures and negotiations that outlive opportunity windows, inhibit opportunity consideration, or consume resources without value have been recognized as pernicious for some time now.

The process of creating a product is receiving the lion's share of attention in most industries today. Concurrent engineering has given way to "product realization", which encompasses the entire concept-to-cash process. This area gains in importance as the competitive focus moves from cost to innovation.

High variety, small-lot manufacturing and mass customization are issues popularly associated with Agility. Both are examples of real-time change-proficiency during the performance of production operations. Expedited production orders are another example of change during the performance of the production operation. Though all are major issues in defense industries where small quantity and job-shop practices prevail, mass producers are valuing the advantages of proficiency in the performance-time change area as well.

Continuous improvement seems at first blush to belong to other paradigms than

Agility; but the principles of Agile systems enable and facilitate continuous improvement rather than simply mandating it. Software is taking an increasing role in the operation of our factories and the infrastructure of the company - yet making a simple upgrade or improvement is postponed as long as possible -- unpredictable disruption to service is all too inevitable.

Increasing process and equipment complexity along with increasing productivity has put a spotlight on the issue of process and equipment failure recovery. Perhaps a more crippling recovery issue, however, is the nightmare of computer virus.

The sixteen current challenges we chose to exemplify our eight change types are not meant to be comprehensive -- but look at the list in the figure and guess how much money and time in your company is devoted to the issues shown. Ask yourself how much of your company's competitive position is defined in that list. And ask how proficient your company is at each of these challenges. Agility is today's priority.

This column has built a foundation in four monthly installments that will now let us explore the construction of change-proficiency. We will talk next about utilizing **reusable** resources in a **reconfigurable, scaleable** framework to achieve Agility.

EXAMPLE	TYPE OF CHANGE
<b>Product Realization Contract Agreement</b>	<b>Creation/Deletion:</b> Make (or eliminate) something.
<b>Continuous Improvement Software System Upgrade</b>	<b>Augmentation (Improvement):</b> Minor incremental change.
<b>Organizational Learning Business Reengineering</b>	<b>Migration:</b> Major fundamental change.
<b>Skill and Tool Training New Process Installation</b>	<b>Addition/Subtraction:</b> Add/subtract unique capability.
<b>Computer Virus Cleanup Process/Equipment Failure</b>	<b>Correction:</b> Rectify dysfunctional resource.
<b>Expedited Production Small-Lot Manufacturing</b>	<b>Variation:</b> Real-time operating change.
<b>Staff Up/Downsizing Demand/Surge Tracking</b>	<b>Expansion/Contraction:</b> Increase/decrease existing capacity.
<b>Technology Diffusion Production Changeover</b>	<b>Reconfiguration:</b> Change resource relationships.

**FRAMEWORK FOR ANALYZING CHANGE PROFICIENCY**

# Agility Engineering: Lego Lessons

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Remember the child's round-peg, square-hole hammer toy? It had a framework with 6 or 8 uniquely shaped holes and a set of individually shaped wooden pegs. The trick was to integrate each of the pegs into a completed system by finding its uniquely compatible hole. These toys taught us valuable lessons about compatibility.

A more valuable lesson might have been about incompatibility, however. The framework had a fixed number of holes that demanded filling. A missing peg rendered the system incomplete. Spare pegs could not be bought separately, and trying to replace a lost peg with one from a friend's set generally found a different peg geometry.

Contrast that system with the Legos that younger generations are growing up with. The framework has a simple repetition of identical sockets on a standard grid pattern, and can be extended indefinitely by simply attaching additional framework sheets together. The modules come in various simple forms, all with an identical socket structure. Macro-modules can be assembled from basic pieces and replicated as often as needed to build or expand complex systems quickly. Losing a few pieces is hardly noticeable.

The framework is so simple that compatible modules from competitors are readily available with special characteristics and pricing advantages. And the observed useful lifetime of the reconfigurable Lego set far exceeds the peg-pounder.

Legos even eclipsed Erector Sets. Though you could build almost anything with an Erector Set, without a framework every project was a custom construction effort that consumed too much time in the piece-interfacing activity.

A design strategy of reusable modules, reconfigurable within a scalable framework (RRS - introduced in a prior essay) can engineer Agility into a wide variety of Agile systems.

Framework and module are the two distinct key objects here, and reconfigurableness is the key desirable characteristic. Though this may be oversimplified for some, and too mechanistic for others, it is a useful way to begin examining our business Agility-engineering task.

The accompanying table shows a cross section of enterprise elements, and suggests how specific systems within these elements might be viewed as modules and frameworks. Simply looking at these systems as modules and frameworks does not make them Agile of course. From this viewpoint, however, we can engineer the nature of the modules and frameworks to give us the desired reconfigurableness.

Certain corporations in Japan have put these concepts to fruitful technical use. The "software factory" is a Japanese approach to creating very large software systems in very short times, at very low costs, and with a remarkable lack of "bugs" (see Japan's Software Factories: A Challenge to US Management, Michael A. Cusomano, Oxford Press, 1991). They do this by constructing new systems from previously used and proven modules that are readily drawn from a well-maintained pool. They have established a standard framework so that all modules are plug compatible. Though they have not employed object-oriented programming environments, they build their modules as stand-alone encapsulated units to minimize side-effects when modules are combined in new systems. Though American programmers scorn the approach as non-creative and lacking in elegance, the fact is that these "engineered" systems get up and running bug free to satisfy a need in a fraction of the cost and time of traditional hand crafted systems.

Closer to home, Sun Microsystems describes their

"We find less use for the MBA on board and more need for a new MBE - the Master in Business Engineering."

## SAMPLE SYSTEMS VIEWED AS MODULES AND FRAMEWORKS

<u>Enterprise Element</u>	<u>Specific System</u>	<u>Case</u>	<u>Modules</u>	<u>Framework</u>
Organization	Cross Functional Teams	Xerox*	Multi-Skilled Workers	Labor Contract
People	Learning	J. Doe	Skills	Prior Knowledge/Experience
Procedure	Dual-Use Accounting	Defense Contractor	Data Capture Software	MIS Legacy Wrapper
Information System	Order Entry	Rover*	Application Programs	Inter-Module Message Protocol
Control System	Adaptive Feedback	Saginaw Machine*	Sensors & Machines	Generic Machine Model
Plant Facility	Reconfigurable Factory	Texas Instruments*	Workstations	Physical Facility
Material Handling	Global JIT Production	Global Transpark	Planes/Trains/Ships/Trucks	Operating Contracts
Production Process	Flexible Machining	Saturn Corp*	LeBlond Makino Equipment	LeBlond Makino Standards
Production Equipment	Modular Fixtures	Watervleit*	Clamps/Components	Fixture Base Plate
Change-Over Process	Electronic Assembly	Solectron*	Assemblers/Machines	Culture/Information-System
Supply-Chain	Pre-Qualified Pool	Collins Avionics*	Component Suppliers	4.5 Sigma Qualification Program
Distribution-Chain	Brand Market	General Motors	Dealers/Customers	Product Positioning

\*For case details see "1994 Best Agile Practice Reference Base", Agility Forum, 1995.



corporate “strategy for change” based on five S’s: Small, Simple, Separable, Scalable, Stateless. Production Magazine’s January 1995 issue reports this on page 61 as: “When you do a project, do one that’s small and simple, one that has elements that can be removed and reused (i.e., separable) elsewhere (i.e., stateless) and expanded if necessary (i.e., scalable)”. Sun is described as a \$5-billion workstation manufacturer with 95% of its revenues from products less than 18 months old, with a 30% change in production techniques annually.

It should come as no surprise that Agile operating modes are beginning to emerge informally from many companies in the high-flux industries of electronics and software. As we try to formalize these understandings we look across all industries for emerging patterns like the RRS strategy, and we analyze these patterns for their contributions to change proficiency.

We recognize a need for change proficiently in a variety of ways -- all of which we loosely call reconfigurableness: increase in capacity (e.g. add more modules), increase in capability (e.g. add different modules), continuous improvement (e.g. modify a module), migration to a different operational foundation (e.g. modify the framework), creation of new capability (e.g. develop a new module type), reconfiguration of relationships (e.g. change the groupings of modules that interact directly with each other), recovery from a module dysfunction (e.g. reconfigure module relationships during operational performance), and respond to a performance-time surprise (e.g. change operating priorities).

The framework in our RRS strategy is basically a set of standards that defines a plug compatible environment. The concept of standards in the world of Agility is a two edged sword, and a central engineering issue. Standards are necessary to eliminate module interfacing as a problem; yet they will also determine and restrict the range of employable modules. So the framework must facilitate its own migration with time, and will probably benefit from simplicity as well.

If we provide embedded utility services within the framework we will benefit if they are implemented as modules - constructed as plug compatible self-contained modular units that provide fundamental common services to other modules. In the production environment MRP is a good example of something that should be implemented as a module rather than as an integral inseparable part of the framework. In the organizational environment teaming is a good example - especially as we learn about the pitfalls of early teaming approaches and recognize the need to evolve these systems over time.

There is much more to be said about design principles for RRS systems that will have to wait for another time. But we have said a little about frameworks, so we will also say a little about modules.

A key issue with modules is “facilitated” reusability. Modularity by itself does not provide the degree of reusability we look for. A support capability is needed that facilitates the creation, replication, and modification of modules. This will include some sort of repository for unused modules or templates for reproducing them; procedures for cataloging and finding modules; and tools for replicating, modifying, creating, and testing modules. This support capability is the

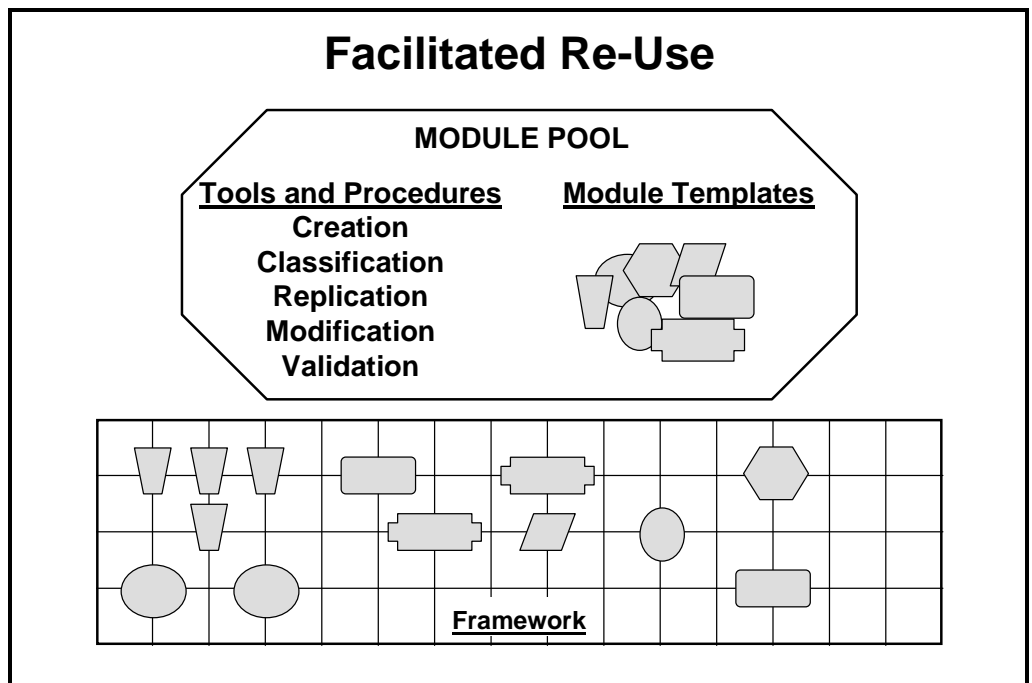
engine of Agility, and the domain of the business engineer. And it becomes the seat of organizational learning and knowledge

Westinghouse Electric and AT&T have both created a corporate consulting pool containing a wealth of proven skilled personnel. These pools were formed initially when downsizing in various business units liberated valued competencies and skills that the corporation was afraid to lose. The concept in both companies has since evolved into a valued resource that can provide a “plug compatible module” with immediate effectiveness to any hot spot in the organization. The framework for these modules is best described as the corporate culture.

With the increasing complexity of global economic systems and business environments, the metaphor of management at the helm is passé. Piloting a ship through troubled waters is the wrong picture when even the waters are changing; demanding that the ship change accordingly as it goes. We find less use for the MBA on board and more need for a new MBE - the Master in Business Engineering.

We have covered a lot of ground in a small space here and will plumb the depths with a more narrow focus in later segments. In the meantime, the Agility Forum (610-758-5510) has published an initial “Best Agile Practice Reference Base” that can shed more light on this area with industrial examples.

Resource management is the enablement foundation for Agile enterprise - it is what change proficiency is all about - and it is what we have been focusing on in this series. By itself it does not guarantee an Agile enterprise, which also requires Agile opportunity management and Agile innovation management - concepts we will put in perspective at another time.



# Agile Benefits: Viability and Leadership

Rick Dove, Sr. Fellow, Agility Forum, dove@well.com, Paradigm Shift International, 505-586-1536

Expectations change: overnight delivery, one-hour glasses, 10-minute oil changes, and instant faxes. We wouldn't have it any other way now that we know it's possible. Technological advances keep changing the impossible into the standard, with the pace of these advances quickening.

Globalism has expanded the size of the market community, customer and competitor alike - and technology lets new entrants begin at the top without having to build the legacy that developed countries live with. With global reach CNN and MTV have made this larger community a more intimate community, and the explosion of satellite and cable channels shapes global knowledge with an understanding that you can have it now. For customers, this in-your-face opportunity to have something better now has killed the concept of brand loyalty.

“Beware of anything that dons the robe of political correctness, these masquerade as simple total solutions.”

Globalism brings more people into the technological development arena, all looking for a competitive edge. Though indirectly this expanding base of competitor and customer are drivers of the quickening pace, the real engine is ceaseless technology development. The next development no longer waits until the last is mature. The concept of successive “S” shaped maturity/utility curves worked when everyone rode the same curve, driven by diminishing returns to take a risk

or be inventive.

Hewlett Packard makes the point - undercutting their own returns from a growing laser printer market with the introduction of ink-jet technology. They understood that if they didn't, some vigilant competitor would.

A producer of goods today is like a runner on a treadmill, where tolerance for stumbling depends on how fast the machine is running. Different markets, different innovation speeds; but in every market someone's diddling with the speed control. For some the speed is comfortable and for others an effort in remaining viable. With innovation speeds in virtually all markets changing, healthy companies must be adaptable; either to react to someone else's innovation or proactively introduce one of their own.

In the accompanying figure the four objects of customer, producer, competitor, and technology, and their relationship vectors, are not especially new; but the adjectives capture the mercurial behavior we see emerging today.

New understandings in the relationship vectors are also worth exploring. We talk today about listening to the voice of the customer, about being customer responsive, and about delighting the

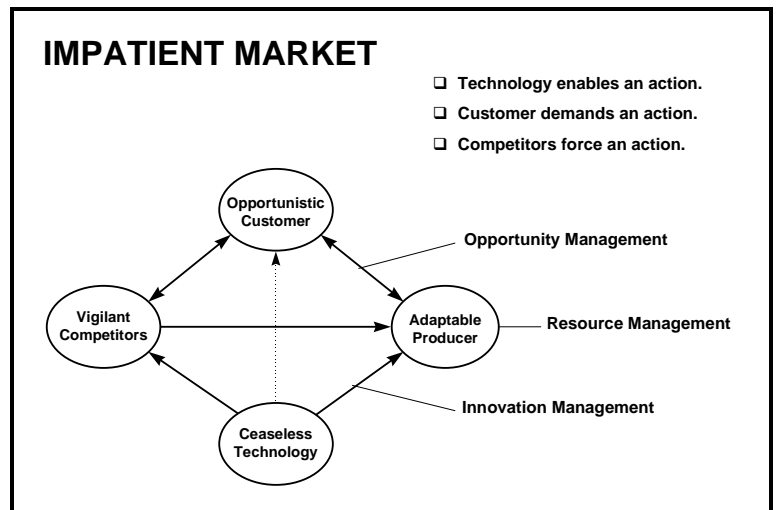
customer. It is politically incorrect to suggest otherwise, and these concepts are the fundamental platform for many corporate strategies. Beware of anything that dons the robe of political correctness, these masquerade as simple total solutions.

In the late seventies the American machine tool industry made a point of asking the Detroit automakers, their biggest customers, what they should do next. They listened very well to the voice of their customer, and then watched as Detroit bought new innovations from Japan. Vigilant competitor and opportunistic customer in action.

Customers cannot be expected to have the command of new technology and its possibilities that suppliers have - their core competencies are purposely focused elsewhere. Their voice can offer valuable improvements to what they already understand, and will probably be heard by the competition as well. Not listening to the voice of the customer creates an easy opportunity for the competition.

The voice of the customer, whether offered or sought, is a pointed demand for reaction made by the customer to the producer. If managed well the vigilant competitor cannot dislodge the current relationship, at least not under the current rules. Managing the opportunity from the competitor's point of view means introducing a new set of rules - proactively bringing an innovation to the opportunistic customer.

Successful opportunity management requires an active point on both ends of the vector between customer and producer. You can be sure that there is a two-way vector between customer and



competitor - number two has to try harder.

At the heart of all of this is the engine room of ceaseless technology introduction. It is what makes innovations and improvements possible. Fairly independent of producer, customer and competitor, technology happens. New possibilities all of a sudden exist where nothing was before. What to do about this, how to foster it internally, and how to harness it effectively is the innovation management issue.

Silicon Graphics, a very successful computer workstation manufacturer, purposely seeks out the most difficult-to-satisfy customer. Fortune magazine reports that Chairman Ed McCracken "has established a practice of actively cultivating customers who want to do things that just can't be done with SGI's products -- or anyone else's, for that matter". These customers then become part of the next generation product design team. It's like General Motors going to Bangkok, Thailand with a clean piece of paper and no rules - to design a car fit for traffic congestion that keeps people in their cars four-plus hours a day routinely. The car might become an alternate office or entertainment platform, or sprout autopilot assistance for the lone driver; all of which could lead to change in larger markets.

Hewlett Packard is recognized for product innovation - and practices an interesting discipline - insisting that the hardest thing be done first in any new development project. This has two valuable side effects: projects that have killer problems are killed and killed early, and developers gain a deeper and broader knowledge of the possible.

Market viability comes from Agile opportunity management,

market leadership comes from Agile innovation management. Both are enabled and coupled by Agile resource management.

Agile resource management focuses on change proficiency, seeking specific advantages that bring the benefits of leadership and viability. A company needs both proactive and reactive competencies to initiate and counter external change events, and it needs both progressive and resilient competencies to initiate and counter internal change events. These advantages are enabled by the feature of change proficiency - specifically eight types of change discussed at some length elsewhere.

Agility is the ability of an organization to adapt proficiently (thrive) in a continuously changing, unpredictable business environment - a combination of viability and leadership. The accompanying table shows the relationships between the features, advantages, and benefits of change proficiency; providing an actionable viewpoint for the strategist, the manager, and the Agility Systems Engineer (business process reengineer?).

<b>( Resource Management )</b>		
<b>FEATURE (Proficiency at:)</b>	<b>ADVANTAGE</b>	<b>BENEFIT</b>
<ul style="list-style-type: none"> <li>■ Creation/Deletion</li> <li>■ Improvement</li> </ul>	<b>Proactive</b>	<b><u>Leadership</u></b> <b>( Innovation Management )</b>
<ul style="list-style-type: none"> <li>■ Migration</li> <li>■ Addition/Subtraction</li> </ul>	<b>Progressive</b>	
<ul style="list-style-type: none"> <li>■ Correction</li> <li>■ Variation</li> </ul>	<b>Reactive</b>	<b><u>Viability</u></b> <b>( Opportunity Management )</b>
<ul style="list-style-type: none"> <li>■ Expansion/Contraction</li> <li>■ Reconfiguration</li> </ul>	<b>Resilient</b>	

**Agility: The Adaptability to Thrive in a Continuously Changing and Unpredictable Business Environment**

# Mobilizing Knowledge with Agility Audits

Rick Dove, Sr. Fellow, Agility Forum, dove@well.com, Paradigm Shift International, 505-586-1536

Hidden in every sizable company are a wealth of innovative techniques that will improve its competitiveness -- if they are recognized and diffused to the rest of the organization. How do you find the pearls? How do you get the rest of the organization interested in something they didn't invent?

Mobilizing embedded corporate knowledge is a cornerstone of Agile competition. If a company is going to accelerate its proactive and reactive capabilities it cannot afford to reinvent the same solutions over and over again, it cannot afford to make the same mistakes over and over again, it cannot afford large changes when small ones will do, and it cannot afford to ignore the pearls that go begging for recognition.

Leverage comes from reusable knowledge, reconfigurable for different applications across the entire corporation.

The principle asset in a corporation today is its collective knowledge -- something that doesn't show on the balance sheet. The value of that asset is multiplied by its mobility within the corporation. Most companies today have not thought about that knowledge base, how it changes, and how it gets deployed at points that need it while it still has something to offer.

“Mobilizing embedded corporate knowledge is a cornerstone of Agile competition.”

An auditing technique for profiling Agility in corporate plant environments provides interesting advantages here. The technique we will discuss recognizes that an organization is a complex thing, especially if it is a production unit, and starts with a top-down look that produces a general but broad-based profile. This initial profile illuminates the important areas of change proficiency for the organization being audited, and pegs each as either well in

hand or in need of real attention.

Audits are motivated for many reasons, e.g., to ferret out opportunities for improved performance, or to validate capital expenditure plans for maximum applicability in an unpredictable future. But the unsolicited advantage they bring immediately is the discovery of hidden corporate pearls. The audit is for Agility, so it looks for examples of real change proficiency, frequently finding it as an accidental and unrecognized benefit of some innovation motivated by a different reason. Whether purposeful or accidental, however, these innovations have not been leveraged across the corporation.

In addition to finding these pearls, the audit process gives them visibility among decision makers who look for corporate leverage. It does this by employing these decision makers in both the actual audit process and the authoring of the final report.

It is a combination of the high-level, cross-cutting approach and the minimal time commitment that permits these scarce resources to become involved.

Twelve subject areas are explored in order to build a comprehensive profile. The exploration process involves twelve individual sessions, each devoted to one of the areas. In each case the plant provides two or more people who can speak knowledgeably and broadly about each area being discussed. In general it is good if each session includes both management and hourly so a full spectrum of knowledge is present. The order of the areas below is not important. Interview sessions may be scheduled for the convenience of the participants.

The profiling is done with a team of two-to-four people who are present in all interviews.

Each interview session is scheduled for approximately 60 minutes; and works best when started with a 20-30 minute thumbnail presentation from the plant experts being interviewed, followed by a question and discussion period for the remainder of the time. The initial presentation can be as

formal or informal as the plant experts desire, but should attempt to paint a reasonably comprehensive picture of the area being discussed.

Questions and issues that each set of experts should consider before the interviews are suggested below for each of the twelve areas, with a set of questions common to all areas listed as item number 13.

**1. Organizational Structure** - Discuss the organization relative to its structure. How are responsibilities compartmentalized? What are the organizational units and sub-units? What are the standard mechanisms and events of inter-unit interaction? How are decisions and approvals obtained. What is organizationally rigid and what is fluid? Are teaming concepts employed? What about cross-functional teams? When was the last reorganization and what was its nature?

**2. Human Resources** - Discuss the human factors for all employees - management and labor alike. What forms of training and education exist? Is cross functional training available. To what degree are people empowered? How is hiring and downsizing accomplished? What mobility exists within the plant, within the corporation, and within the community for employees? Are there unique, difficult, or rare skill sets involved? When an open or new position is filled, is there a bumping ripple effect among other employee positions? What is the general access-to-information situation? What surprise events have occurred in this area in the last 24 months that required a response.

**3. Operating Procedures** - Discuss standardized policy and operating procedures. Is there a standard procedure for new product start-up, or for factory conversion? What operating procedures apply to the production activity? What requires approval signatures and how long do they take. What events have caused procedures to be implemented and/or modified? What performance metrics are used within the plant, and what by corporate? Discuss work rules and speed of responsiveness to unexpected production needs.

**4. Information Automation** - Discuss the MIS and decision support computer-related environment. What kind of operating and management reports are available? What kind of general information is accessible? To what degree are personnel supported with desktop access? How often have these been updated and modified? What kind of shop-floor reporting exists? What role does simulation and modeling play. What project management tools used? Describe an event where a change to the system was desired but did not (could not) occur. What forms of electronic communication exist - and between who? How are engineering changes dealt with? Are suppliers and customers tied electronically to the plant in any way?

**5. Control Automation** - Discuss the automation control environment. What systems, hardware, and software are in use? Discuss a case where an improvement was implemented. Discuss the backlog of unimplemented improvements and corrections. How is control code developed and maintained.? How do new controls enter the plant? How are controls and their systems maintained? How is training for new technology accomplished?

**6. Facility** - Discuss the physical plant facility relative to its fixed and flexible nature. Has the plant been reconfigured ever? What restrictions exist in adding equipment and processing capabilities? Discuss the utilities (electric, gas, steam, sewage, toxic disposal, etc.) required by the production process, and their fixed and flexible nature. Discuss the procedures involved in relocating or obtaining new utility service in the physical plant. How is equipment relocated - installed initially - removed?

**7. Material Movement/Management** - Discuss material, wip, and finished goods movement and storage within the facility. Discuss JIT implementation and examples of when it fails - like material not available when needed from both internal and external sources.

**8. Production Process** - Discuss production process issues. What is the capacity utilization of the processes in place? Do capacity requirements fluctuate? How is the plant scheduled? How does installed process technology compare to the state of the art? What changes in process technology are occurring and what does the future require? When was the process last changed, and why and with what procedure? Are workstations or work areas ever idled because of upstream or downstream stoppages. What forms of flexibility exist in the process? What is the human role in the process? What kind of process characterization knowledge exists? What is the role, if any, of simulation and modeling?

**9. Production Equipment** - Discuss the general state of production equipment. What degree of automation exists? What degree of flexibility exists? What range of materials can be accommodated? What unique single-point equipment has caused the biggest problem when it is down. How does installed equipment compare to the state-of-the-art? What is the turnover and upgrade of equipment technology? What does the future require that is not present? Are unique and/or rare skills required for any equipment? What is the nature and state of operator and maintenance training? What are equipment utilization and failure rates? Where would you like to make a change but can't? What kind of process characterization knowledge exists? What is the role, if any, of simulation and modeling? What degree of variation and commonality exists among equipment types?

**10. Changeover/Setup System** - Discuss the changeover and setup processes. How often do they occur? What are the procedures? How is equipment utilization affected? What are the cycle times? How is a new product introduced to the production environment - and how frequently does this occur?

**11. Supply Chain** - Discuss the supply chain and supporting logistics. How stable is the supply chain? What is the procedure for gaining new suppliers? What is supplier turnover? Describe an unexpected supplier failure that was costly. How flexible are supplier contracts? What is JIT situation and performance history?

**12. Distribution Chain** - Discuss the customer interface and logistical support. How is business obtained? How is the customer interface conducted? How are product-orders obtained and received? How often do product-orders get modified - and with what lead time? What are the trends in this area? What are sizes and frequencies of orders? How many product types are there? What shipping alternatives exist? What finished-goods inventory exists? What are the customer delivery-time expectations and trends?

**13. Every Area** - What types of change occur in this area, how often, at what cost, and how long do they take to settle down? Where are the costs of these changes captured? What unpredictable events out-of-your-control have impacted this area in the last 24 months. Examples of "unpredictable events out-of-your-control":

- Absenteeism of key people with unique skills.
- Externally imposed production schedule changes.
- Bad materials/subassemblies received from supplier.
- Key supplier insolvency.
- Mandatory short-notice engineering changes.
- Market demand increases/decreases.

- New performance/cost/staffing metrics imposed.
- Discovery that shop floor control has major bug.
- New product needs new materials or new process.
- Process technology breakthrough becomes available.
- Major process/equipment/die failure.
- Downsize directive from headquarters.
- MIS/CIM software changeover mandated by headquarters.
- Regulatory procedure/process change mandated.
- Etc.....

The team can conduct the twelve interview sessions in two days, and then spend a day in a team workshop identifying key change proficiency issues; grading each as good, bad or indifferent; and analyzing the cases where good approaches were found. This analysis of the good approaches will later be used to develop and spread a conscious understanding of beneficial techniques as well as export really good ideas to other parts of the organization.

There is value in restricting the interviews to the two-day period - the information transferred to the interviewers is rapid-fire and massive, and results in the team looking for patterns and integrating the information across the organization. Participating management has reported the experience as extremely enlightening and valuable. The report writing and development of the cases-to-be-illuminated are generally assigned to one or two of the team for later review and concurrence by the full team.

The questions asked of each of the twelve area experts plants seeds among them for further development. Done right, all of the participants will take ownership for the final report, and should be involved in a final brief-out and workshop when the report is finished.

We believe that the best way to make an organization Agile is to build upon concepts that are already accepted and just need amplification. We also believe that truly Agile approaches by their nature facilitate a migration from the existing legacy situation to a strong Agile environment, and should not require a major discontinuity in the operating environment. You may in fact ask to have something done very differently, but you won't need to institute this change on a massive scale in order to begin the transformation process.

**Key Change Issues and General Proficiency**  
(Generic Example)

<p><b>Creation</b></p> <ul style="list-style-type: none"> <li><input checked="" type="checkbox"/> Start New Supplier Relationship</li> <li><input checked="" type="checkbox"/> Write New PLC Code</li> <li><input type="checkbox"/> Build New Bid Package</li> </ul> <p><b>Improvement</b></p> <ul style="list-style-type: none"> <li><input checked="" type="checkbox"/> Thru-Put</li> <li><input checked="" type="checkbox"/> Overtime</li> <li><input checked="" type="checkbox"/> Absenteeism</li> </ul> <p><b>Migration</b></p> <ul style="list-style-type: none"> <li><input checked="" type="checkbox"/> To Cross Functional Teams</li> <li><input type="checkbox"/> To Lean Operating Practices</li> <li><input type="checkbox"/> To Quick Custom Delivery</li> </ul> <p><b>Addition/Subtraction</b></p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Skill Training</li> <li><input checked="" type="checkbox"/> Install New Tooling</li> <li><input checked="" type="checkbox"/> New Product Prototype Builds</li> </ul>	<p><b>Correction</b></p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Equipment Failure</li> <li><input checked="" type="checkbox"/> Bad JIT Parts</li> <li><input checked="" type="checkbox"/> Absenteeism</li> </ul> <p><b>Variation</b></p> <ul style="list-style-type: none"> <li><input checked="" type="checkbox"/> Every Product Different</li> <li><input type="checkbox"/> Engineering Changes</li> <li><input checked="" type="checkbox"/> Bottle-Neck Backup</li> </ul> <p><b>Expansion/Contraction</b></p> <ul style="list-style-type: none"> <li><input checked="" type="checkbox"/> Meet Increased Market Demand</li> <li><input checked="" type="checkbox"/> Downsizing</li> <li><input checked="" type="checkbox"/> New Product-Pilot Surge</li> </ul> <p><b>Reconfiguration</b></p> <ul style="list-style-type: none"> <li><input checked="" type="checkbox"/> Process Changeover</li> <li><input type="checkbox"/> Lean Inventory Management</li> <li><input checked="" type="checkbox"/> Job Bumping</li> </ul>
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Proficiency:  High    Medium    Low  
(See prior essays for discussion of eight change types above)

# Leveraging Agile Practices at Home

Rick Dove, Sr. Fellow, Agility Forum, dove@well.com, Paradigm Shift International, 505-586-1536

The product realization process is a major strategic focus today in almost all industries. From creation of new product and process designs through production change-over and final shake-out, everybody wants shorter cycles, less scrap and rework, and minimal impact on existing production activity. The object of course is to introduce a new product or new model seamlessly into a functioning production environment and never miss a lick: No overtime, no lost units, no scrap, and full production rate the whole time. Change proficiency at its best.

How do we achieve this? Where do we start? Though a considerable research effort is underway to develop design principles and operating procedures for the magic factory, few companies have appetites for a capital-intensive, new-paradigm, greenfield approach these days. At the same time, beleaguered production management is so busy making rate that reengineering a functioning environment for Agility sounds risky, faddish, and foreign.

“An Agility audit will discover both mature and fledgling Agile practices within an organization.”

Picture this: The King watches from his castle tower as his knights battle below. On bended knee before him is a machine gun salesman with a fully loaded, 50-caliber, air-cooled tri-pod model. “Not now”, says the King, “Can’t you see there’s a battle going on?”. Short sighted, but his battle will end, and then he’ll have the time for calm consideration. In too many production environments

and downsized engineering departments the battle never ends; and machine guns don’t look at all like the familiar sword.

The machine gun salesman might get off to a better start by praising the values of the catapult -- noting that it sent projectiles a great distance and avoided hand-to-hand casualties -- and suggesting that this familiar concept could be applied to personnel as well as castle-walls. By the same token, creating interest in Agile practices can be facilitated by pointing to some that already exist.

With change on the increase any sizable company today is bound to have some reasonable examples of Agile practices somewhere. Though these mature examples may be hard to find, undeveloped Agile practices are generally present in much larger numbers. Like the catapult, they can provide a comfortable and familiar starting point if their Agility values and characteristics are identified and promoted.

A descriptive technique for Agile practices was tested by the Agility Forum recently on eighty cases of various business elements, ranging from equipment and control architectures through organizational and operating procedures. This initial “Agile Practice Reference Base” uses a standardized 2-page format of explanatory text and tabled summaries (and can be obtained from the Forum by calling 1-800-9BE-AGILE). Tables identify the key change issues and compare change proficiency metrics and system characteristics of the Agile practice with a more common practice.

Our objective here is to show how Agile practices in your company can be identified, evaluated, and communicated by applying change proficiency metrics (this column, Jan. ‘95), change types (Feb. ‘95), and Reusable-Reconfigurable-Scalable strategies (Mar. ‘95). This descriptive procedure can be a powerful tool in the Agility audit process (May ‘95) for leveraging valuable organizational knowledge.

To illustrate the procedure we will use a specific case of an Agile practice to help in our discussion. The accompanying side-bar example describes a modular checking fixture known as the “Pittsburgh Universal Holding Device” in a GM metal stamping application. It is chosen because it is patented public information, and because it illustrates an Agile practice developed serendipitously under stressful circumstances.

These check fixtures are used to verify tools, dies and processes involved in the production and fabrication of automotive body parts. As the side-bar suggests, this innovative approach was motivated by a shortage of storage space at the Pittsburgh plant -- but the solution yields Agile benefits leveragable across the corporation.

Referring to the top of the side-bar we see a comparison of change-proficiency metrics. This comparison highlights the dramatic difference in cost and time to develop a new fixture, promising cost reductions across the corporation as well as shortened develop cycles and new innovative uses.

Scope is the metric that gauges breadth of potential applicability. Some of the innovations possible with this approach might include: Temporary fixturing, set tooling, match checking, and high frequency part verification. Opportunities are enabled for partial production checks, checking at production as well as assembly points, and duplicate fixtures at different locations.

Referring to the bottom of the side-bar we see a capsulation of the key change issues associated with the life cycle of a checking fixture. Importantly, the top of this table defines the specific system we are focused on in terms of its framework and modules. Experience has shown that this defining process is necessary to keep the change issues focused on the system in question and not on its environment.

For instance, this particular table does creep outside the fixture architecture system and into its environment when it offers relocation of fixture and storage as reconfiguration issues, and when it offers multiple use points as a capability issue. These two

are actually issues in a system where portable tools are the modules and plants, processes, and facilities are the frameworks. The issues are valid and well dispatched with this fixturing approach, and correctly belong in a second column of the table devoted to these higher level issues. We have taken liberty in these constrained

spaces.

This example also illustrates an important feature of truly Agile practices: They can be introduced to the existing environment without disruption, and easily migrate to stronger and more pervasive forms over time. The Pittsburgh example is meritorious in that it requires no special expertise or new technology, nor does it require an investment and payoff period of any significance. When capital investment and sophistication are permitted, the concept can be extended with new technological solutions that automate the fixturing set-up and employ laser CMMs. Even then, the Pittsburgh approach with manual fixturing set-up might continue to have value where physical portability to points of use is important, e.g., in prototype and pilot part production perhaps.

Plants that are stressed are ideal settings for Agile practices. The unique specialization on high variety, short run processing at the Pittsburgh plant has spawned other innovative solutions such as quick-die-change processes and universal shipping containers, welding cells, and adhesive applicators.

An Agility audit (May '95) is a productive way to discover both mature and fledgling Agile practices within an organization. Agile practice descriptions then provide a corporate diffusion mechanism and business case foundation for more of the same, heighten the general appreciation for RRS values and characteristics, standardize a digestible communication format, and illuminate the bottom line values of Agility. Of course exposing an Agile practice description across a corporation also celebrates and encourages meritorious contributions.

Good places to find Agile practices are in stressed plants -- those with space constraints, variety and lot-size extremes, short lead-times, quick response requirements, etc. Another good hunting ground is in those plants that accomplish major change activities better than others - the ones that meet capacity fluctuation demands and carry out new model introduction, new product start-ups, and facility reconfigurations predictably.

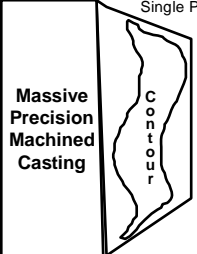
Agility has always been a requirement of successful business - but in slower times it was easy to adapt to the changing business environment. Though being proficient at change these days is getting tougher, the pervasiveness of change has forged some novel practices in most companies. Finding and illuminating these gems can be a powerful kick-start to any internal Agility program.

### Agile Practice

#### Modular Body-Panel Check Fixtures

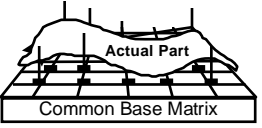
	Hard Fixtures	Benefits	Pittsburgh Universal Holding Device
Create:	\$70,000	Cost	\$3,000
Create:	37 Weeks	Time	1 Week
Use:	4 Parts/Hr	Time	40 Parts/Hr, 3.5 Min. Set-Up
Create: 20% Rework	Robustness 1%	Rework, Easy Modification	
Use:	100% Accurate	Robustness	100% R&R Accuracy
	60% Predictable	Scope	100% Predictable
	Restricted Use	Scope	Innovative Uses
	Single Purpose	Scope	Opportunistic

**Massive Precision Machined Casting**



**Features**

No	Reusable	Base, Retainers
No	Reconfigurable	Retainers, Details
No	Scalable	Details/Part, Parts/Facility



Patented by General Motors, contact Joe Pelan, 412-469-6571, GM Pittsburgh Metal Center.

The General Motors Pittsburgh stamping plant specializes in small-run, high-variety, service parts such as hoods, quarter panels, doors, and other stamped and welded metal fabrications. Small quantity orders stress traditional operating modes for profitability, while high variety stresses tool and die management and manual operations.

Body panel check fixtures presented a particular problem to this plant: 700 plus fixtures, with more coming, required a prohibitive amount of storage space. The financial climate did not permit a capital intensive high-technology solution but relief had to be found.

The plant invented a modular fixture scheme that utilized a common grid-work base plate with part-specific holding "details" that snapped into "retainers". Details could be machined in-house quickly and inexpensively, and then stored in a shelved shoe-box sized tray.

Unplanned, this space problem solution offers a variety of valuable Agile benefits for GM's traditional stamping and assembly plants.

**(Explanation details would continue with a complete description.)**

RRS System (Reusable, Reconfigurable, Scalable):	
Framework:	Common base plate with retainer grid.
Modules:	Retainers, Details.
Key Change Issues:	
Creation:	Make new checking fixture. Make duplicate checking fixture.
Augmentation (Improvement):	Reliability and repeatability.
Migration:	To laser CMM. To automated creation and set-up.
Addition/ Subtraction:	Both CMM and manual measurement alternatives. Check at point-of-production and point-of-assembly.
Correction:	Broken/bad/lost check fixture.
Variation:	Set-up for different part.
Expansion/ Contraction:	Parts checked per hour.
Reconfiguration:	Construct different fixture from common parts. Change facility storage location. Change plants.

**Partial Example of Agile Practice Description Format.**

# Agile Practice Reference Models

Rick Dove, Sr. Fellow, Agility Forum, dove@well.com, Paradigm Shift International, 505-586-1536

It is painfully obvious that there are no role models for the Agile enterprise. Some companies are clearly better than others at short-cycle product realization, some are quicker to outsource and partner, some excel at low-volume, high-variety production, some have harnessed the commitment and involvement of empowered teams, others have instilled customer responsiveness in every employee -- but none have put it all together in a preemptive operating strategy.

Chrysler's platform teams moved them to the front of their industry, Motorola's leverage on people gives them a clear advantage in their markets, and Hewlett Packard's first-to-market capability gets the highest margins among their competitors.

Each of these companies pioneered new operating capabilities with powerful results. Competitive success has come from leveraging these unique operating capabilities with well chosen market strategies.

But we sit at the beginning of a new business era driven by decreasing innovation cycles and increasing globalism. One where continuous and unpredictable change are the emerging dominant forces. In these early days a few companies have found a few ways

"Business is an experimental science.

We learn what works by examining the survivors."

to put them in front of the pack; but none are masters of change. None are yet the Agile enterprise that thrives in this new unpredictable and uncontrollable environment.

Business is an experimental science. We learn what works by examining the survivors. To write the construction manual for the Agile

enterprise we can simply wait a decade and then catalog the operating procedures of those that are left standing -- or we can examine the pieces that already exist now, extract some principles, and try to fill in the missing parts. This is unprecedented, but so are the times. It's a choice between natural selection and genetic intervention. But before we can manipulate the genome of business we must map it first.

This mapping process began among the industry focus groups at the Agility Forum, with six cornerstone reference models defined in 3rd quarter of 1994, and initial case investigations completed in the

1st quarter of 1995. Agile Practice reference models focus on Agile concepts only, using proficiency at change as the qualifier.

Six teams of participants in the Agility Forum's focus groups investigated six different areas important to business Agility: people issues, legal issues, virtual enterprise, process and equipment, information and control, and product realization.

Reviewing a case from each of the six models will provide the flavor of the reference base, and perhaps encourage a deeper look or serve as inspiration to begin your own internal search for Agile practice cases (see this column June 1995).

**Process & Equipment:** Machine tools built by Applied Materials employ an architecture that offers significant Agility gains to both their customers and themselves, and should be a role model for processing equipment in general. Processing technology advances quickly in the semiconductor wafer fabrication industry, with a typical manufacturer buying a plant-full of new generation machine tools every three years for multiple locations.

Applied's "cluster tool" approach recognizes that a new generation of processing technology only accounts for 40% of the machine tool, and 60% is relatively timeless utility and support mechanism. The architecture separates this utility platform from the processing chamber, and accommodates four or more processing chambers attached to a single platform much like outboard motors to a boat.

Applied now has a faster design and development cycle by reusing the common platform framework, and has more international options for local content with non-critical platform construction. Applied's customers can incrementally upgrade any platform one chamber at a time any time, mix or match chambers on a platform for redundancy and custom processing needs, reconfigure platforms to add new capability or pace growing demand, and swap dysfunctional units for fast recovery.

**People Issues:** Team recognition at Xerox started in 1983 with 300 people gathered in a cafeteria to honor twelve exemplary manufacturing and engineering teams in a corporate wide celebration. Today 10,000 people meet in a convention center with satellite linkages to Canada and Europe to exchange the ideas that gained them recognition. Team excellence at Xerox is scored on five dimensions: business impact, innovation, use of tools and processes, teamwork, and building as a team. The highest

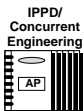
## AGILE PRACTICE REFERENCE BASE

(Available from Agility Forum 1-800-9BE-AGILE)

- 80+ Agile-Practice Case Examples.
- 2-Page Standard-Format Case Summaries.
- Case-Search Prioritized by Industry Focus Groups.
- Case-Qualification Established by Industry Focus Groups.

**Phase 1: 1994/95**  
Test of Procedures  
Bottom-Up Emphasis  
March '95 Publication

**Phase 2: 1995+**  
Standardized Procedures  
Evolving to Enterprise Emphasis  
Continuous Publication





ratings in any dimension go to teams that have had their work adopted in other parts of the business. As part of the team-support infrastructure this mobilizes reusable ideas internally and fosters team initiative and a sense of common cause - important building blocks for both proactive and reactive change proficiency.

**Information & Control Systems:** Information systems that span multiple organizations and integrate everything from dealer-based customer order entry to production scheduling and supplier breakout promise streamlined operations. But in a sector like the automotive industry we would need to call time-out for a few years to design and implement a totally integrated system -- sheer scope and complexity of ongoing operations, legacy systems and multiple supplier, dealer, and production organizations precludes a straightforward design and implementation cycle.

Without calling time-out, Rover Group in the UK is actively deploying a full-stream order processing system. With a highly modular message based approach they are able to "wrap" legacy systems and add functionality at will, bringing new capability on-line incrementally without interrupting ongoing operations. The Rover vision sees implementation and upgrade of the system as a never-ending effort: adding functionality and replacing legacy systems with modules that will themselves become legacy as innovation continues. They have adopted an object-oriented network framework that is vendor independent, facilitates constant incremental upgrade and augmentation, and easily accommodates prototype tests and design correction.

**IPPD - Integrated Product & Process Development:** Helping people make and implement decisions faster and more accurately is a cornerstone of the Agile enterprise, as is development and evolution of corporate core competency. General Electric believes that design engineers spend approximately 60% of their time looking for information, and then additional error prone time in manipulating and transposing this information into various design notebooks and documents. To relieve the designer of this non-value-added time they have developed a series of interacting "active document" working tools that include a Requirements Notebook, Process Worksheet, Process Notebook, Parts & Supplier Catalog, Best Practice Handbook, and Logistics Experience.

These notebooks are the work-in-process tools that capture the engineer's creative process and automatically cross correlate and propagate design activity and changes throughout all notebooks, provide links to an array of analysis tools, and suggest or enforce preferred parts and vendors. Experience in plastic snap-fitting design has shown information search time cut by 85%, detail part design cut by 90%, and redesign time cut 65%. These notebooks provide a framework for mobilizing reusable knowledge.

Importantly, the tool set itself can be quickly customized for a wide range of different engineering tasks: only two months was required to set up the tools for plastics snap-fitting engineers.

**Virtual Enterprise:** The purest form of Agile virtual enterprise is a business operating entity composed of organizations that do not share a common working span of control, forms quickly to pursue a common opportunity, and dissolves just as quickly when the opportunity is over. A sizable naval shipyard recently faced the need to enter the commercial ship-building market or go out of business when defense cutbacks killed their market. Landing commercial business was considerably different and they had long since lost their core competency in commercial practices. Their supplier base was sufficiently diversified to have the necessary knowledge,

however, and valued the shipyard as a customer and prime contractor.

An opportunistic virtual enterprise was set up to pursue a single order, with a sharing of risks as well as rewards that was a new concept for the suppliers. A process plan had to be developed just to coordinate and integrate the large number of bottom-up process plans this approach generated, and is recognized as a key practice in this virtual enterprise's eventual success. Upon successfully securing the ship order the virtual enterprise dissolved and the relationships reverted back to the traditional prime-sub for construction.

**Legal Barriers:** The team involved in building this reference model was composed of corporate lawyers and deal-makers from a broad base of industry, and identified twenty-four barriers to establishing an Agile business relationship. This reference model focuses on the nature of these barriers currently, and will be augmented in subsequent work with Agile practice case examples that address each of the barriers.

The reference base is an ongoing Agility Forum project to collect Agile practices in a variety of important business areas. It is the first attempt to utilize a qualification procedure and metric framework to identify practices in industry as being Agile. Though the initial phase in 1994 has not had the rigor that mature benchmarking processes impose, the activity has followed a consistent practice of investigation, qualification, and documentation, and does provide useful quantitative and qualitative case-to-case comparisons.

All told there were approximately 150 team people involved in the efforts to define, find, evaluate, and qualify the 80+ case examples in the initial phase. Many of the participants expect to find immediate benefit from deployable ideas in this reference base, others are looking across cases for underlying principles that can be used to build and customize new Agile systems more suited to their specific needs.

Putting a number of Agile practices together in one place will not necessarily result in an Agile enterprise. The reference base should not be viewed at this early stage as containing the bricks from which Agile enterprise is made, though many will indeed be found there already. Study these bricks as closed systems, and then scale the principles up to the enterprise.

# Introducing Principles for Agile Systems

Rick Dove, Sr. Fellow, Agility Forum, dove@well.com, Paradigm Shift International, 505-586-1536

Being Agile means being a master of change, and allows one to seize opportunity as well as initiate innovations. How Agile your company or any of its constituent elements is, is a function of both opportunity management and innovation management - one brings robust viability and the other brings preemptive leadership. Having one without the other is not sufficient in these times of quickening unpredictable change. Having neither is a time bomb with a short fuse today.

How much of each is needed at any time is a relative question - relative to the dynamics of the competitive operating environment. Though it is only necessary to be as Agile as the competition, it can be extremely advantageous to be more Agile.

All of this talk about "how Agile" and "more Agile" implies we can quantify the concept, and compare similar elements for their degrees of Agility. However, as the associated figure shows, there is some question about value tradeoffs between an increment of

"Getting to your chosen spot and staying there is a job for masters at business engineering, not business administration."

leadership and an increment of viability.

Leadership wins if the leader always chooses the most optimal path to advance - but one false step allows a competitor to seize the advantage; putting the previous leader in reaction mode. A competitor with excellent viability can track the leader, waiting for that sure-to-come mistake. Poor viability may then keep the fallen-from-grace

ex-leader spending scarce resources on catch-up thereafter.

Choosing a desired spot in the Agile quadrant is one of the important ways to strategically differentiate yourself from your competitors. Getting to your chosen spot is another issue entirely -

and a job for masters at business engineering, not business administration.

How innovative/opportunistic are you - relative to your competitive needs and environmental situation? How fast are the rules changing in your market? Are you able to respond fast enough, can you introduce a few changes of your own? Importantly - what allows you to do that? We will look shortly at some promising design principles to answer this last question.

The search for metrics and analytical techniques that can pinpoint an enterprise in the Agility space is receiving a lot of attention today. Self analysis tests that ask lists of questions are one form, house-of-quality QFD-like templates are another. These have a certain appeal in that they deal with familiar concepts that enjoy intuitive association with Agility: teaming, empowerment, partnering, short-cycles, integrated process and product development, and so forth.

But experience shows us that simply saying yes to these questions will not tell us anything useful - too many people, for instance, will say yes to having empowered teams when the yes-ness has nothing to do with the quality of the implementation, or if the implementation promotes Agility.

Better to ask how well we respond to critical types of unexpected situations, how often we lead with a meaningful innovation, how proficient we are at a variety of identified change we feel to be strategically important. For sure, empowered teams

embody an organizational structure and business practice that can help us be more Agile if they are designed and supported with that end in mind.

Firstly, we must locate ourselves (qualitatively) in the Agile space relative to our environmental and competitive realities - a subject of some depth that will be covered at another time. Then, where we find ourselves wanting, we must select and design appropriate strategies to move us to where we want to be. The selection of appropriate strategies will change with the times, and differ from market to

**Agility Space**

Opportunistic	Agile
Fragile	Innovative

**Proactive (Leadership)**

**Reactive (Viability)**

- **Plot operating position** relative to dynamics of operating competitive environment at specified time.
- **Plot any business element:** Enterprise competitive position, plant operation, supply-chain strategy, specific shop-floor process, teaming strategy, product development, etc.
- **Viability:** Seeks and responds to the voice of the customer, says yes to opportunity, reactive, resilient, staying power, robustness.
- **Leadership:** Introduces new approaches, makes existing approaches obsolete, changes the rules, out-of-box thinking, disrupts the market.
- **Dynamics:** Are you or aren't you?  
**Statics:** Could you or couldn't you?

**If You Could Move, Which Is The Better Move?**

market; and today might include concepts like mass customization, virtual enterprise, empowerment, commonization, listening to your customer, and other such.

Strategic concepts by themselves are open to a wide range of interpretation, and are often interpreted incorrectly. Commonization in shop-floor controls, for instance, doesn't pay Agility dividends if it is interpreted as buying controls from one vendor; empowerment doesn't pay without an information and support infrastructure; and customer listening doesn't pay when competitors change the rules.

Regardless of the strategies chosen, effective implementation will employ a common set of fundamental design principles that promote proficiency at change.

Designing Agile systems, whether they be entire enterprises or any of their critical elements like business practices, operating procedures, supply-chain strategies, and production processes, means designing a sustainable proficiency at change into the very nature of the system. With the business engineer's eye we will be interested in both the statics and the dynamics of these systems - where the static part is the fundamental system architecture and the dynamic part is the day-to-day reengineering that reconfigures these systems as needed.

Seeking and sustaining a desired opportunistic/innovative profile will rely upon the Agility of these systems, which in turn will be impeded or enabled by their underlying architectures. Earlier essays have discussed Reusable/Reconfigurable/Scalable (RRS) system strategies that employ a Framework/Module approach. The accompanying table completes the engineering strategy by advancing a set of design principles for these RRS systems. These principles have emerged from observations of both natural and man-made systems that exhibit RRS characteristics, with contributions from the Forum's Agile Practice Reference Base,

Kevin Kelly's thought-provoking book (reference below), and the sizable body of knowledge growing out of object oriented systems design.

We will explore the application of these early stage principles in the next issue, tying them into various business strategies critical for the Agile enterprise.

Business strategists recognize the imperative of the Agile enterprise, with virtually all popular business writers today extolling the need for change proficiency of one kind or another: Peter Drucker, Tom Peters, Michael Hammer, Peter Senge, and all the rest are talking about today's dominant effects of a faster paced business environment. The newly released Agile Competitors and Virtual Corporations by Goldman, Nagel, and Preiss provides an encompassing view for most of these concepts with many examples. Richard D'Aveni's excellent Hypercompetition focuses on wielding change proficiency as a preemptive business strategy. And Kevin Kelly's Out of Control provides fundamental examples for the business engineer who would design and build Agile enterprises and systems.

## Agile System Principles

**Any organization of interacting units is a "system": an enterprise of business resources, a team of people, a cell of workstations, a contract of clauses, or a network of suppliers.**

### Self Contained Units

System composed of distinct, separable, self-sufficient units not intimately integrated.

### Plug Compatibility

System units share common interaction and interface standards, and are easily inserted or removed.

### Facilitated Re-Use

Unit inventory management, modification tools, and designated maintenance responsibilities.

### Non-Hierarchical Interaction

Non-hierarchical direct negotiation, communication, and interaction among system units.

### Deferred Commitment

Relationships are transient when possible; fixed binding is postponed until immediately necessary.

### Distributed Control & Information

Units respond to objectives; decisions made at point of knowledge; data retained locally but accessible globally.

### Self Organizing Relationships

Dynamic unit alliances and scheduling; open bidding; and other self adapting behaviors.

### Flexible Capacity

Unrestricted unit populations that permit large increases and decreases in total unit population.

### Unit Redundancy

Duplicate unit types or capabilities to provide capacity fluctuation options and fault tolerance.

### Evolving Standards

Evolving open system framework capable of accommodating legacy, common, or completely new units.

# Agile Machines and Agile Production

Rick Dove, Sr. Fellow, Agility Forum, dove@well.com, Paradigm Shift International, 505-586-1536

Agile production operations thrive under conditions that drive others out of business. When forecasts prove too optimistic or markets turn down, they throttle back on production rate with no effect on product margins. If product life ends prematurely, they are quickly reconfigured and retooled for new or different products. Instead of loosing market opportunity when product demand soars beyond capacity, they expand to meet the market. Rather than postpone or shut down periodically for major process change, they evolve incrementally with continuous incorporation of new process technologies. In support of new product programs, they freely accept prototypes in the workflow. For niche markets and special orders, they accommodate small runs at large run margins. Irrespective of all these changes, they maintain superior quality and a steady loyal workforce.

Oh yes . . . they also accommodate work flows of intermixed custom configured products -- the mass customization concept frequently misunderstood as the defining characteristic of Agile production. Mass customization is just one of many valuable change proficiencies possible in the Agile production operation.

“Mass customization is frequently misunderstood as the defining characteristic of Agile production.”

The capabilities extolled above are not meant to be comprehensively defining, but rather to set the stage for a discussion about real machines and real production processes that do all of this. The example we use here is from the semiconductor manufacturing industry; but the principles and concepts illuminated are applicable in any industry.

The U.S. lost the semiconductor market to Japan in the '70s, and hopes for regaining leadership were hampered by a non-competitive process equipment industry - the builders of the “machine tools” for semiconductor fabrication. In this high paced industry, production technology advances significantly every three years or so, with each new generation of processing equipment cramming significantly more transistors into the same space.

With each new generation of equipment semiconductor manufacturers build a completely new plant, investing \$250 million or more in equipment from various vendors, and twice that for environmentally conditioning the building to control micro-contaminates.

For equipment vendors, each new generation of process equipment presses the understandings of applied physics and chemistry. Million dollar machines are developed for depositing thinner layers of atoms, etching narrower channels, imprinting denser patterns, testing higher complexities, and sculpting materials at new accuracies and precisions. Generally each machine carries out its work in a reaction chamber under high vacuum, and sports a sizable supporting cast of controls, valves, pipes, plumbing, material handling, and whatnot.

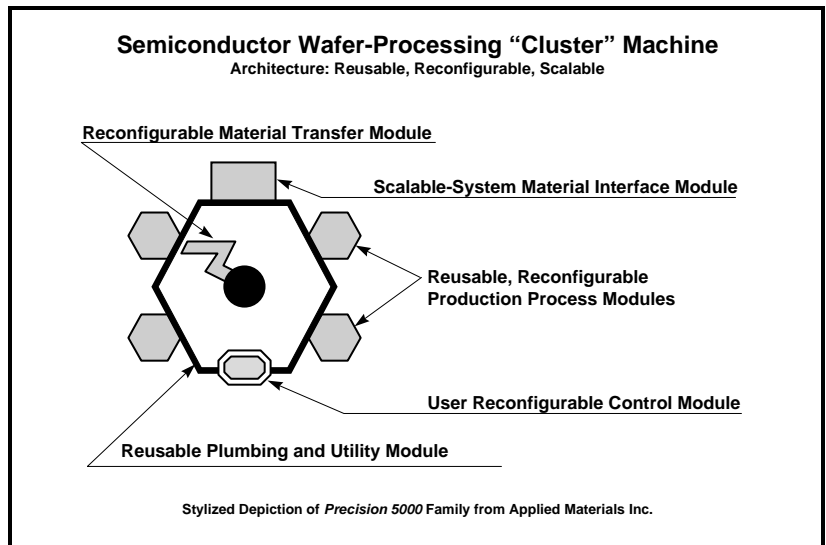
New equipment development is actually new invention, frequently taking longer than the three-year prime-time of its life. And because the technology utilized in each generation is so unique, market success with one generation of equipment has little to do with the next or the last generation. The industry's history is littered with small vendors that brought a single product-generation to market.

Single purpose, short lived, complex machines. Long equipment development cycles. Repeatability and reliability problems. All in a high volume, highly competitive production environment serving impatient, unforgiving markets. And every new generation requires a new plant with more stringent environmental conditioning to house the new machines. The learning curve in this industry is dominated by touchy equipment that takes half its product life to reveal its operating characteristics. Forget about rework here, and get used to scrap rates way above 50% in the early periods of production (You car builders may scoff at the low scrap cost, but this means lost deliverables with devastating loss of critical short-lived-market penetration). Equipment budgets routinely factor high outage expectations into extra machines -- million dollar machines -- and that's the way it is in this industry.

Getting product out the door is so critical, and mastering the process so tough, that no one has time to question the craziness; or guts to say “I'm not going to take this anymore”. Everybody is used to it. This is the way of semiconductors.

At least it was until something significant occurred in 1987: Applied Materials, Incorporated, a Sunnyvale, California-based company, brought a new machine architecture to market -- an architecture based on reusable, reconfigurable, scalable concepts.

The AMI Precision 5000 machines decoupled the plumbing and utility infrastructure from the vacuum chamber physics magic, and introduced the “multichamber” architectural concept. Instead of one dedicated processing chamber, these machines contained up to four independent processing modules serviced by a shared programmed robotic arm. Attached like outboard motors, process modules could be mixed and matched for custom configured process requirements. A centralized chamber under partial vacuum housed a robotic arm for moving work-in-process wafers among the various workstations. The arm also services the transfer of wafer cassettes in and out of the machine's external material



interface.

A single machine can integrate four sequential steps in semiconductor fabrication, decreasing the scrap caused by contamination during inter-machine material transfer. Yield rate is everything in the competitive race down the learning curve -- but this integrated modular approach pays other big dividends too.

Applied Materials shortened its equipment development time and cost significantly by separating the utility platform from the processing technology. Development resources are focused now on process technology, reusing the common utility base which accounts for 60% of the machine. This eliminates a significant design effort for each additional process capability Applied brings to market, and shrinks the complexity and time of shakeout and debug in prototyping stages. More importantly, perhaps, is the increased reliability that Applied's customers enjoy with a mature and stable machine foundation.

In process sequences with disparate time differences among the steps, a configuration might double-up on two of the modules to optimize the work flow through a three-step process.

A malfunction in a process module is isolated to that module alone. It can be taken off-line and repaired while the remaining modules stay in service. The architecture also facilitates rapid and affordable swap-out and replacement servicing if repair time impacts production schedules.

Semiconductor manufacturing is barraged with prototype run requests from product engineering. New products typically require new process setups and often require new process capability. When needed, redundant process modules can be dedicated to prototyping for the period of test-analyze-adjust iterations it takes to get process parameters understand. And if a new capability is required, a single "outboard motor" is delivered quicker and at a lot less cost than a fully equipped and dedicated machine.

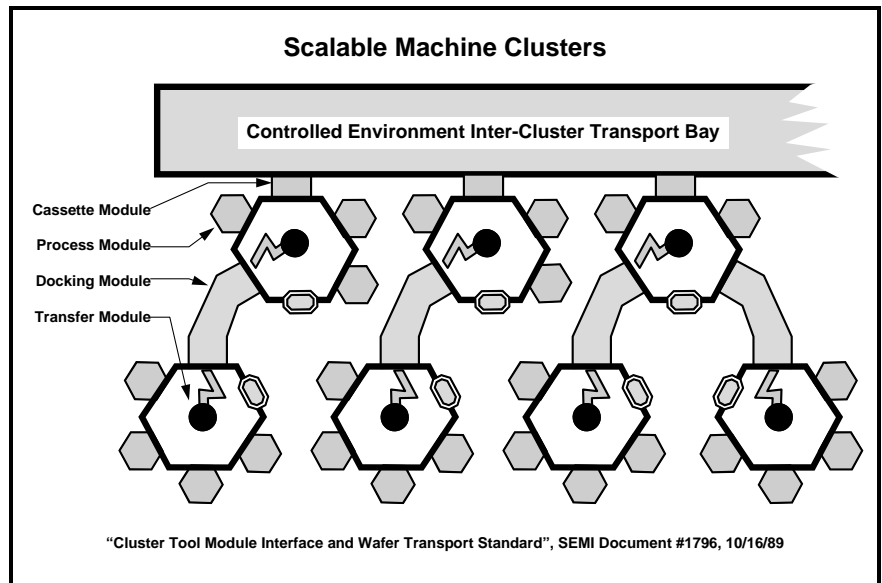
Cluster architecture also brings a very major savings in both time and cost for creating new fabrication facilities. The ultra-clean environment needed for work-in-process can be reduced to controlled hallways rather than the entire building. People can attend and service the machines without elaborate decontamination procedures and special body suits.

Work-in-process is most vulnerable to contamination when it is brought in and out of high vacuum. The cluster machine architecture reduces these occurrences by integrating multiple process steps in one machine. Using a docking module, these machines can be directly interconnected to increase the scale of integration.

Extending these concepts and combining them with a strategy for reconfigurable facilities might push the utility services below the floor and the clean transport above the machines. Though this "ultimate" configuration does not yet exist in a production environment, the possibility is obvious.

In 1989 the Modular Equipment Standards Committee of SEMI (Semiconductor Equipment and Materials International) started work on standards for mechanical, utility, and communications interfaces. What started as a proprietary idea at Applied Materials is moving toward an industry open architecture, promising compatible modular process units from a variety of vendors.

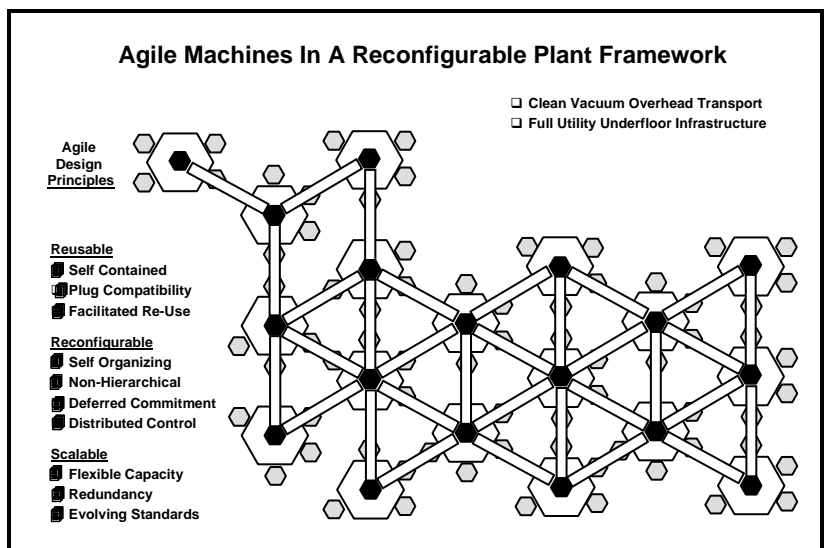
Applied Materials revolutionized the semiconductor industry. Their cluster machines have propelled them into global leadership as the



largest semiconductor equipment supplier in the world. Leadership is defined by followers, and today, every major equipment supplier in the world has a "cluster" tool strategy.

The Manufacturing Execution System (MES) software completes the total Agile production environment. This is the software that controls and schedules the routing of wafer batches through the production resources. Until recently these systems were no better at scheduling resources than your typical MRP that assumed infinite resources and had no clue about current plant status. In 1995 software vendors serving this market began introducing finite and real-time schedulers that reconfigure routings on the fly to optimize throughput.

Here we see the ten Agile system design principles that were introduced in last month's column in action; with an Agile machine architecture that enables an Agile production environment. Next we will look at an equally Agile metal-cutting production operation; but with machine tools that are not themselves Agile.



# Agile Cells and Agile Production

Rick Dove, Sr. Fellow, Agility Forum, dove@well.com, Paradigm Shift International, 505-586-1536

Manufacturing cells in general and flexible machining cells specifically are not especially new concepts, though their use and deployment is still in an early stage. Machining centers are not inexpensive machine tools, and the economics of building cells from multiples of these machines is still beyond the vision and justification procedures for many. It is typical to expect benefits from these flexible machining cells in production operations with a high part variety and low volume runs. When justification and benefit values are based on flexible configurations and objectives this is understandable.

Recently, however, innovators are finding important values in quick market response: rapid new product introduction, accommodation to unpredictable demand, fast prototype turnaround, non-premium-priced pre-production runs, efficient ECO incorporation, longer equipment applicability,

“Agile system values now challenge applications where transfer lines and dedicated machinery have traditionally reigned.”

and the latitude to accept (or insource) atypical production contracts to improve facility utilization. These new Agile system values now challenge applications where transfer lines and dedicated machinery have traditionally reigned -

and their applicability is based upon concepts that push beyond the traditional flexible values. “On Cells at Kelsey-Hayes” (Production Magazine, Feb 95) has an excellent discussion about these Agile values with the Kelsey-Hayes decision to build two entirely cellular plants for the production of ABS and other braking systems. “We want to achieve a strategic advantage on product cost and delivery” was the vision voiced by Richard Allen, president of their Foundation Brake Operations.

We are not talking mass customization here, with custom configured products. We are talking about fundamental change in the value structure of the high-volume-car / high-volume-brake markets. Technological advances in ABS systems has cut each succeeding product generation’s life-time in half.

The trend to higher automotive-system integration and more technology promises even more change. Car companies want leadership in functionality and feature, and faster times to market; and can’t afford to feature obsolete systems when competitors innovate. Kelsey-Hayes sees opportunity in this faster paced, less predictable market.

Let’s look at some change proficiency issues first. This will put the problem in perspective for us and provide a basis for evaluating the depicted solutions.

In actual practice we would do a more complete “change domain analysis” that identifies all key change issues and assesses change proficiency with metrics for cost, time, robustness, and scope (see prior essays).

Product life-cycle for ABS has dropped from ten years to three years over three generations of product, and is expected to go lower yet - so taking 4-6 months to retool a dedicated transfer line is a significant part of the production life - not good. As automakers mine new niche markets and increase total systems integration in standard models the frequency of ABS model change increases. Within

### AGILE MACHINING CELL

**Change Proficiency**

- Install and Set Up New Cell in 4-8 Weeks.
- Reconfigure Cell for Entirely New Part in 1-4 Weeks.
- Duplicate Cell Functionality in Another Cell in 1-2 Days.
- Add/Calibrate New Machine in 1-2 Days While Cell Operates.
- Remove or Service Machine without Cell Disruption.
- JIT Part Program Download.
- Insert Prototypes Seamlessly.

Concept Based on LeBlond Makino A55 Cells at Kelsey-Hayes

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**Observed RRS Design Principles**

**Reusable**

- Self Contained - Machines, work setting stations, pallet changers, fixtures.
- Plug Compatibility - Common human, mechanical, electrical, and coolant framework.
- Facilitated Re-Use - Machines do not require pits or special foundations, and are relatively light and easy to move.

**Reconfigurable**

- Self Organizing - Cell control software dynamically changes work routing to accommodate module status changes and new or removed modules on the fly.
- Non-Hierarchical - Complete autonomous part machining, non-sequential.
- Deferred Commitment - Machines and material transfers are scheduled by cell control software in real time according to current cell status, part programs downloaded to accommodate individual work requirements when needed.
- Distributed Control - Part programs downloaded to machines, machine life history kept in machine controller, machines ask for appropriate work when ready.

**Scalable**

- Flexible Capacity - Cell can accommodate any number of machines and up to four work setting stations.
- Redundancy - All modules are standard and interchangeable with like modules, cells have multiple instances of each module in operation, machines capable of duplicate work functionality.
- Evolving Standards - Utility services and vehicle tracks can be extended without restrictions imposed by the cell or its modules.

this shortened life of any model is the increasing frequency of modifications to add feature advantages and necessities. Of course all these modifications and new models don't spring to life from pure paper - they each need prototypes and small pre-production runs.

Automakers like most everyone else have never been able to forecast demand accurately, and it's only getting worse. Coupled with new JIT requirements and reduced finished goods auto inventories the automakers need to throttle production in concert with demand on a week-by-week basis. Suppliers must either be proficient at capacity variation or face increased costs with their own finished goods inventories and obsolete scrap.

Well, the ABS market isn't alone in this application of technology and continual improvement as we will see with a look at some machine tool advances.

Previously (Sep 95) we looked at an example of an Agile machine architecture, and how those machines might (and do) support an Agile production operation. Here we will continue the illumination of design principles that give us Agility by looking at an Agile cell architecture and how it supports an Agile production operation. Both the Agile cell and the Agile production environment depicted make use of capabilities and configurations possible with the LeBlond Makino A55 machining centers, and are substantially similar to actual installations. Perhaps other vendors can provide a similar capability, our purpose in using the LeBlond example is to show that these concepts are real and not imagined.

The depiction of the Agile machining cell includes a synopsis of some of the change proficiencies obtained by the configuration. Flexible machining cells have been implemented in many places, but the Agile configuration here brings additional values. The configuration and the specific modules were chosen to increase the responsiveness to identified types of change. The LeBlond Makino A55 horizontal machining centers do not require pits or special foundations, so they are (relatively speaking) readily movable. A cell can increase or decrease its machining capacity in the space of a day and never miss a lick in the process. This is facilitated by a plant infrastructure of common utility, coolant, mechanical, and human interfaces that provide a framework for reconfiguring modules

easily. These and other Reusable-Reconfigurable-Scalable Agile system principles (introduced in prior essays) are detailed in the depiction.

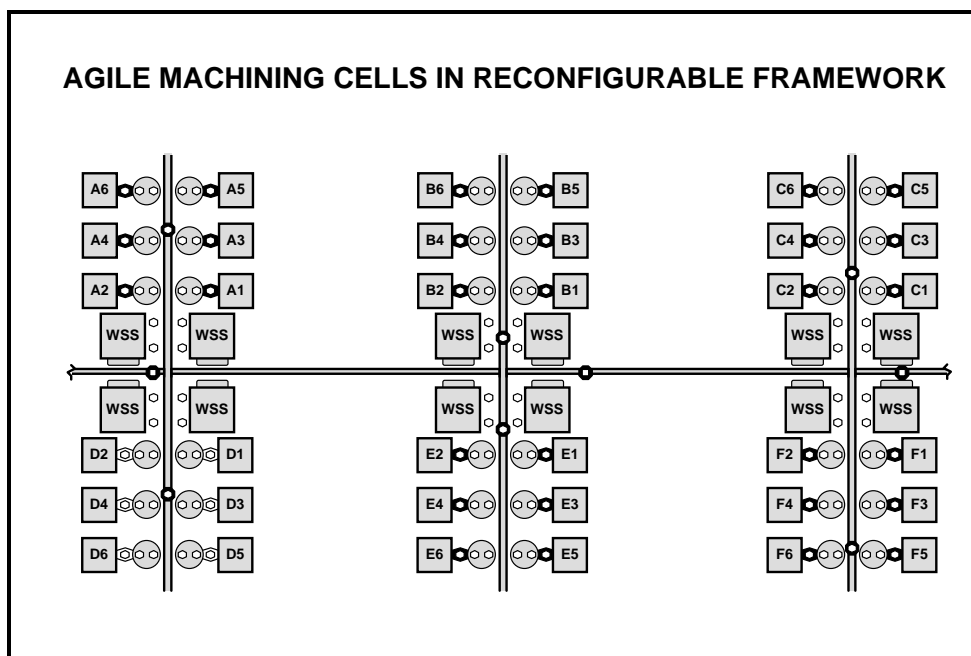
It is accepted knowledge that replacement or massive retooling of a rigid production module is more expensive than transformation of a flexible production module. Now we see where Agile system configurations can further change the economics to overcome an initial investment that has been higher. "Has been" should be stressed. The price/performance ratios of modular production units are becoming better as we increase our use and increase their production quantities.

Agile production requires neither Agile nor flexible machines - for the Agility is a function of how the modules of production are permitted to interact. An Agile system must be readily reconfigurable, and may gain this characteristic by simply having a very large variety of compatible but inconsistently or infrequently utilized production units.

The toy industry is an example where this is a common approach. Not knowing from year to year what kind of toys the kids will want until a few months before volume deliveries are required, toy manufacturers are either highly vertically integrated (with poor utilization) or broadly leveraged on outsourced manufacturing potential. Agility is a relative issue - and the toy industry has few alternatives to either Agile outsourcing or just-in-case vertical integration. As virtual production concepts mature to support Agile outsourcing, this approach might become more proficient than the just-in-case captive capability alternative - unless of course those practitioners become proficient at insourcing other company's needs to cover the costs of their insurance base.

From the corporate viewpoint an Agile

production capability can be built from a reconfigurable network of outsources. We will look at Agile production from the Agile enterprise viewpoint next time.





# Agile Enterprise and Agile Production

Rick Dove, Sr. Fellow, Agility Forum, dove@well.com, Paradigm Shift International, 505-586-1536

The Duracell Bunny may run out of juice someday, but the Agile enterprise will just keep on truckin' no matter what. Not because it has a bigger battery (deeper pockets), but because it is adaptable enough to transform itself proficiently into whatever the times require. At least, with the unpredictable and increased pace of change driving business out of business today, that is the salvation hoped-for by corporate management. They understand that business is not just about making money, it is also about staying in business. We used to think that making money was all it took to stay in business. Now we know that you can make money right up to the day you become irrelevant - then you'll probably be the last to know and be ignored to death.

A corporation stays alive because customers continue to pay more for goods than the "real" cost of production. This excess payment is required to cover the cost of production inefficiencies (nothing is perfect), and the cost of preparing for new goods to replace ones that lose favor. With increased global competition it is getting harder to fund these production inefficiencies: someone is always finding a better way to produce the same thing. With faster technological obsolescence it is getting harder to fund the preparation for new goods: reduced product life generates both less

investment cash and a higher risk of investing in the wrong thing.

The profit making predictability of any company that wants to outlive its currently successful product family becomes more important and more difficult than ever. The marketplace grows less tolerant of mistakes and inefficiencies, and deep pockets are getting shallower. Borrowing from one successful area of a business to cover

**“You can make money right up until the day you become irrelevant - then you'll be the last to know and be ignored to death.”**

problems in another increases the threat to all.

Resources that were correct for customer satisfaction only yesterday may no longer be relevant today. With the increased risk to the entire business comes sharpened recognition that every internal resource must either be making profits today or insuring profits tomorrow.

The board room knows this, and business reengineering is proceeding accordingly. Though many companies may appear to be slow on the uptake, take a closer look. Most are "leaning" out while simultaneously testing and implementing more responsive operating modes. Downsizing has been the dominant strategy employed by companies seeking leaner operating modes, and outsourcing is quick becoming a strategy for increasing responsiveness.

The downsizing process attempts to realign the corporate managerial, professional and labor profile to harsh and changing market realities.

Nobody likes the process, but cost and skill mismatches threaten the viability of the entire corporation. When business picks up or new products enjoy high demand, these downsized corporations are not upsizing as they once would - instead they are seeking alternative ways to gain the necessary skills and capability without the inertia of captive resources. Consulting organizations are growing to fill the gap for managerial and professional help, contract manufacturing is providing new options for fluctuating production capacity, and outsourcing in general is broadening the capabilities and capacities available to a company on quick notice.

Successfully living with fickle markets and unpredictable technological change requires a higher frequency and freedom of resource reconfiguration than in the past. Looking at it from the corporate view, gaining new productive capacity as well as new productive capability through outsourcing has several potential advantages: short term requirements are not burdened with long term costs, capital investment and its associated risk are both eliminated, the learning curve to develop new production competency is eliminated, and unit costs may well be lower.

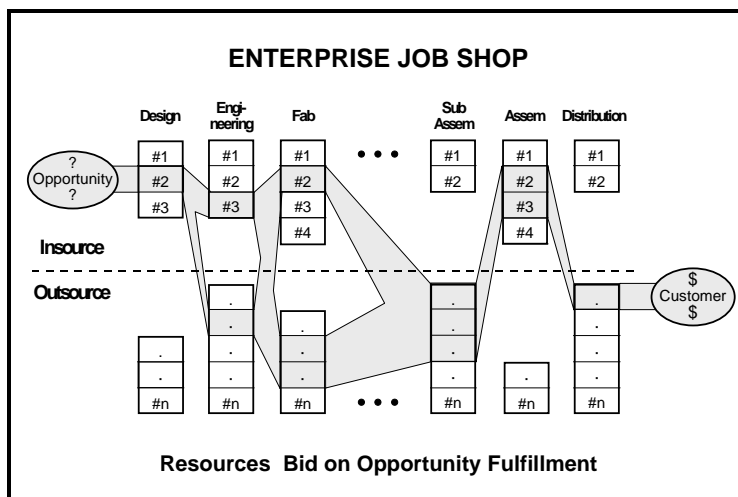
Contract manufacturers and outsource firms are thriving. At least the good ones are. They are focusing on areas where they have a high degree of competency, innovating in these areas to maintain leadership, organizing common-process production facilities applicable to a variety of manufacturing customers, and loosely coupling the elements of production so they can be reconfigured to meet demand fluctuations among their customers. Many reach advantageous scale economies by aggregating similar needs of multiple customers; and in any event spread their risk over a broader base of market servers. Kelsey-Hayes (this column Oct '95) is a prime example of all these points.

On the other hand, internal production operations in large corporations carry baggage filled by many captive years, generally lack the authority to invest in the future, and typically subsidize less effective sister operations. What's a plant manager to do? More on this later.

At the corporate level, with or without a conscious corporate strategy, most companies are moving toward Agility, some faster than others. They have no choice. Too much inertia impedes the ability to capitalize on market opportunities, and short changes the ability to bring innovation to fruition. The continued survival of any corporation demands a more Agile operating capability, and most corporate strategies are following a path in this direction.

There are, however, many paths. We have previously looked at the paths that build Agile production from Agile machines and Agile cells. Here we look at a path that builds Agile enterprise from Agile production; and we look from the corporate view where there are alternatives, if there is a will.

We will take a broad view here of production and include all the functions that satisfy a customer opportunity. To put the outsourcing alternative in perspective here, new product design and engineering is the latest wrinkle.





Solectron is a world-wide, billion-dollar-plus, multi-plant, Baldrige-winning contract manufacturer of electronic boards that gets involved with serious engineering responsibility with increasing frequency. The Industrial Designers Society of America and Business Week recently did a survey that showed budgets up but staffing down, time-to-market shortened, and decentralization in: design is moving away from headquarters to the business units and to outside sources.

From the enterprise point of view, Agile production is achieved when the makeup and relationships of the enterprise's production resources are easily adapted to the precise needs of the moment, and a fleeting moment it is.

The internal strategy breaks the company into independent functional resource units that look like one big job shop - where units bid on work based on their performance capabilities. Good performance is awarded with lots of jobs, bad performance is starved to death, and the "system" is self-organizing. Some units learn and improve, others get traded out, shut down, or simply ignored to death. Subsidiaries are replaced with local profit responsibility and investment authority.

Nucor Steel has decentralized decision making so much that plant managers find their own raw materials, find their own customers, and set their own production quotas. Business Week reports that one Nucor plant general manager turned down the presidency of another steel company because it would be a return to "taking orders". Sure, there are efficiencies to be gained with centralized purchasing . . . and a crushing price to pay in overall corporate health. These are not lonely ideas, an irrefutable success base abounds. Nor are they a swing of the centralize-decentralize cycle seen in older corporations with history.

The external strategy recognizes that production resources do not necessarily have to be owned and captive, they only have to perform effectively when needed. Outsourcing and contract manufacturing enters the corporate mix of possibilities here. When a good system is set up these outside alternatives are not used as threats to distort internal costing, but rather as a self-organizing influence that brings best-in-class to the table. If management values the retention of captive resources it must build a system that levels the real difference over a reasonable time. Invariably this leads back to local responsibility and local authority. Internal units that must compete with best-in-class external alternatives must be allowed to compete on an even basis. And by the same token, they must be able to find other customers that will help maintain a balanced production rate, justify new capability investment, and inspire innovative leadership.

From the corporate point of view these liberated internal resources are incomparably stronger assets than they were as exclusive captives. Stronger as profit generators for the corporate coffers, and stronger as reliable best-in-class suppliers. A good system might institute a most-favored-nation relationship with some group profit sharing plans as the ties that bind. Large partner-based organizations like Andersen Consulting offer interesting models here

So what's a plant manager to do? Stuck in a corporate environment where the Agility decisions are being made at the higher levels a plant manager, with hands tied, is liable to (is likely to) see the outsourcing alternatives favored. Think about it - we all know it's cheaper to get it ready-made elsewhere then re-tailor the resources we have. We must: observation says this is human nature, even among plant managers.

So a plant manager could go take a job with one of these outsourcing firms that has all the advantages. Some have. Some keep marching with their heads down figuring they'll retire before the inevitable happens. A few might see the inherent advantage that an internal resource has with the corporation if it is an irresistible member of the family.

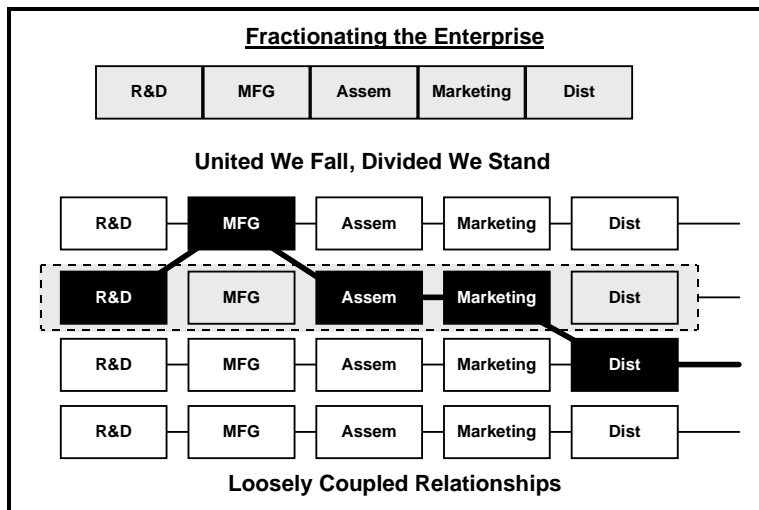
People get downsized, plants get outsourced. But nobody outsources a plant that can respond to the changing corporate needs; just as nobody downsizes the employee that keeps one step ahead of the employer's needs.

Viable business entities are those that can keep up with the mercurial markets that are only going to get more slippery. The Agile enterprise is an imperative. And it will happen with or without captive Agile plants. But those that have Agile plants will have a more robust and broader scope foundation.

You can build an Agile system out of rigid in-Agile modules by considering those modules expendable. Thus, you can have an Agile enterprise composed at any one time of in-Agile production facilities, wholly un-owned and virtual, and replaceable at whim and will. But when the enterprise includes captured and enduring business units, the Agility of each captured unit becomes important to the Agility of the total enterprise. If they are rigid rather than Agile, they become defining anchors. They must either be Agile enough to transform as needed when needed, or they too must be replaced. And replacing an owned unit, unlike an outsourced unit, is a change transformation that extracts a toll.

When Agile design principles are employed, replacement of a rigid module is more expensive than transformation of an Agile module. Thus, it costs more to fire and hire than it does to retrain (an Agile person). Of course, if you are dealing with a contract employee (one you don't own and can consider expendable) than you have our other model of an Agile system.

Plant management that waits for the corporate light to go on may see it shine in a different room. As a newscaster friend used to say: "If you don't like the news, go out and make some of your own". Agile production is not dependent on machinery and capital investments - as the corporate alternatives clearly show. Good application of Agile principles with people, organization, and practices can make a decisive difference in the "Response Ability" of any plant before the corporate strategists consider the options.



# Design Principles for Agile Production

Rick Dove, Sr. Fellow, Agility Forum, dove@well.com, Paradigm Shift International, 505-586-1536

This series of articles has been exploring the nature of Agility in production systems and occasionally the enterprise systems that encompass them; making the argument more than once that Agility is a characteristic which emerges from design. Behind each of these systems are "business engineers" responsible for the system's design - consciously or unconsciously as the case may be.

Good engineering is applied science. Some would argue about management as science, and others believe a manufacturing science remains elusive. Nevertheless, the design of manufacturing enterprise systems, from production process to business procedure, can result in a more or less adaptable system to the extent that certain design principles are employed. The expression of Agility design principles explored in three production systems (Sep, Oct, Nov '95) is assembled on the next page in tabular form showing various applications.

Instead of simply lurching to the next competitive operating state, Agile design principles facilitate continuous evolution.

Science is born from gathering data, analyzing this data for patterns, making hypothesis on principles, and iterating toward validation. We are not employing the rigors of scientific investigation yet; but we are finding repeatable patterns

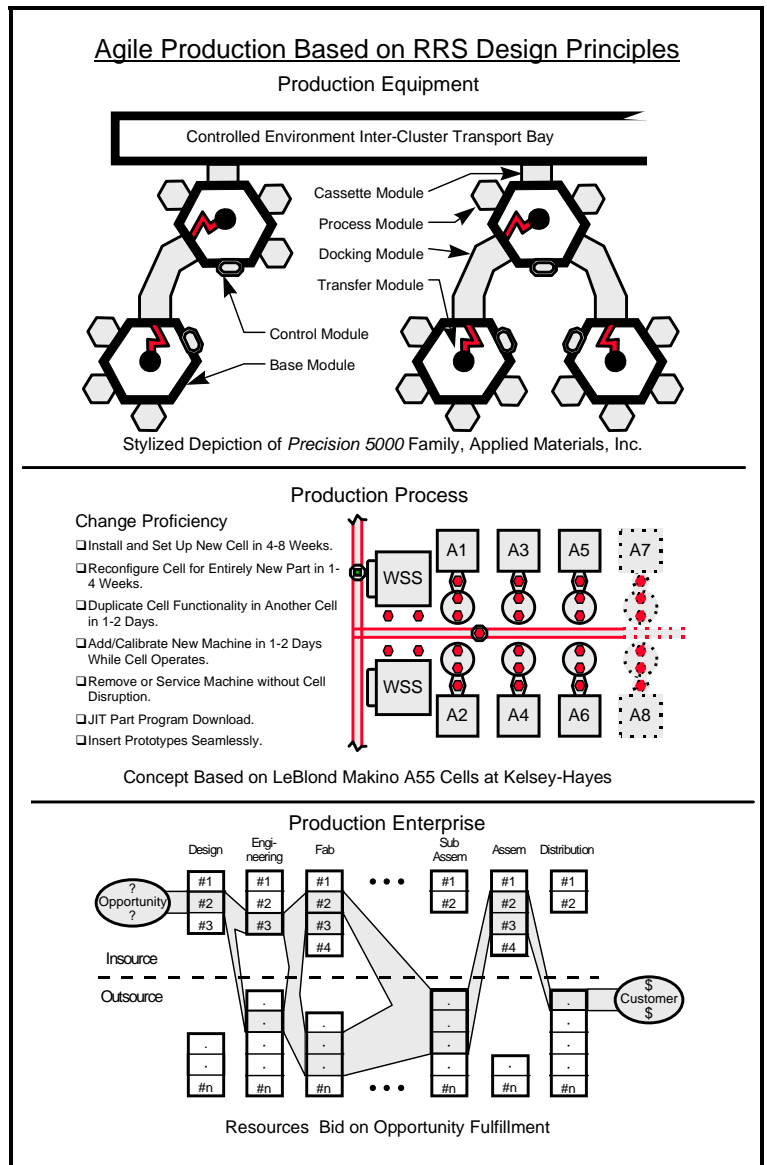
that appear to govern adaptability.

Few would disagree that information automation systems are critical enablers for modern production; but what will the information automation system do to support an Agile operating environment? Perhaps more importantly, what will make the system itself Agile so that it can continue to support an Agile operating environment rather than guarantee its obsolescence? Are there fundamental characteristics that provide Agileness that we can look for in selecting information automation systems?

Adaptability (Agility) actually became a reasoned focus with the advent of object-oriented software interests in the early '80s. The progress of software technology and deployment of large integrated software systems has provided an interesting laboratory for the study of complex interacting systems in all parts of enterprise. The integrated software system, whether it's in the accounting area, providing management decision support, or spread over countless factory computers and programmable logic controllers, is understood to be the creation of a team of programmers and system integrators. We

recognize that these people also have the responsibility for ongoing maintenance and upgrade during the life of the system. In short, the integrated software system is the product of intentional design, constant improvement, and eventual replacement with the cycle repeating.

As engineering efforts, the design and implementation of these integrated software systems proceeds according to an "architecture", whether planned or defacto. Over the years the size and complexity of these systems grows to a point where traditional techniques are recognized as ineffective. This awareness comes from experience: from waiting in line for years to get necessary changes to the corporate accounting system; from living with the bugs in the production



control system rather than risk the uncertainty of a software change; and from watching budgets, schedules, and design specifications have little or no impact on the actual system integration effort.

The problem stems from dynamics. Traditional techniques approach software design and implementation as if a system will remain static and have a long and stable life. New techniques, based on "object oriented" architectures, recognize that systems must constantly change, that improvements and repairs must be made without risk, that portions of the system must take advantage of new sub-systems when their advantages become compelling, and that interactions among subsystems must be partitioned to eliminate side-effects.

These new approaches have been matured over a decade now and are emerging most visibly into everyday employment under the name client-server architecture. Though there are significant differences between systems concepts called client-server and those called object-oriented, "encapsulated" modularity and independent functionality are important and shared key concepts. More to the point, information automation practitioners are now focusing a good deal of thought on the architectures of systems that accommodate change; providing a rich laboratory and experience base from which fundamental Agility principles are beginning to emerge.

The ten "RRS" (Reusable, Reconfigurable, Scalable) design principles introduced earlier (Aug '95) and tabulated below are based on object-oriented concepts augmented with understandings from production and enterprise systems exhibiting high degrees of adaptability.

Readers far removed from systems engineering or computer

technology may find the words used to describe these principles too abstract at first. A human resources director, for instance, might feel more comfortable with "empowered work team" then with "encapsulated modules", though the two are similar architectural concepts. But then, few people in business are taking a business engineering approach as yet.

The Agile RRS design principles identified here are presented as a useful working set that will undergo evolution and refinement with application. Their value is in their universal applicability across any system that would be adaptable. Instead of simply lurching to the next competitive state, Agile design principles facilitate continuous evolution.

Each of these principles will be subsequently examined in much greater depth, as will methods for establishing the objectives of an Agile system and the metrics of success. Though we have focused on the "solution" approach here, it is critical to establish an objective understanding of the opportunity and "problem" before embarking upon the solution.

Agile Reusable-Reconfigurable-Scalable (RRS) Design Principles				
RRS	Design Principles	Production Equipment (Cluster Machines - Sep '95)	Production Process (Agile Machining Cell - Oct '95)	Production Enterprise (Enterprise Job Shop - Nov '95)
Reusable	<b>Self Contained Units:</b> System of separable, self-sufficient units not intimately integrated. Internal workings unimportant externally.	Wafer transfer module, various process modules, docking module, cassette transfer module, utility-base module.	Machines, work-setting stations, pallet changers, fixtures, rail-guided vehicles.	Design, engineering, fabrication, sub-assembly, assembly, and distribution resource modules.
	<b>Plug Compatibility:</b> System units share common interaction and interface standards and are easily inserted or removed.	Common human, mechanical, electrical, vacuum, and control system interfaces.	Common human, mechanical, electrical, and coolant system interfaces. Common inter-module mechanical interfaces.	Common info system and procedures among captured corporate resources, common interface in outsourcing contracts.
	<b>Facilitated Re-Use:</b> Unit inventory management, modification tools, and designated maintenance responsibilities.	Machine manufacturer extends/replicates module family for new capabilities. Fast module-swap maintenance is facilitated.	Machines do not require pits or special foundations, and are relatively light and easy to move.	Corporate outsourcing department maintains pre-qualified pool of potential outsources.
Reconfigurable	<b>Non-Hierarchical Interaction:</b> Non-hierarchical direct negotiation, communication, and interaction among system units.	Processing modules decide how to meet part production objectives with closed-loop controls.	Complete autonomous part machining, direct machine-repository download negotiation.	Business unit resources free to bid on internal jobs and external jobs.
	<b>Deferred Commitment:</b> Relationships are transient when possible; fixed binding is postponed until immediately necessary.	Machine custom configured with processing modules at customer installation time.	Machines and material scheduled in real-time, downloaded part programs serve individual work requirements.	Individual business unit assigned to opportunity fulfillment at last possible moment.
	<b>Distributed Control &amp; Information:</b> Units respond to objectives; decisions made at point of knowledge; data retained locally but accessible globally.	Intelligent process modules keep personal usage histories and evolving process characterization curves.	Part programs downloaded to machines, machine history kept in machine controller, machines ask for work when ready.	Enterprise integration information system queries data bases local to the business unit.
	<b>Self Organizing Relationships:</b> Dynamic unit alliances and scheduling; open bidding; and other self-adapting behaviors.	Real-time control system makes use of processing units available at any given time, scheduling and re-routing as needed.	Cell control software dynamically changes work routing for status changes and new or removed machines on the fly.	Bid-based production-flow alliances.
Scalable	<b>Flexible Capacity:</b> Unrestricted unit populations that allow large increases and decreases in total unit population.	Machines can be interconnected into larger constant-vacuum macro-clusters.	Cell can accommodate any number of machines and up to four work-setting stations.	Outsourced resources can be easily added or deleted to increase the population of production modules with no size restrictions.
	<b>Unit Redundancy:</b> Duplicate unit types or capabilities to provide capacity fluctuation options and fault tolerance.	Machine utility bases are all identical, duplicate processing chambers can be mounted on same base or different bases.	Cells have multiples of each module, all cells made from same types of modules, machines have full work functionality.	Multiple duplicate production resources and second-outsources.
	<b>Evolving Standards:</b> Evolving, open system framework capable of accommodating legacy, common, and completely new units.	Base framework becoming standard across vendors, and has accommodated processing technology across generations.	Utility services and vehicle tracks can be extended without restrictions imposed by a cell or its modules.	Enterprise integration Information system is open architecture, client-server based.

# Assessing Your Position in Agile Space

By Rick Dove, Senior Fellow, Agility Forum, dove@well.com, Paradigm Shift International: 505-586-1536.

What would it mean for Chrysler to be in the masters class at change proficiency? How would we assess GM's and Ford's position in relationship to Chrysler's? How can any assessment process be more than fleetingly useful in a business environment of accelerating change?

We will explore a framework and assessment approach for answering these questions. This initial exploration will be shallow in order to touch all the steps. We will add depth to each step individually in subsequent discussions. Most of the concepts have been introduced here previously, with a close look recently into the use of design principles that underlie Agile capabilities. Now we step back and look at the bigger picture to help prioritize a transformation to Agility, assess progress toward Agility, and comparatively position one company with another either as competitors in the same industry or as benchmarks independent of industry.

Traditional manufacturing companies can learn a lot about Agility by looking into other industries at some of the companies in the electronics and computing markets. With punishing advances in product and

Judgment and engaged minds are required here; but then that really is what distinguishes the masters class from the journeyman.

process technology, product life cycles moving to under a year, and rapid globalization of both markets and competitors -- successful players in these markets are employing equally fast-paced operating practices. Of course high growth markets can give the illusion of corporate growth even when market share is shrinking and reserves are being depleted, so caution must be exercised when looking for

benchmark examples.

Intel, Motorola, Hewlett-Packard, and Microsoft are all touted by the press for their successful practices in fast paced markets. That doesn't necessarily mean that they are Agile to the point of being masters at change proficiency; but they are probably better than their current competitors currently are.

Assessing whether or not they are in the masters class is something that should be of interest to them since their competitors aren't simply trying to catch up. Assessing where they are and what they do to stay there is something that should be of interest to everyone in any industry.

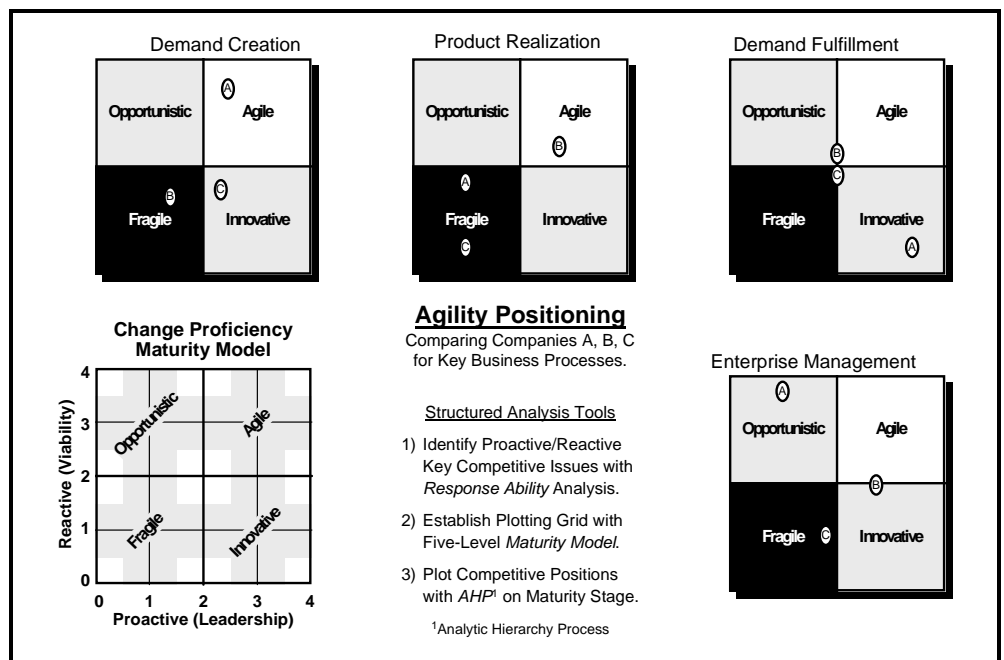
Building the business case for Agility is different for every company and every industry. Certain concepts are enduring yet certain other concepts are short-lived and faddish: witness the Japanese current rethinking of both lean work-in-process inventory and the values of high-variety customer options (but that's another story).

More to the point, if we want to gauge a company's progress toward timeless mastery at change proficiency will we accumulate points for practices like teaming, mass customization, virtual partnering, integrated product/process development and other very important concepts of the day? Or will we look for more fundamental capabilities that allow a company to adopt and integrate whatever operating concepts are important today as well as those yet undefined that become important tomorrow?

Implementing today's competitive practices says nothing about your ability to implement tomorrow's.

So how can we gauge this fundamental capability at change proficiency that makes a company timelessly Agile? What we are looking for is some sort of continuum from novice to professional at change proficiency, and a way to place our own or someone else's company in that continuum. What we need is a "change proficiency maturity model" that gauges process mastery. The Software Engineering Institute (SEI) of Carnegie Mellon University has developed a highly regarded process maturity model that we can "reuse" with some "reconfiguration".

The nature of process improvement and process mastery have become a major focus for many industries in the last few years. The US Government is accelerating this interest by funding the development of process assessment and improvement tools, and auditing process mastery among its defense suppliers. Recognizing the increasing complexity and criticality of software systems to automation of all kinds, the Government wanted a method for assessing the capabilities of its software contractors. In response, SEI released a brief description of a software



development "process maturity framework" along with a "maturity questionnaire" in 1987. The framework demarcated a progressive series of five stages from totally unconscious to total mastery, much like a person's professional maturity path: amateur, apprentice, journeyman, master, guru-de-guru. The questionnaire was intended to help identify a vendor's stage of development-process maturity and illuminate areas for improvement.

To SEI's consternation, early users mistakenly embraced the questionnaire as "the model" rather than as a tool for exploring and prioritizing issues of process maturity. Not unlike the wide-spread substitution of TQM procedures for TQM objectives: Turn the crank, nose to the grindstone, mind un-engaged.

To combat this problem SEI augmented the maturity framework in 1992 with a model that includes key processes and key practices, and is the common foundation for: 1) an effective process assessment for the supplier developing an improvement program and 2) a disciplined method for the customer evaluating a supplier's capability (see <http://www.sei.cmu.edu/>).

Most importantly, the model recognizes that there are alternative ways to accomplish the goals of the key processes: It is not prescriptive about specific approach. Thus, the key practices refer to what must be done rather than mandating how to do it. Judgment and engaged minds are required here - but then that really is what distinguishes the masters class from the journeyman.

The software process Capability Maturity Model deals with a well bounded area (software development) with forty years of observable practice. The Agile enterprise in its infancy has not yet displayed its full range of necessary infrastructure and successful practice. Nevertheless, we can build a useful Change Proficiency Maturity Model by following the SEI lead and focusing on process requirements rather than process prescriptions.

### Assessing Competitive Change Proficiency

The framework shown in the figure is the foundation for the maturity model which we will explore in more depth later. For now, the five stages of maturity provide a metric for measuring a company's proficiency on the two axes of interest: Proactive and Reactive change proficiency (this column April '95).

Determining what stage of maturity fits a company can be done simply or studiously. The simple method is equivalent to the educated guess and is based upon whatever knowledge and perception the analyst (or group consensus) has of the company and its observable behaviors.

A more studious approach utilizes the Analytic Hierarchy Process (AHP) to rank order the many practices and behaviors within the full maturity model that constitute and indicate a maturity level - especially when a company exhibits scattered capabilities from various levels. AHP is a process for reaching useful conclusions with fuzzy data (T.L.Saati, Decision Making for Leaders, <http://ahp.net/www/ahp/>). More importantly, AHP will lead the user(s) through a thought process that builds a deep appreciation for the practices involved in change proficiency and the ways in which different companies implement them.

A primary question, of course, is what will be the focus of the assessment? If we look for a single Agility roll-up as comparison among

companies (who's the Agilest of them all?) the AHP methodology offers a way to arrive at a conclusion, though it is not clear what value this would offer. Better perhaps to identify a number of key business practices and assess competitive change-proficiency for each.

The "Agility Positioning" figure shows four top-level generic business practices. Each of them is equivalent to the "software process" focus of the SEI model complete with an individualized set of key processes and key practices. The key processes for each generic business practice is developed using some form of *Response Ability Analysis* that identifies the important change-proficiency issues. *Response Ability Analysis* refers to a variety of methods based on the "Change Domain" concept (Feb and Jun '95).

The four generic business practices in our figure are clearly at a higher enterprise level than SEI's software process model addresses. A change proficiency assessment at this high level is useful to help crystallize a corporate vision. To develop an actionable improvement program, however, a further reduction in process granularity is in order, and is accomplished with *Response Ability Analysis*.

In subsequent columns we will explore this maturity model and its application further - with the intention of describing a set of tools that can help build a business case as well as an actionable prioritized improvement strategy - at any process level in an organization.

For the truly adventuresome, Paradigm Shift International will be conducting guided exploration executive workshops to custom develop and apply these tools. Inquire at 505-586-1536. Safaris start in second quarter 1996.

<u>Change Proficiency Maturity Model Framework</u>				
<u>Maturity Stage</u>	<u>Metric Focus</u>	<u>Working Knowledge</u>	<u>Capabilities</u>	
			<u>Reactive</u>	<u>Proactive</u>
Accidental	Pass/Fail	Examples	Lucky	Accidental
Repeatable	Time	Concepts	Safe	Occasional
Defined	Cost	Metrics	Confident	Competitive
Managed	Quality	Responsibilities	Sure	Aggressive
Mastered	Breadth	Principles	Automatic	Formidable

↑  
Note: These metrics apply to "Change Proficiency", thus, the concern is cost-of-change, not cost-of-product.

# Building Your Own Maturity Model for Agility

By Rick Dove, Senior Fellow, Agility Forum, dove@well.com, Paradigm Shift International: 505-586-1536.

Chrysler's invention of the mini-van was a good example of innovative leadership; but running out of engines is a poor example of both resource management and opportunity management. This is not a case of you-win-some and you-lose-some; but a result of organizational maturity in the area of change-proficiency. When demand soared, production resources could not meet increased capacity needs. This is not an indictment of Chrysler: they exhibit much more overall change proficiency than their larger competitors. It is a recognition that change proficiency comes in various levels of competency.

We focus on change proficiency as a necessary and fundamental enabler for the Agile enterprise; and recognize that an Agile enterprise can be as simple as a portfolio management company that constantly reshuffles the in-Agile resources it controls, or as complex as a vertically integrated organization concerned about the Agility of each of its operating units, which in turn are concerned

"Any company that builds a Model for itself and its industry will have a preemptive, actionable competitive understanding"

about the Agility of each of their key business processes. Complexity aside, all enterprises have frequent occasion to weather change, and each does so with its own degree of proficiency, or lack thereof. Some deal with each event as the come, some learn naturally from each event and get better at the next change, and some recognize competitive value in mastering the process of change.

Continuing the discussion begun in last month's column, the five-stage framework for change proficiency depicted in the accompanying figure moves from "accidental" to "mastery" as the business element under examination incorporates more competency at adaptation.

## Maturity Stages

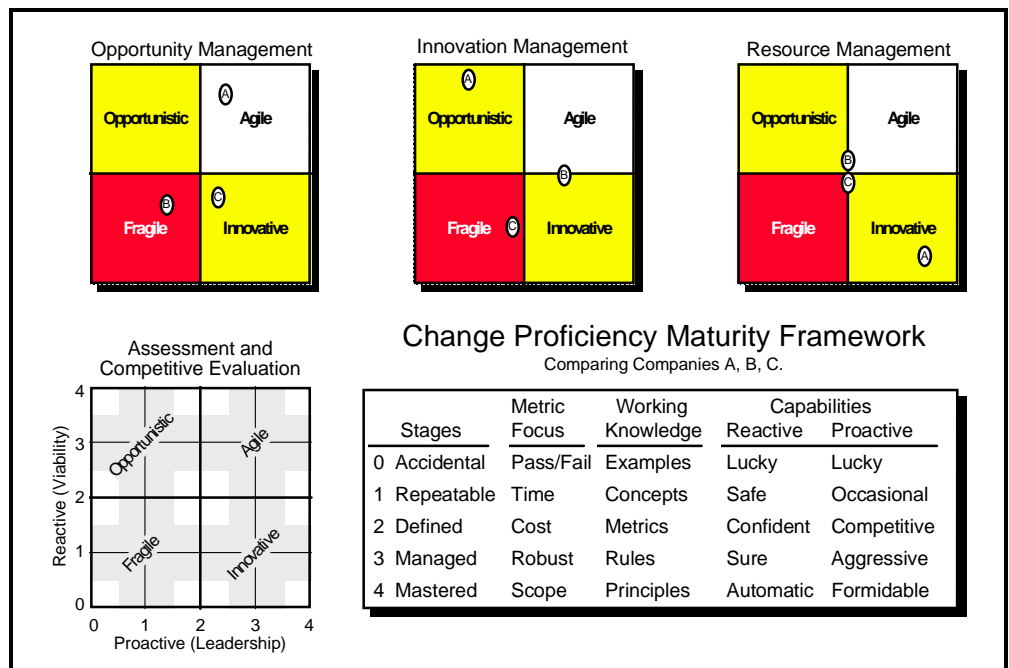
The *Accidental* stage is characterized by the lack of any change-process recognition, yet change manages to occur. The actual process is ad hoc: typically exhibiting false starts and retries, unpredictable completion dates and costs, surprising results and side effects, and undesirable reactions from, and effects on, the personnel involved. On the obvious bad side: grueling overtime, downsizing, multiple reengineering attempts, management fad-

of-the-day, fire-fighting, expediting. The seemingly good side also has its accidental successes: Sun Microsystems is in the limelight today for changing the network computer market with its new Java product; but it stumbled there through missed opportunity, false starts, and sleepy competitors (The Java Saga, Wired, Dec 95).

The *Repeatable* stage is typically based on anecdotal "lessons learned" from past change activities. Specialists and talented SWAT teams are recognized for prior successes and abilities to repeat these in relatively quick time frames.

The *Defined* stage begins to recognize formal change processes with documented procedures. The base of potentially successful practitioners is broadened as process rather than intuitive talent becomes appreciated. Metrics for the change process are identified and predictability becomes a primary goal. Typically procedures at this stage are rigid and based on studied experience and analysis.

The *Managed* stage is characterized by the appointment of change managers (business engineers) with established responsibilities. An evolving knowledge base of change process fundamentals begins to emerge, appreciation for and participation in the corporate change-process is widespread, rigid procedures are loosened and predictability is the norm.



The *Mastered* stage is characterized by a principle-based deep appreciation of adaptability, an understanding that process alone is not sufficient, and a conscious engineering and manipulation of the structures of business practices and organizational infrastructures. Like a flock of birds swooping and turning as a unit, corporate change loses its event status and takes on constant fluid motion.

### Metrics

As a company progresses through these maturity stages there is a specific and different emphasis on change proficiency metrics at each stage. These metrics are associated with the change process itself and refer to the *time* to affect a change, the *cost* of making a change, the quality (*robustness*) of the change process, and the breadth (*scope*) of the change capability.

Of course all of these metrics are interrelated, and all are important when evaluating any specific change capability, such as creating a new product or doubling plant capacity to meet unexpected demand; but the process of maturity places special emphasis on individual metrics at each stage. Being able to take advantage of an opportunity while the opportunity is meaningful makes time the initial focus, even if you have to pay a premium. After the "cycle time" of instituting a change is sufficiently under control to hit the "market window", the cost of making these changes enters the spotlight. When both time and cost are acceptable the focus turns to predictability and consistency, or the quality of the change process. Finally, when good sound change proficiency capabilities are understood and managed an organization gains competitive advantage in broadening the range of application.

### Building a Change Proficiency Maturity Model

A Change Proficiency Maturity Model (CPMM) is a general model that can be focused on any aspect of business, from the entire enterprise to the lowest sub-process. Thus, it is necessary to focus your CPMM on a specific aspect of business before the details take shape. Furthermore, it is necessary (at least in principal) to give shape to the processes and practices of a specifically focused CPMM anew every time it is applied. Thus, when we wish to gauge the maturity of a company's product realization process we will add process and practice flesh to the CPMM skeleton at that time, and not dust off a set of processes and practices that were relevant to an earlier time.

We are attempting to characterize a capability that can keep up with a changing environment, so the processes and practices appropriate at one point in time may not be appropriate at another, nor is there any expectation that processes and practices in one industry or even one niche market are equally applicable in another.

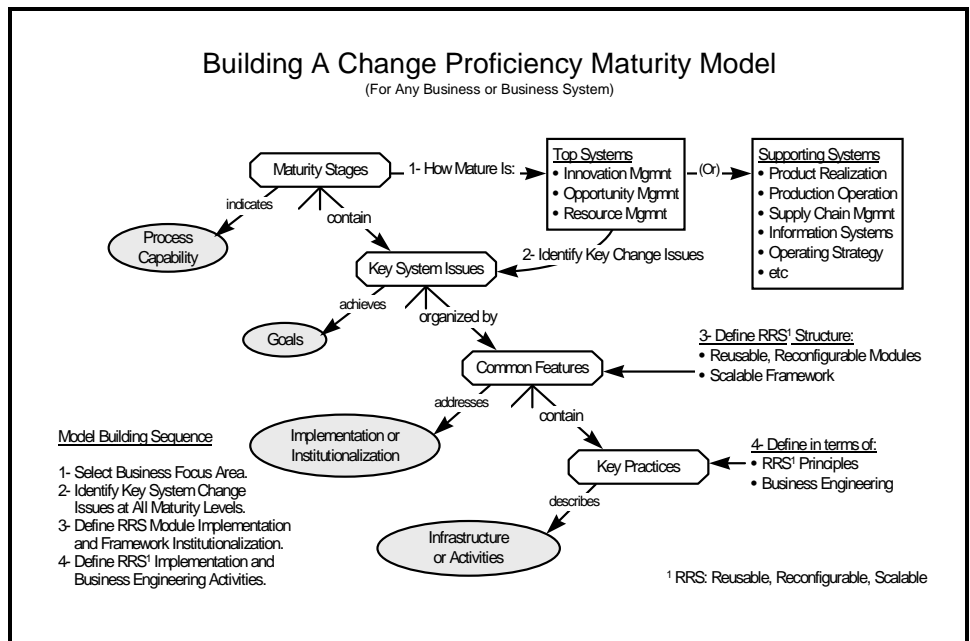
Applying a CPMM requires engaged user interpretation as the practices themselves must be determined at each application. That is the nature of this Agile environment we are attempting to gauge. Nevertheless, there is enough substantive structure to

guide the practitioner through a consistent process that builds an evaluative and comparative understanding of change proficiency maturity at any point in time. In actual practice it is expected that new applications will build heavily upon previous applications, with no changes in many cases.

Like zero-based budgeting, where next years budget must be justified from scratch rather than simply perpetuate the previous expenditure items, so must the application of a CPMM start with a freshly justified set of processes and practices.

We opened with a statement about Chrysler principally because their mini-van innovation is a high point in recent changing auto markets. Though we used the example to show an immaturity in balanced change proficiency, Chrysler appears to be leading the pack in discovering and implementing practices that make them more adaptable to faster changing times. Small wonder, smaller animals typically survive among larger predators due to their superior agility. But how Agile is Chrysler really? Are they just running amok among a bunch of sleepy competitors, looking good by comparison? Is there any law that says a larger competitor can't be more Agile than a smaller one? Any company that builds a Model for itself and its industry can answer questions like these; and will have a preemptive, actionable competitive understanding.

For the inquisitive, Paradigm Shift International will be conducting guided exploration executive-workshops to custom develop a variety of industry and corporate models. Inquire at 505-586-1536. Safaris start in second quarter 1996.



# The Voice of Industry Speaks on Agility Priorities

By Rick Dove, Senior Fellow, Agility Forum, dove@well.com, Paradigm Shift International: 505-586-1536.

Two hundred industrial organizations recently ranked their high priority change-proficiency issues in a Voice-of-Industry survey. The survey is notable in that the majority of respondents were presidents, vice-presidents, and other top-level executives; and that it provides a picture of contrasting priorities among eight different industrial sectors. The picture that emerges is both instructive and useful for competitive positioning and evaluation.

That 200 top executives took the time to fill out a fairly extensive survey is testament alone to the importance of the subject. The survey was developed by industry, government, and academic representatives on the Agility Forum's Strategic Analysis Working Group; and distributed through both Forum and National Center for Manufacturing Sciences channels.

The purpose of this initial survey was experimental, to see if anything meaningful could be gleaned from a cross-industry database. Caution should be exercised against drawing too much

"These sector priorities can be especially useful when constructing the competitive Maturity Models introduced here recently."

significance from these rankings: an average river depth of 5 feet doesn't mean you can ford the river safely. Nevertheless, the differences between sectors is consistent with our intuitive understandings, and the priority issues unique to individual industrial sectors are illuminating.

These sector priorities can be especially useful when constructing the competitive Maturity Models

introduced here in the last two columns. Whether a Maturity Model is used to compare change proficiency among companies, or to guide an internal improvement program, the model is custom fit to both the industry sector and the individual organization.

Building a model for a specific organization requires a comparative understanding of current sector-wide issues and trends. The previous introduction to the Maturity Model indicated a potential for differences in different industries. Here is proof; but more importantly, here is focus. The survey conclusions are of course averages and don't apply perfectly to any one company; but these profiles and contrasts do reflect common intuitive understandings of these industries. We will explore some of these contrasts and similarities and get a better feel for industry priorities and indications of where we might find some maturing focus.

Notice that the Motor Vehicle sector ranked Culture Change as its

number one priority. This ranked 9th in Aerospace and 9th overall (see Table 2), so it's clearly important to others but behind more pressing issues.

With the exception of the 3rd ranked Identification of Opportunity, all of the top priorities for Motor Vehicles are focused inward on improved operating practices and resource management. Contrasting this with Electronics we see Create New Ideas as their sole outward focus and at the bottom of the list, perhaps because they have this activity well in hand but know better than to ignore it. Aerospace, on the other hand, has four outward looking priorities: Identification of Opportunity, Correct Customer Problems, Create New Ideas, and Adding Customer Relationship Skills. This might be a reflection of the serious downsizing of the defense market and the resulting intense competition for survival. The Metal Products sector has two outward-looking priorities that might be motivated by the changing operating practices in their OEM markets.

The Motor Vehicle sector places major emphasis on internal change, with Create Strategy for Change as a unique priority among the four sectors shown. This is also seen with the unique Adaptable Process Technology and Adaptable Teams, reflecting a response to a more mercurial and shorter-run market. Evolving Organizational Learning is the fourth unique priority here and complements this theme of major internal change.

The Electronics sector generally serves both consumer and OEM markets; but respondents to this survey are skewed toward OEM markets, like autos. Nevertheless, a decidedly different picture emerges. The major theme is consistent with growth-oriented, short-cycle, fluctuating demand response. Identifying and Acquiring Human Resources both play an important role here, and this is the only sector concerned with Identifying Capital Needs. Real-Time Worker Variation reflects customized products and increasing job/workstation variation. Here we see the only

**Table 1: Top Nine Change-Proficiency Issues in Four Industry Sectors**

(Bold type shows sector-unique priority among four sectors - data from AMEF Q1-95 VOI survey)

Eight-Sector Average	Motor Vehicles	Electronics	Aerospace/Defense	Metal Products
Identify Opportunities	Evolve Culture	Improve Product Quality	Identify Opportunities	Identify Opportunities
Improve Product Quality	Improve Product Quality	Product Realization	<b>Add New Core Competency</b>	Improved Product Quality
Create New Ideas	Identify Opportunities	Identify Human Res. Needs	<b>Correct Customer Problems</b>	Create New Ideas
Product Realization	<b>Adaptable Process Tech.</b>	Acquire Human Resources	Product Realization	Acquire Human Resources
Acquire Human Resources	<b>Adaptable Teams</b>	<b>Identify Capital Needs</b>	<b>Adaptable Org. Structure</b>	Correct Supplier Training
Improve Cycle Time	Product Realization	Improve Cycle Time	Create New Ideas	Improve Cycle Time
Identify Human Res. Needs	<b>Evolve Org. Learning</b>	<b>Real-Time Worker Variation</b>	<b>Identify Core Comp. Needs</b>	Identify Human Resource
Correct Customer Problems	<b>Create Strategy for Change</b>	<b>Surge in Product Dev.</b>	<b>Add Customer Rel. Skills</b>	Needs
Evolve Culture	Correct Supplier Training	Create New Ideas	Evolve Culture	<b>Improve Product Cost</b>
				<b>Continuous Learning</b>



instance of Surge in Product Development, a concern when technological innovation ceases to advance in steady, predictable cycles.

The Aerospace/Defense sector is of course in total turmoil. With one dominant customer that has cut back on purchases dramatically, companies are scrambling for most-favored status and new commercial market development. In addition to the strongest roster of outward-looking priorities previously discussed, we can see a unique focus on both Identifying (current) and Adding New Core Competencies as means for accentuating preemptive capability and also developing capabilities required in new markets. Adaptable Organization Structure is the final unique priority here, and appropriate for an industry undergoing both massive downsizing and merger frenzy, not to mention the emerging short-term tactical customer focus where a long-term strategic focus prevailed in the past. It is also interesting to note that this is the only sector that doesn't rank Improve Product Quality in the top nine.

The Metal Products sector is predominantly serving OEM markets, with a healthy flow into the Motor Vehicle sector. Improved Product Cost and Continuous Learning are the unique priorities here, notable by their absence from the other three sectors. It is interesting that the cost issue is not in the top nine for the other sectors, though it is tied for 10th in all of them. Even here it is eighth; indicating perhaps an emerging broad-based threat to corporate viability tied to other more pressing issues.

This demotion of the cost improvement priority is the clearest indicator that broad-based change-proficiency is gaining importance.

Survey respondents came from small, medium, and large companies including: Acme Electric, Allied Signal, AMF, Battelle, Boeing, Caterpillar, Concurrent Technologies Corp., Dow Corning, Drexel, Eaton, Fairchild, General Tank, GM, Delphi, Goodyear, Hauser, Hughes, IBM, James River, John Deere, Johnson Controls, Kodak, Lockheed, National Machine, Otis Elevator, Pratt and Whitney, Rockwell, Tektronics, Texas Instruments, TRW, Westinghouse, Whirlpool, and many others less commonly recognized.

Table 2 contains forty-five issues that achieved priority ranking within at least one sector. A priority ranking either received a "High" priority rating by at least half of the respondents in a sector, or received a weighted average numerical rank of one through nine within a sector by those who provided the additional numerical rank (approximately half in each sector). Forty-seven additional issues appearing on the survey failed to gain this status.

Table 2: Ranks across sectors; awarding 10th place to issues designated "High" priority by at least half of the total respondents. "H" ratings are awarded within sectors if half or more sector respondents rated issue as "High" (AMEF Q1-95).									
	Vehicles	Electronics	Aerospace	Metal Products	Electrical	Chem/Plastics	Other Mat's	Misc.	Average Rank
Companies Responding:	19	26	18	63	22	25	25	14	212
Create New Ideas	H	9	6	3	3	6	3	H	3
Create Strategy for Change	7		H		7	3		H	
Create Buy-In / Acceptance	H								
Product Realization	6	2	4		2			H	4
Identify Opportunities	3		1	1	4	2	1	H	1
Identify Human Resource Needs	H	3		7	H	H		H	7
Identify Capital Needs		5					4		
Identify Needed Technology				H	H		7		
Identify Core Competency Needs			7		8				
Acquire Human Resources	H	4	H	4	H	5		H	5
Acquire Capital							5		
Acquire Technology					H				
Improve Cycle Time	H	6	H	6	6				6
Improve Product Quality	2	1	H	2	H	1	2	H	2
Improve Alignment of Effort & Strategy					H			H	
Improve Product Cost	H	H	H	8	H	7	8		10
Continuous Learning		H		9		H		H	
Evolve Culture	1		9		9	3			9
Evolve Organizational Learning	7						6		
Evolve Empowerment & Alignment		H			H				
Evolve Time Compression	H								
Add New Core Competencies			2	H	5		H	H	10
Add Customer Relationship Skills	H	H	7	H	H	H	9	H	10
Add Gen. Skills with Education/Training				H	H			H	
Add New System/Process/Equip			H	H		H	H		10
Add Access to New Information								H	
Add Supply-Chain Management Skills								H	
Correct Supplier Training	7	H	H	5	H		H	H	10
Correct Equipment Failure				H				H	
Correct Customer Problem	H	H	3	H	1	H		H	8
Correct Quality Problems		H	H	H	H	H	H		10
Real-Time Scheduling & Execution	H		H	H	H	H		H	10
Real-Time Material Availability		H		H					
Real-Time Process Variation								H	
Real-Time Worker Variation		7		H					
Surge in Product Development		8	H		H	8		H	
Surge in Human Resources	H						H		
Surge in Production Quantity	H							H	
Adaptable Process Technology	4	H	H	H	H	H	H	H	10
Adaptable Equipment & Process			H			H	H	H	
Adaptable Teams	5				H				
Adaptable Organizational Structures			5						
Adaptable Equipment & Process						H			
Adaptable Workers		H		H	H			H	10
Adaptable Strategies						9			

# Agile Supply-Chain Management

By Rick Dove, Senior Fellow, Agility Forum, dove@well.com, Paradigm Shift International: 505-586-1536.

What does that mean? Do you want to manage an Agile supply chain -- or do you want to manage your supply chain Agily? Is there a difference? Does it matter? Either one is probably better than what's happening now.

A few years ago we all looked downstream to the customer and focused on "the voice", now we're all looking upstream to the supplier and focusing on "the partnership". Whether you're looking downstream or upstream or both ways now, you also have to look to the future; and know that the future will have something different in store for you.

For sure, if you're in one of those companies with an arrogance problem, you need to learn about "the voice"; but when you catch up with the world, don't mistake that corrective action for a strategy. Your competitors will simply change the rules with some innovation and you'll be listening to your own "But you said . . ." echoes in an empty room. Nobody ever told Chrysler they wanted a minivan.

"Out-of-box thinking isn't automatically better, nor is it necessarily synchronized with the corporate preparedness to switch.

Lean operating practices are the dominate driver to highly integrated, down-sized supply chains; promising both cost savings and closer, more productive working relationships. When the total focus is on the static steady-state operating case, however, we see where too-Lean becomes too-fragile.

Ryder has 60% of GM's hauling business and 40% of Chrysler's; and sales at both companies were impacted when the Teamsters struck Ryder in September '95. A known dynamic of the supply-chain environment, yet one that wasn't covered in the business practice design. Ford wasn't hurt noticeably by the Ryder strike; but in that same September they shut six plants down when one supplier couldn't deliver a power-steering-systems component.

Last fall wasn't just bad in the auto industry. Presaging the recent shakeup at Apple Computer, an October '95 Business Week article noted that the part shortages plaguing all PC makers were hitting Apple the hardest because "many of its components are custom-designed and sourced from one supplier." Christmas demand was booming but remained unfilled because Apple lacked critical parts. Apple blamed its sales people, saying they "sandbagged" forecasts on purpose to get over-quota bonuses. What a whine that is! Blame the business practice that had no room to adapt to a typical supply-chain dynamic. Now-ex-president Spindler was quoted: "I resent this idea that we have systemic problems." Well, even if he can't see the inability to increase capacity when demand soars as systemic, a commission structure that encourages low-ball forecasts happens by design as well.

Supply-chain business practices must be designed for the dynamics of the operating environment, not for some steady-state idyllic set of conditions that can't be maintained. Only a decade ago we all talked second sources as a minimum, even 3-2-1 practices that gave half the business to a lead supplier and kept two others hot with sustaining quantities. Better to figure out how to make that cost

effective than to abandon it for single-point failures that have no choice but to happen. The marketplace doesn't forgive stumbles like it used to: "I want it now - If you don't have it - I'll get it somewhere else."

Look at your existing or planned supply-chain management practices and identify the real types of unpredictable change that can ruin a good quarter, alter market-share permanently, or miss a market opportunity completely. Reactive change proficiency brings corporate viability, proactive change proficiency enables market leadership.

Intel's in the microprocessor business. Each

**Change Proficiency** - the competency in which an adaptive transformation occurs (e.g. how fast can we recover from a failed supplier situation).  
**Change Proficiency Metric** - measured performance item(s) that assign a comparative competency values to change-proficiency: Time, Cost, Robustness, Scope.  
**Change Proficiency Issue** - the item that the metric will be applied to (e.g. formation of partnership).  
**Change Proficiency Measure** - Time is measured in units of time, cost in units of money, robustness in predictability and expectation shortfall, and scope in lost opportunities and market innovations.

new product model costs \$1 billion to develop and each new plant costs \$1 billion to build; and they just make a small component in the "real" product - the computer system. Two years ago they were just a supplier to the OEMs in the computer business. That's history. Their "Intel Inside" marketing campaign is like Ford, Toyota, and Mercedes putting a "Delco Inside" sticker on each car they sell.

Intel didn't stop with that: they decided the OEM's weren't growing the market fast enough, so they started building entire motherboards. That whole market just got turned upside down - if you sell computers and you want to hit the Christmas sales season with the latest Intel chip you don't have time to design your own motherboard anymore, so now what used to be a computer maker is only a computer sales channel -- Intel is the computer maker..... But that could never happen in the auto market.

The auto industry is bringing its suppliers closer and closer, getting the supplier more involved in design, even co-locating the supplier's manufacturing activity on the premises. Volkswagen has even started to use the supplier to assemble the vehicle. Some real out-of-box thinking going on here; but too much of it is looking at a static box. There better be something more to your strategy than lower costs and shorter

cycles. Be careful what you ask for, you may get your wish.

From the comic strips recently Snoopy laid three panels of doghouse philosophy on us: "Secrets of Life: Always look ahead -- Also, always look back over your shoulder -- Make sure you can still see your supper dish."

Out-of-box thinking isn't automatically better, nor is it necessarily synchronized with the corporate preparedness to switch to something radically different. Decision makers focused on realigning existing supply relationships with the accelerating business environment are generally unwilling to risk the current income stream on unproved concepts. A new supply-chain management practice should focus initially on delivering immediate "supper-dish" benefits, while enabling advanced capabilities for more gradual exploitation.

The accelerating pace of change in the business environment is fueling an interest in technological support for supply-chain management, with the expectation that electronic inter-enterprise connectivity can speed the flow and increase the accuracy of information exchanges, reducing both time-dependent and mistake-induced costs in multi-tier procurement and design activities. Lockheed/Martin, Rockwell, and Texas Instruments are building an open infrastructure for supply-chain management called AIMSNet. In order to focus the design requirements, change-proficiency issues were identified for three different modes of operation, with the high leverage items short-listed. The accompanying table is similar to the one they are working with.

Agility is about change-proficiency. Organizations of interacting elements (supply-chains are one example) are said to be

Agile if they can accommodate a variety of different kinds of change adequately. Identifying the change issues explicitly is what leads to a solid list of requirements against which any design can be measured.

Agility is about change proficiency - it's not about trust-based relationships, virtual enterprise, or electronic commerce - those may be tactics or strategies or enablers to improve change proficiency in today's business environment, but when they are replaced with the approaches of the 2010's you can be sure that those replacements will be justified on their support for even greater adaptability. Focus on the issues, don't mistake a strategy for an objective.

The table uses change proficiency tools (the eight change domains) as a means for exploring the different types of change that must be accommodated. Supply-chain management is just one of many business practices that are becoming more change proficient today - and each has a progression of maturity levels that differentiate one company's competency from another's.

### One Company's Supply Chain Agility Issues

( Change Proficiency Metrics: Time[T], Cost[C], Robustness[R], Scope[S] ----- x: Initial Focus o: Future Interest )

Change Types	Virtual Enterprise Partnering	Production Outsourcing	Component Supplier Networks
<b>Creation / Deletion</b>	o Finding potential partners [T] x <b>Forming partnership</b> [TR] o Dissolving partnership [C] x <b>Forming IPPD team</b> [TR]	x <b>Finding potential outsources</b> [TC] x <b>Developing requirements spec</b> [T] x <b>Contract agreement</b> [T] x <b>Forming IPPD team</b> [RS]	x <b>Finding potential suppliers</b> [TC] o Qualifying potential suppliers [TR] x <b>Contract agreement</b> [T] x <b>Forming IPPD team</b> [TR]
<b>Augmentation (Improvement)</b>	o Formation speed [C] o Operating response [T]	o Faster interaction response [T] o Improve core competency [R]	x <b>Faster interaction response</b> [T] x <b>Cost reduction</b> [T]
<b>Migration</b>	o Closer strategic integration [R]	o Integrated communications [R] o More outsourced design [S]	x <b>Integrated communications</b> [R] o More commercial production [CS]
<b>Addition / Subtraction (Capability)</b>	o Integrating new partner with unique capability into existing team [TR]	o Finding suitable outsource [TCR] o Adding necessary capability to meet customer requirement [TRS]	o Integrating additional supplier [TR]
<b>Correction (Recovery)</b>	o Contract dysfunction/obsolescence [TR] o Partner no longer viable [TC]	o Outsource insolvency [T] o Outsource delivery failure [T] o Customer relationship terminated [T]	o Supplier ceases to exist [T] o Qualification revoked [T]
<b>Variation (Performance)</b>	o Incorporate urgent ECO [R] o Key partner resources diverted [T]	o Incorporate urgent ECO [T] o Custom job configuration [TC]	o Incorporate urgent ECO [T] o Custom job configuration [TCRS]
<b>Expansion / Contraction (Capacity)</b>	o Increase/decrease magnitude of partnership activity [T]	x <b>Increase/decrease production qty</b> [T]	x <b>Increase/decrease production qty</b> [T] o Add 2nd sources to network [T]
<b>Reconfiguration</b>	o Change partner responsibilities [R]	x <b>Switch insource/outsource for optimal core competency</b> [TCRS] o Switch customer assignment [R]	o Switch between defense and commercial production [RS] o Change supplier responsibilities [T]

# Crank Cases and Agile Supply Chains

By Rick Dove, Senior Fellow, Agility Forum, dove@well.com, Paradigm Shift International: 505-586-1536.

**Editors note:** The recent political commentary best seller "Prime Colors" still has the publishing world guessing at its "Anonymous" authorship. Apparently Anonymous is branching out on his or her commentary as evidenced by email received by Rick Dove recently.

**Date:** Mon, 1 Apr 96 10:36:15 PDT  
**From:** anonymous@atdot.com  
**To:** dove@well.com  
**Subject:** Primal Colors

California has landed on your head: Trust-based relationships, cooperation, long-term relationships, exceeding expectations - real touchy-feely stuff, a kinder gentler world. Wake up already. China ain't playin' by those rules, Japan never has, and Russia won't. Mexico? Europe? Just who is it you are competing/cooperating/supplying/customering with? Even the farmers ain't buyin' it.

"Putting faith in trust-based relationships is like whistling past the graveyard. We need instead a new system of ethics."

So bad guys feel guilty and spend awhile atoning, bringing themselves more to a center balance point - it's about time. I mean we don't need the likes of that Detroit purchasing warrior again.

On the other hand, he is doing something that needs watching. He's building busses without any assemblers on the payroll, and it's not 'cause he's buyin' them already built - its 'cause he found a way to

get the suppliers to put their parts into the assembly at just the right time. This has real possibilities when you run with it a bit. Why pay for the roof? Why not just drive that chassis through everybody's shop, hell, let them run a relay race and drive it to the next shop themselves. All you gotta do is be there when the customer pulls out his wallet.

You gotta admire this guy. Is he payin' those people for anything extra or did he convince them that they just saved all that packaging and shipping expense, so the parts ought to be even cheaper. Hell, he's probably chargin' them for rent on the space, after all, they'd have to pay for it if they built this stuff in their own facility.

I'm havin' fun, I hope you are too. But there really is something to play with here.

Wyck Seelig at Lucent Technologies (nee AT&T) has this idea he calls a "factory mall" - and it looks a lot like Lopez's bus-building idea with a different twist. He wants a bunch of production concessions under the same roof that a product designer can "shop". Any product he designs is fine as long as he can find concessions at the mall that can collectively put this thing together. This is the same thing Lopez is doing - but Wyck is doing it with insiders - not suppliers. At least to start with - though there's no reason he couldn't rent some space to a specialty process that Lucent doesn't have expertise in. Better yet, when a concession "goes out of business"

they can weed themselves out, and Lucent won't have any personnel problems to contend with.

Where should the union fall in all of this? Well, unless they just want to be some big welfare agency that drives everybody out of business in this country, they just might return to the craft days, and provide some real value to those concessionaires that want to be entrepreneurs and operate on a small Agile scale but also need an apprenticeship program and benefits and other common infrastructure items. Better for everyone everywhere. The unions are no longer adding value like they did in the early days of big business. Now business wants to get small - the unions need to respond with a page from history - update it for sure - but it's not like it never happened before.

Wyck has an Agile result, self determining and revitalizing. Ignaz has a Lean result, controlled from the top where he found another way to squeeze the suppliers. Well we'd all like to believe that anyway, of that nasty guy. He's also a smart guy and may just work this beginning into an Agile act with time. But my money's on Wyck. He's working on the common process theme, the infrastructure thing, the self determination thing, and finding a way to bring economy of scale back into the low-volume production run.

**Sincerely, Anonymous.**

No telling what you'll find in your email in-basket these days. But the thoughts expressed above add to our continuing exploration of Agile supply chain management.

Trust-based relationships? The shoe squeaks on the other foot sometimes. Intel routinely enters its customer's markets and competes with them, eventually driving many of them out. Ill advised in times past, but now a necessary strategy because technology continually migrates functionality upstream in the supply chain as chips take on more sophisticated capabilities.

The discontinuity here (supplier steals customer market) might be fixed if a long term close-knit relationship realized that the product and market each company would be dealing with was changing yearly - but that would make Intel dependent upon their downstream customers to anticipate and service the emerging markets correctly - which is counter to all evidence and unlikely under any circumstance. Even Sun Microsystems was caught napping when the desktop and personal Internet market emerged. Intel needs the capability to develop and change its

customer relationships - and Intel's customers need an equally facile capability to develop and change their supplier relationships.

Welcome to the insecure '90s. Don't tell me what you did for me last year, what are you doing for me now? Don't hope for trust-based relationships. Make them value-based relationships. And know that when you have no value to offer you must be replaced by someone who does. Cruel, you say. Crueler that you think the rest of the organization should die with you rather than have a fighting chance. This picture isn't as extreme as it first seems - one supplier in a tightly integrated lean supply chain can bring all suppliers down - just look at the ripple effects of the ABS shortage caused by the recent Dayton UAW strike.

Build relationships that recognize value in a standardized interaction infrastructure, and know that if one supplier can no longer provide goods and services that are appropriate, they will be welcome back as soon as they can again contribute to the common good. Perhaps you have a program to help redirect their competencies, or help them develop new competencies - but let's get something real clear - you're not doing this out of compassion or because you all agreed to be trusting friends, you're doing this because it's cheaper to retrain them than it is to replace them. Suppliers, too, have a responsibility in this fast changing environment - a responsibility to develop different skill sets in anticipation of replacing ones that will become non-competitive.

To counter the effect of technology moving functionality upstream in the supply chain we must build relationships that move innovation downstream at an equal rate - how do you play this new instrument to your advantage, no matter where you are in the supply chain?

Agility is determined by the nature of the interaction links among business elements. It is possible to build an Agile enterprise from elements that are themselves very rigid and in-Agile - provided the interaction framework allows you to engage, disengage, and replace the elements at will with high proficiency. Examples abound in construction and entertainment industries - and neither customers nor suppliers feel put upon or unfairly treated as a result.

Intel and Microsoft have both shown excellent leadership capabilities in their respective industries, thriving while they make and break alliances according to the mercurial markets they serve. And they continue to serve those markets as a result.

Conversely, we see ample evidence that building close-knit supplier relationships builds a new inter-company bureaucracy along with the need to maintain and protect the relationship - both non-value-added activities that siphon off funds better spent in new relationship development. The book *Hypercompetition* by Richard D'Aveni makes the point quite well: protecting and shoring up old products and relationships is obsolete barrier strategy that diverts money away from innovative breakthroughs (which is what your competitors are killing you with if you haven't noticed).

The supply chain management focus must be on the inter-corporate interface and the framework of plug-compatibility. Trading one set of problems for another - getting tight with your suppliers to gain cost advantages - creates bureaucratic problems of another type, and exposes the entire chain to costly single point failures. We should focus on the nature of plug-compatible relations

that facilitate synergistic engagement and operation, and painless disengagement - rather than on the building of long term integrated activities that just mimic the existing corporate structure in the end.

These new supply chain strategies: Trust-based relationships, cooperation, long-term relationships, exceeding expectations, voice of the customer, are just that - strategies, not objectives. They are ephemeral like any other business strategy, and will come into disfavor as people find their operating warts - they are neither universal nor timeless - though they may offer real value today for those who master them early, and can use that mastery to advantage while others lack it. The playing field will level with time if in fact these are good operating modes. The advantage will then go away and the mode will not be useful in competitive leadership.

The vision painted by these strategies requires a large degree of intimate integration, the antithesis of Agility. That's why CIM never worked. Better to have a society of interacting cooperative free agents seeking mutual benefit.

The company that masters the ability to reconstitute its supply chain at will can have the steady-state way when that makes sense, and can also create something new when that is necessary - such a company will have the means to act when opportunity presents itself as well as when innovation promises an advantage.

Putting faith in the emergence of trust-based relationships is whistling past the graveyard. We need instead a new system of ethics - for starters:

- Early warning of pending relationship changes, don't surprise your "partners".
- Early warning of commitment problems, don't surprise your "partners".
- Protection of knowledge obtained in more intimate relationships.
- Relaxation of Intellectual-Property-Right shackles on useless stuff we insist on keeping secretive.
- Realization that we will all do business together again.
- Realization that cheaters and bullies can't hide their sins in this mobilized information age.

A recent study identified a framework of twenty-five "Critical Business Practices" for the current US competitive environment. That supply chain management is prominently featured among them should come as no surprise. This framework provides a useful tool for examining maturity stages of critical practices in different industry sectors; and that will be our subject next time.

# Critical Business Practices for Agility

By Rick Dove, Paradigm Shift International, e-mail: dove@well.com, 505-586-1536, Senior Fellow, Agility Forum

Enterprise Agility is not something that happens because technology is put in place, or because machines are configured differently, or even because all business systems are reengineered for reconfigurability. Agile enterprise occurs because of business practices.

Business practices are the way we do things, and why we do them that way. Explicit practices are codified in our procedures manuals and mission statements; implicit practices are part of the unwritten "system" and culture, and the more powerful because that's the way things really work.

The top-down hierarchical management model that dominates business today likes rules, thrives on rules, relies on rules to direct the mindless employee it envisions. When we attempt to identify all of the business practices that govern the way we do things the list becomes oppressively long. But they do not all equally

## **"The "soft" issues are the hard issues in the business world today."**

determine a company's competitiveness. Some are more important than others.

So what subset should we look at to determine Agility? Is there a manageable subset that can make an impactful difference in our competitive posture?

If we can identify *the* critical set of business practices that determine our abilities to thrive in uncertain times, and measure our competency with these practices, we would have a powerful way to evaluate ourselves against the competition, as well as a road map for improvement.

A recent series of industry workshops I conducted for the Agility Forum attempted to identify this critical subset of business practices. This effort identified a "short-list" of business practices impacting an enterprise's potential Agility and critical in today's general competitive environment. Its purpose is to serve as a starting-point model for companies interested in taking steps toward Agility. Factors placing practices on the critical list included high immediate leverage potential, indications that industry is actually ready to deal with them, priority recognition in a "voice-of-industry" survey conducted by the Agility Forum in early 1995 (This column, Feb 96), and the emergence of vanguard reference examples.

This starting-point model is the result of industry-group debate among participants in the Agility Forum's 95/96 Agile Business Practices focus group, and reflects the realities and concerns of their sponsoring companies from sectors that include electronics, autos/trucks, aerospace/defense, chemicals/process, computers,

software, business reengineering, management consulting, and the Department of Defense.

As an immediate reengineering tool, this framework can focus questions and strategies in fruitful directions. Its purpose is to identify those areas that lack sufficient attention, yet are timely and critical in today's competitive environments. It ignores many competitively necessary and timely practices, such as "listening to the voice of the customer" and "integrated product and process development", that already enjoy high visibility and significant implementation examples. Instead, it illuminates items that meet three specific criteria: 1) they deal specifically with important competitive change proficiency competencies, 2) instances of good implementation and usage are relatively rare and not well understood, and 3) industry in general appears prepared to tackle these elements as a natural next step in its transformation to higher forms of Agility.

This, then, is the frontier of a constantly advancing front. It is what industry is ready to do next, where "industry" is a representative amalgamation of the diverse states of various industry sectors into a single picture. Experience has taught that looking too far from what industry is ready for might be entertaining, but it will not cause anything to happen. We are not ready for trust-based virtual relationships that spontaneously form among partners with no prior working histories. We are not ready for partnering with people we only know through electronic images. We are barely ready to seriously tackle most of the most important issues - those that lie in the "soft" domains of the socio/technological interface, the corporate/employee relationship, and self-organizing distributed control and responsibility.

This is not a comprehensive taxonomy of business practices, nor are the category groupings a suggested decomposition of a business model. In the near future one would hope that a different set of practices would be appropriate as the focus moves on to subsequent priorities. Thus, the reference framework discussed here is not timeless; but rather timely: it is both actionable and a necessary next step in general progress today.

The focus of course is on Agility. For instance, the definition for the sub-category of "Business Case Justification" is solely interested in the justification process for investing in an Agile capability, and not the more general activity of making an investment in anything the business may require. The model addresses the "organization" as opposed to the enterprise or the corporation, because the information is potentially applicable to any operational group: division, plant, department, perhaps even a team under appropriate circumstances.

There are issues about the Agility of a given practice, as well as issues about that practice's ability to support an Agile enterprise - both are important, for it is difficult to envision an Agile enterprise supported by rigid practices (unless those practices are easily discarded and replaced - which implies an Agile practice framework). It is instructive, however, to understand that the principal Technology in support of an Agile enterprise is the Agility of the information technology infrastructure itself.

There will always be front runners that have a very different familiarity with the frontier than the majority of others in their industry, or especially others in slower-paced industries. What they are reducing to practice others are experiencing accidentally, or seeing as hints and glimmers elsewhere. Here we hope to lay a foundation from which companies, and organizations within companies, can plot a course of action.

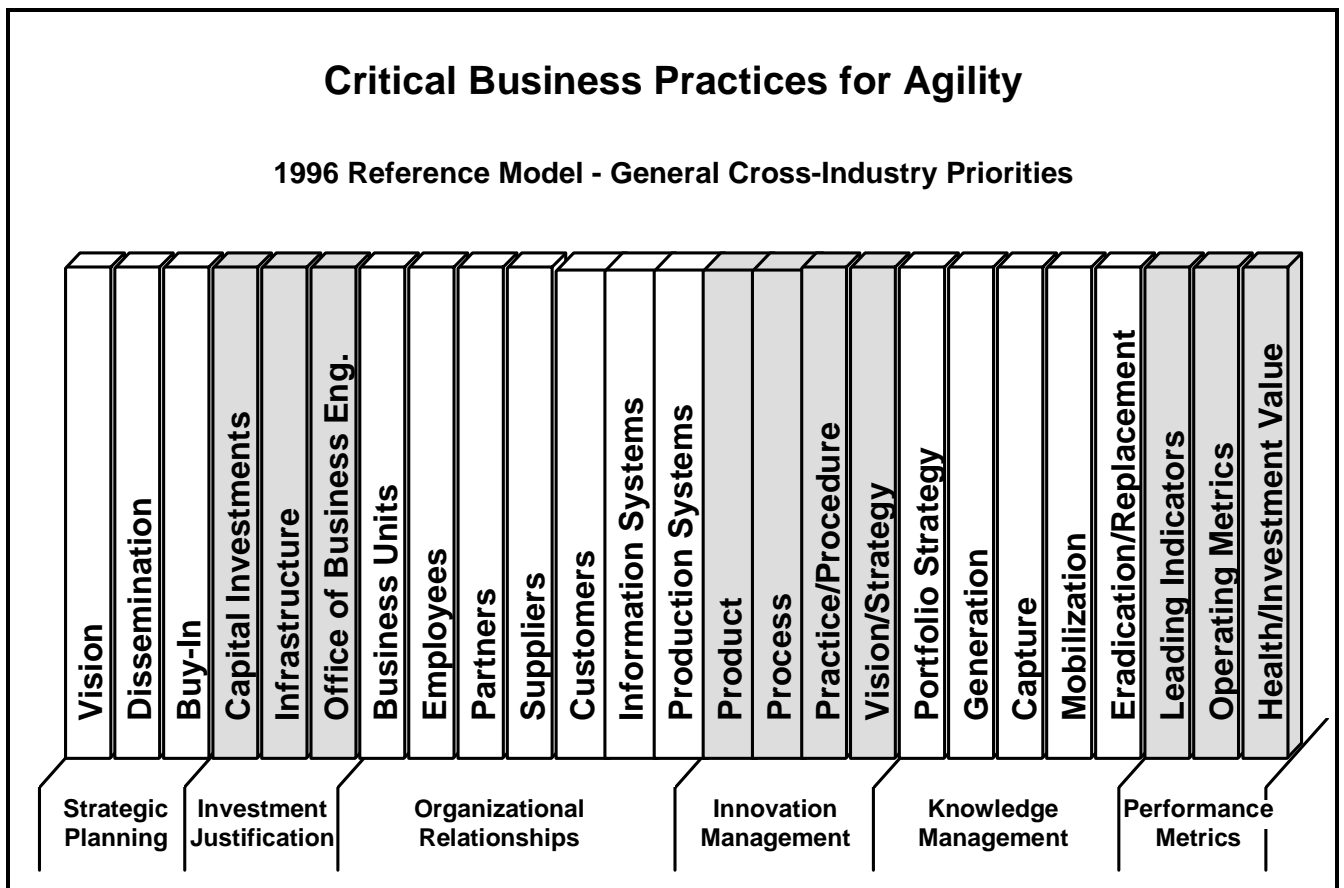
This column does not permit an examination of each of these twenty-five practices and their relationship to enterprise Agility. The seriously interested are referred to the proceedings of the 1996 Agility Conference available from the Agility Forum. There is no universally applicable absolute truth for all companies in all industries in all times - this framework is intended to illuminate most of the timely frontier areas without belaboring the accepted mainstream work-in-process.

The "soft" issues are the hard issues in the business

world today. If there are any silver bullets left, they don't fit the guns we have today. Change proficiency is principally impeded by cultural and people-based issues. Technology has strong and necessary contributions to make in facilitating decision support and decision implementation; but innovation and motivation are the domain of people and the cultural environments that shape them.

This framework can be used now to focus reengineering workshops and strategies in fruitful directions. We continue to update the structure while using it as a foundation for benchmark-case targeting. In March of 1996 this framework was employed as the foundation for the first structured case study of enterprise-wide Agility. Remmele Engineering, a \$100 million Minnesota machining company, is currently being analyzed across all twenty-five business practices; and will shortly become the first enterprise-wide reference model for high competency at change proficiency.

We will discuss this reference model next time, with Remmele Engineering providing real substance for the abstractions appearing in the Critical Business Practices framework.



# Building Agility Improvement Strategies

By Rick Dove, Paradigm Shift International, e-mail: dove@well.com, 505-586-1536, Senior Fellow, Agility Forum

Today it is fairly easy to hop in your car, turn on the ignition key, step on the gas and brake pedals alternatively while steering, and arrive at your destination. But before that was possible somebody had to invent and build engines, tires, roads, gas stations, combustion science, and a whole lot of other complicated stuff; and make sure that all the pieces and subsystems were compatible and functionally integrated. Well, a similar process of sub-system development has been occurring in the Agility world for the last few years, and is right now coming together with its first enterprise-wide test-drive at Remmele Engineering, a \$100 million Minnesota-based machining company with four divisions and five plants.

Steady readers of this column's past 20 essays have witnessed in real-time the emergence and evolution of tools and concepts for describing, analyzing, and

**“...what makes companies last forever, that's what Agility is all about...”**

measuring change proficiency - the underlying competency of an Agile enterprise. Now we can discuss the integration and validation of these sub-systems as we employ them to develop the first reference model for Agile enterprise.

Remmele was chosen very carefully for its observable broad proficiencies at change, discovered when Sue Hartman (ex-Kodak business-line manager) led an Agility Forum Industry-Group through an analysis of production practices there. It is important to understand that Remmele exhibits more competency at broad change proficiency than any other company we have found.

The Maturity Model assumes that a progression through increasing stages of general competency will parallel a progression through specific competencies and characteristics. A major motivation for this test-drive at Remmele was to validate and refine this assumption, or correct it in the process.

The accompanying figure shows how the Change Proficiency Maturity Model (Jan 96) integrates most of the primary concepts discussed previously into an enterprise-wide profile of total competency. The radar chart employs the twenty-five Critical Business Practices (Jun 96) as the armature for analysis - an important validation experiment in this test-drive. The general progression of metric emphasis (Feb 96) was recognized before we went to Remmele; but the exercise revealed the key integrating relationship of specific change domain

(Apr 96) proficiencies to maturity stages - and further tied them to proactive and reactive capabilities.

The radar chart shown here may not reflect our final analysis of Remmele as the analysis work is still in process. Thus, some of the maturity stages shown here are still based on initial team intuition. In any event, it is clear to the team at this point that Remmele scores quite highly.

This company could be incorrectly characterized as one with few procedures, as they do not have a company procedures manual, as such; yet they clearly innovate, practice, evolve, and improve standard procedures on a solid consistent foundation of past practice. The nature of some procedures are captured in automated operating tools, like the quotation and cost estimation spreadsheets, the Program Manager's 24-hour customer-status-update spreadsheet, and the Quality Procedures data-base system. Most procedures and practices are simply understood by their objective, which provides direction, and the corporate culture, which provides discipline: you are held accountable for your decisions and methods by all employees, and must be prepared to display and justify them.

The company ideology maintains a pervasive understanding that objectives must be consistently satisfied with a continuously improving methodology - and that these evolving methodologies must be actively communicated. The practice itself is not an overt procedure, but rather an emergent phenomenon of the underlying ideology, guiding principles, and prosecution of the strategic policies. As a result, Remmele has pioneered many innovative practices in their industry, including: selling services internationally in an industry that generally services a local region only, employing a network of sales reps where the normal selling practice employs top management, providing a single "Program Manager" customer interface responsible for both profit and revenue rather than separate estimators and producers, implementing finite scheduling years ago when the concept was barely understood, implementing a simple form of ABC for job estimating and cost accounting before the concept was popularized, and now they are implementing a general framework of reconfigurable Quality Programs that meet customized requirements for individual customers.

Webster defines "ideology" as the body of ideas reflecting the social needs and aspirations of an individual, group, class, or culture. What is clear is that Remmele has a strong core ideology that is reflected in virtually every business practice we analyzed.



In a must-read book on what makes companies last forever (that's what Agility is all about), the authors of *Built To Last* say: "Companies seeking an 'empowered' or decentralized work environment should first and foremost impose a tight ideology, screen and indoctrinate people into that ideology, eject viruses, and give those who remain the tremendous sense of responsibility that comes with membership in an elite organization. It means getting the right actors on the stage, putting them in the right frame of mind, and then giving them the freedom to ad lib as they see fit. It means, in short, that cult-like tightness around an ideology actually *enables* a company to turn people loose to experiment, change, adapt, and – above all – to *act*". If you need proof of this concept, get the Remmele Reference Model in a few months from the Agility Forum.

The very soul of the corporation is directly focused on both leadership and viability in a fast-changing world:

- o Proactive Leadership - Press the technology and seek the latest where premium margins can be extracted; encourage a strong and constant self-learning culture; hire inquisitive, driven people.
- o Reactive Viability - Don't get financially leveraged at the bank; don't let any customer dominate you; don't let any market dominate you.

Some level of competency in the characteristics of stages 1 and 2 are required of virtually all companies today. On the proactive side, creation (e.g., product

realization) and improvement (e.g., cost reduction) are change capabilities that are at the very focus of today's competitiveness. Likewise on the reactive side, correction (e.g., fixing/replacing broken resources) and variation (e.g., accommodating customer preferences) are equally at the entry-level for playing today's game.

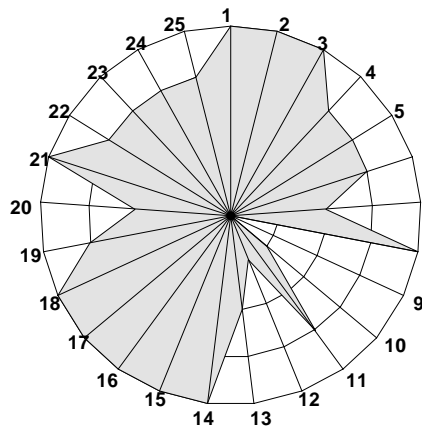
The more advanced stages 3 and 4 are where preemptive competitive capabilities emerge. As yet, few companies have much to show in this rarefied area. Remmele's strong showing here undoubtedly owes a lot to their ideological belief and emphasis on continuous learning and constant change.

The Maturity Model is a profiling tool that can help build a business case, as well as an actionable prioritized improvement strategy, from any organizational perspective: corporate, division, plant, department, process.

The Remmele case is properly viewed as an alpha test. The beta test happens later this year when we employ the system in a series of focused workshops to profile entire industry sectors. It is not necessary to show Remmele as highly mature in all twenty-five practices to call them preemptively Agile; but to position Remmele competitively will require identifying the subset of practices that are critical in their sector today - a subject for our next discussion.

## Enterprise Change Proficiency Profile

Analytical Guide for Establishing Competitive Strategy and Improvement Targets



Maturity Stage	Working Knowledge	Metric Focus	Change Competencies	
			Proactive	Reactive
0	Accidental	Examples	Pass/Fail	None
1	Repeatable	Concepts	Time	Creation
2	Defined	Metrics	Cost	Improvement
3	Managed	Responsibilities	Robustness	Migration
4	Mastered	Principles	Scope	Modification

Maturity	Critical Business Practice
4.0	1 Strategic Plan Vision
4.0	2 Strategic Plan Dissemination
4.0	3 Strategic Plan Buy-In
3.0	4 Capital Investment Justification
3.0	5 Infrastructure Investment Justification
3.0	6 Business Eng. Investment Justification
2.0	7 Business Unit Relationships
4.0	8 Employee Relationships
0.0	9 Partner Relationships
1.0	10 Supplier Relationships
3.0	11 Customer Relationships
1.0	12 Information System Unit Relationships
2.0	13 Production Unit Relationships
4.0	14 Product Innovation Management
4.0	15 Process Innovation Management
4.0	16 Practice/Procedure Innovation Mgmt
4.0	17 Vision/Strategy Innovation Mgmt
4.0	18 Knowledge-Portfolio Strategy
3.0	19 Knowledge Generation
2.0	20 Knowledge Capture
4.0	21 Knowledge Mobilization
3.0	22 Knowledge Eradication/Replacement
3.0	23 Leading Indicator Metrics
3.0	24 Operating Metrics
3.0	25 Health/Investment Value Metrics

# Who is the Agilest of Them All ?

By Rick Dove, Paradigm Shift International, e-mail: dove@well.com, 505-586-1536, Senior Fellow, Agility Forum

Yea, tho I walk through the valley of the shadow of death I will fear no evil, for I am the Agilest company in the valley. Christians will recognize this as a take-off on an old joke parodying the 23rd Psalm - Netscape and Sun might recognize this as a take-off on a non-joke parodying the recent rabbit-out-of-a-hat Microsoft Internet strategy. To those silicon valley companies this is not a joke, but testament to the ability of a not-from-the-valley billion-dollar company to turn on a dime.

Bill Gates has clearly responded to a market demand created by Sun's Java and Netscape's browser. And since this was a major strategic about-face, not just a simple feature or option addition to Windows, there were many in the press who gleefully pronounced this as a humbling follow-rather-than-lead comeuppance. Yes - Bill Gates did a complete about face on a vision and strategy that he had championed throughout his company. But listen

**“When it's time to go against the grain; denial is slow death at best.”**

recognize that a major change had occurred in the markets that they served, and that it was time for them to follow rather than lead - at least for a little while. Sort of like being followed by a heard of stampeding buffalo. Do his people think he's lost it - twitching about with new directions of the day? Hardly.

Warren Buffett, another one of the world's richest people, and friend to Gates, is distinguished uniquely as having amassed his fortune by investing in corporate stocks. One of his important investment tenets, excellently described in *The Warren Buffett Way* by Robert Hagstrom, is to stay away from companies that are involved in major change. He doesn't really mean this, of course - what he means is to stay away from companies that don't know how to weather change as a non-event. Something Microsoft has just demonstrated masterfully.

Another one of Buffet's tenets is to favor companies with managers that demonstrate an ability to avoid the "institutional imperative" - that is - they don't blindly follow beliefs and

strategies just because the thoughts have become institutionalized in their industry or in their own minds - when it's time to go against the grain - whether its a prevailing thought or your own thought - denial is slow death at best.

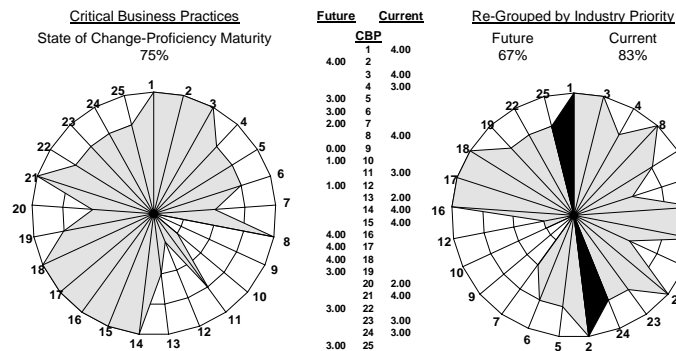
Of course simply deciding to do something different at the top is a long way from getting a massive company to buy-in to that process and actually do something different. Microsoft will have accomplished this feat in less than a year. And it is a mistake to think that it is easy for them just because their products are bits and bytes floating in the ether and not machines and metal on the shop floor. Redesign and retooling takes big time and big bucks for them, too. The important difference is in the corporate buy-in process. Fast, total buy-in won't happen anywhere if a company doesn't have an effective buy-in practice.

In last month's column we introduced the use of a Change Proficiency Maturity Model to develop competency profiles for twenty-five different critical business practices within a company. One of those business practices is "Strategic Plan Buy-in." The framework of twenty-five practices was developed as a generic, non-sector specific, listing across industries. In any specific industry-sector some of these practices are the battleground for competitive position while others are still uncommonly employed. And the mix is different in different industry sectors.

For Microsoft and others in their industry, the practice that routinely achieves strategic plan buy-in appears to be a basic competitive requirement for everyone. In other industries, like metal parts machining for instance, the

closely and you will hear no time wasted on mea culpa. No guilt or apologies for yanking the company into something completely different. No - what he did was simply

## Industry Sector Competitive Practices Developing Road Maps and Improvement Strategies



How One Especially Good Company Might Look Against Its Industry

common requirement for competency at this practice may still be in the future. Of course, a machining company with unique and decided competency at total and rapid buy-in can differentiate itself from all others quite advantageously.

The accompanying excerpt from the Agile Enterprise Reference Model shows the synopsis description of this buy-in process at Remmele Engineering - a machining services company. As a synopsis it doesn't include the back-up detail and implementation examples available in the full report soon to be released by the Agility Forum; but it does show the important issues addressed by the practice, and an awesome degree of competency.

Exactly what this competency means to Remmele in its industry sector is a relative question. At this point we have not yet done a sector-wide analysis, but we are in the process of gathering and averaging opinions in the industry about which practices are commonly recognized already in the industry and which are still uncommon. The accompanying figure with the pair of radar charts suggests how these two practice classes can characterize a company's competitive strengths in current and future areas of import. Keep in mind that competency at "future" differentiating advantages generally translates into preemptive advantage today - something borne out by Remmele's uncommon performance.

The Change Proficiency Maturity Model identifies the important change issues first, then asks how they are addressed, and then provides a method for gauging competency. As a stand-alone assessment this can be extremely enlightening, and help an organization establish improvement strategies; but in conjunction with

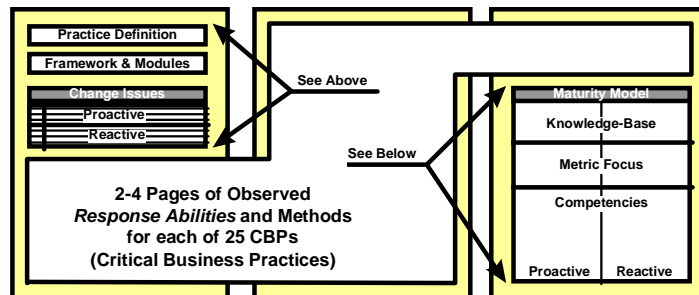
## Agile Enterprise Reference Model

### \$100 Million USA Machining Company - Four Divisions

**CBP #3: Strategic Plan Buy-In** - The process of gaining a sense of ownership and commitment to an organization's vision and strategies by the members of the organization. Generally applicable Agility issues include the depth as well as the breadth of commitment and understanding throughout the organization; the accommodation of substantive changes in the implications of commitment when appropriate; and the ability to bring new membership in the organization to an equal sense of ownership quickly.

The foundation of the buy-in process at Remmele is the corporate ideology and its emphasis on accountable empowerment, open communication and trust, and the strong sense of family-team that pervades the organization. Within this framework the employees, their personal rewards, and the implications of strategic concepts determine local and personal operating modes.

Proactive Change Issues	
Creation	• Creating a sense of ownership and commitment to the vision.
Augmentation (Improvement)	• Improving people's ability to understand & implement the vision & strategy.
Migration	• Early understanding and dissemination of the need for major strategy change.
Modification	• Encourage innovative self-directed vision and strategy fulfillment.
Reactive Change Issues	
Correction	• Helping people who have difficulty accepting responsibility & commitment.
Variation	• Encouraging different interpretations at different plants to fit situations.
Expansion	• Gaining ownership among new employees quickly.
Reconfiguration	• Moving people to/from different operating modes and incentive programs.



### Change Proficiency Maturity - Strategic Plan Buy-In Mastered Stage (4) for Both Proactive and Reactive Change Proficiency

**Principles Knowledge Base:** Remmele's Strategic Policies contribute explicitly: "In the interest of enhancing the psychological ownership of our business by all employees we will continue to (1) involve people in the process of making decisions which affect them, (2) provide for decision making and problem solving at the most appropriate level, (3) encourage risk taking, and (4) empower employees with the freedom and authority to make the decisions necessary for effective job performance."

**Scope Metric Focus:** Time and cost of securing buy-in for corporate and divisional objectives is not a concern, as the corporate ideology responsible for most of this "practice" is virtually invisible - it just happens. Robustness is a non-issue for the same reason: ideological drivers ensure that responsible ownership is the stable state of the operating environment. Emphasis is now placed on broadening the involvement of employees in the decisions that affect them, and helping them develop the personal skills that they need in order to take on increased responsibility.

**Proactive Modification Competency:** Innovative contributions to the operating modes that satisfy strategic plans and vision occur as a matter of course, with employees exercising pre-screened skills and fulfilling expectations of their relationship to the organization. For instance, the station operators are the process innovators in the mature cells at the Production Machining Division (Plant 30). In another plant it was noted that the suggestion box has been virtually abandoned as a time-delay, if it's good the employees just do it.

**Reactive Reconfiguration Competency:** The corporate ideology embraces the concept of continuous change at the same time that it relies on a stable set of beliefs and values. The stable foundation of beliefs is what enables the reinterpretation of acceptable strategies. Plant 30, for instance, is under pressure to obtain new business to keep its people employed, and is considering a wide range of real prospects that may require a buy-in and operating mode different than previous experience. Past examples of such re-thinking include both "clean room" and "small parts" activities which had no prior precedence, were considerably different than the experience base, and required reinterpretation of strategic concepts into local and personal implications.

an industry-sector Maturity Model, a company can develop an optimal road map for improvement. More on this next time.

# Industry-Sector Change Proficiency

By Rick Dove, Paradigm Shift International, e-mail: dove@well.com, 505-586-1536, Senior Fellow, Agility Forum

“Don’t bother just to be better than your contemporaries or predecessors. Try to be better than yourself.” All fine and well, these words by William Faulkner quoted in Built to Last, but too much introspection and too little world-knowledge can put your head in that place where the sun don't shine. Only the singular best can afford to heed this advice - not the almost best. You do need to understand what's going on elsewhere and how you measure against it. The useful point of Faulkner's quote is to not use others as the benchmarks of what is possible - or you'll just play catch-up with them as they explore the frontier and move the fences.

Successful companies know the competitive issues in their business sector, and develop specific competencies that at least make them contenders if not leaders. All industry sectors have multiple competitive issues requiring competency at many business practices. It is unlikely that any one company, even the best company in

**“Directed approaches require energy and enforcement because they are unnatural.”**

an industry, will have the superior competency in all of the critical practices. We define critical practices as those which differentiate successful competition

in an industry - thus, practices that may be necessary for survival but have become a common focus within an industry are no longer on our critical list.

Change proficiency is a broad frontier today - one that is little understood, has few role models, and is not easily accommodated by most of today's companies and today's managers. Soft issues are the major stumbling block. The recent Business Week review of Michael Hammer's new book, Beyond Reengineering, applauds his old partner, Champy, who "renounced reengineering's overemphasis on impersonal process" two years ago; and then takes Hammer to task for his "unwillingness to address the human side of corporate change." Reengineering is about change, and people are the agents and implementers of

change.

The touchy-feely camp think that they have the answers. At best they provide a counter balance to the equally polarized dehumanized approach. Both of these directed approaches require energy and enforcement because they are unnatural. Unfortunately both approaches find strong appreciation and resonance among small groups of influential management, and the rest of us deal with their unnatural act or find employment elsewhere.

The Agile Enterprise Reference Model and its armature of 25 critical business practices discussed in previous essays addresses underlying causal enablers for change proficiency - it looks for natural, systemic, self organizing, free market economy forces that can create and nurture emergent business practices that evolve in synch with the business environment.

Good examples today: GE, Motorola, Texas Instruments, 3M, Microsoft, Remmele Engineering. They all have human-relationship systems that nurture an internal society of people on a mission - people interested in what they do, why they do it, and how they do it. That doesn't mean they are unbeatable. There are other practices that are deterministically important as well - though in these companies most other practices will benefit from the underlying commitment of the people to make them work.

None of these corporate systems are perfect, however, anymore than any of the free market economies managed by governments: MITI fools around with Japan's free market, and the USA subsidizes farms and creates whole technology industries with defense investments. Outside of Adam Smith's dreams and Ayn Rand's fiction a pure free market economy is hard to find.

So what does all of this have to do with modeling industry-sector maturity? Two key things: 1) important practices and the change-issues within them are generally not the surface-visible ones that we deal with every day, and 2) no one company has understood, let alone mastered, all the critical business practices in its industry

Simple Proforma Example: Change-Proficiency Maturity Stages in Machining Industry		
Stages	General Maturity-Stage Characteristics	Example: Maintaining Skilled Human Resources
0: Accidental	Stumble through change, with recognition but no awareness.	Hire what's available, and hope they work out.
1: Repeatable	A set of rules for achieving change become understood.	Common hiring ritual to obtain new skills.
2: Defined	Rules broadened and performance metrics put in place.	Knowledge-based recruitment screening and testing.
3: Managed	Objectives clarified, rules refined, accountability in place.	Individualized employee development program.
4: Mastered	No longer rule based - principles guide action.	Environment enables/encourages self development.

sector.

Here's an issue that surfaced in the critical business practice we call Production Equipment Relationships: In the automotive sector, more equipment is entering the factory with higher technology at shorter intervals than ever before. Result: nobody gets enough training anymore to deal with repair and operation. Beyond the head-in-the-sand responses, we see the allocation of more training time, hiring smarter people, and even elimination of automation in favor of more people.

How about dealing with the real problem: tell your equipment vendors that within five years you will not purchase any equipment unless it can be maintained with less than 15 minutes of training and operated with less than 5 minutes of training - then give them some examples of how this might be achieved - and tell them that each purchase hereafter will evaluate the training requirements as part of the selection process.

Does your industry care about this issue now? For some the answer is "No". But if you're in autos you better look at these numbers very seriously - Japan has already backed away from automation because it can't keep its machines running, and US manufacturers are simply shirking their training requirements and screaming louder at equipment vendors for a situation they have created (buy low and pay for what you get forever).

Why do you think those new plants don't come on stream on schedule? The equipment doesn't work and nobody knows why or how to fix it! Lots of cussing and spit and bailing wire later we see a de-rated plant that is proudly proclaimed as late but wonderful; and then we hear "We learned from the experience." Just exactly what is it we learned? We'll never use those vendors or that design again? We'll assign different people in a different approach to the next plant conversion? All pushing at pimples and symptoms - nobody's looking at the disease.

Equipment should be self diagnosing and able to foresee problems before they occur - not because this is the way it ought to be in some ideal world - but because this is the way some folks are actually already doing it. It can be done. Vendor experts should be able to place a phone call to the equipment and diagnose it with awesome expertise at hand. When anything other than module swap is required, a local untrained person should be guided through rare fix-it activity while online visually

and audibly with vendor expertise and vast knowledge bases. But that's not the subject of this column.

What are the key competitive change proficiency issues in your industry? They are not likely to be the same as the ones in another industry. How do you stack up against today's issues in your industry? If magic equipment maintenance or instant new-equipment mastery is not accomplished by anyone else in your industry, or if production equipment failure is not a significant factor in costs and productivity, then don't worry about it. But if either of these is true and you are not actively embarked upon a path toward graduate wizardry, then we're back to where the sun don't shine.

The industry sector modeling projects (call us for participation) starting this fall and next year will:

- 1) Identify sector-critical business practices.
- 2) Identify key change issues in each practice.
- 3) Identify defining capabilities of maturity stages.
- 4) Build a comprehensive Change Proficiency Maturity Model for the 10-or-so critical business practices of current focus in the industry sector.

Each sector project will have a modeling team of qualified participants from 5-7 companies in an industry - to provide breadth without becoming unwieldy. With group-ware tools and a structured analysis approach, one week in full-team workshop can knock off item 1 and scope out item 2. Then individual one-week workshops at each of the participant's operating sites examines three to five high competency practices, and collectively knocks off item 2 while scoping out item 3. A final full-team one-week workshop deals with the findings to knock off item 3 and build a complete model of all practices. Sensitivity about proprietary capabilities is mitigated by using neutral facilitator-analysts to guide the individual participant-specific workshops - and to filter the data for the final full-team workshop for form rather than content.

So maybe in your sector the model will show that equipment up-time is a problem, but nobody is focused on it strategically as yet. This puts it in the category of future focus as opposed to current. And that means it is an opportunity for innovative leadership and immediate disproportionate advantage.

<b>Simple Proforma Example: Key Human-Relationship Change-Issues in Machining Industry</b>	
<b>Proactive Change Proficiency Issues</b>	
<b>Creation</b>	Obtaining top quality people; and creating a sense of team, ownership, and responsibility.
<b>Augmentation</b>	Improving personnel skills.
<b>Migration</b>	Workforce diversity; top management succession.
<b>Modification</b>	Gaining new skills; guarding against insularity.
<b>Reactive Change Proficiency Issues</b>	
<b>Correction</b>	Correcting mismatches between people and their tasks.
<b>Variation</b>	Filling critical slots when a key employee is absent.
<b>Expansion</b>	Finding more high-quality machinists; handling surge requirements.
<b>Reconfiguration</b>	Reassigning tasks and responsibilities to meet special needs.

Paradigm Shift International is an enterprise research and guidance firm focused on Agile operations and competitiveness. Its current focus is on customized industry- and corporate-specific Change Proficiency Maturity Models. Inquire at 505-586-1536 for participation.

# Enterprise Mandelbrots and Self Organization

By Rick Dove, Paradigm Shift International, e-mail: dove@well.com, 505-586-1536, Senior Fellow, Agility Forum

Twenty-four months ago this series began with an essay entitled "The Meaning of Life & The Meaning of Agile". We now close the series with an essay that could have been entitled "The Secret of Life & The Secret of Agile".

Isaac Asimov's robotic laws of fiction fame had three rules which governed all robotic interaction with humans. Asimov's many books repeatedly show how these three simple rules result in the best possible response to all possible interactions. Interesting that he didn't, instead, hand each robot a policies and procedures manual at birth; but maybe understandable: he would have never finished this manual sufficiently to christen the first robot. Nor could that robot, no matter how wonderful its *positronic* brain, ever finish integrating the apparent but necessary contradictions. The brain would either loop among contradictory procedures or infinitely recurs into catatonia.

Asimov's three simple laws that allowed a vast population of thinking robots to beneficially serve

humankind:

**"A simple set of ideological beliefs generates a highly successful response capability."**

1) A robot may not injure a human being or, through inaction, allow a human being to come to harm.

2) A robot must obey orders given it by human beings except

where such orders would conflict with the First Law.

3) A robot must protect its own existence as long as such protection does not conflict with the First or Second Law.

Another robotist, Rodney Brooks, builds autonomous robots at MIT's Artificial Intelligence Laboratory. One famous six-legged graced many magazine covers a few years ago, uncannily exhibiting behaviors of insect life when faced with obstacles and problems in the real world. What set the Brooks approach apart from others was its lack of any overall world-view or master control - the behavior emerged from the combined interactions of many independent simple-ruled decision mechanisms. There was no master control that understood how to coordinate six legs into forward motion, how to climb over or circumnavigate an obstacle, or how to right itself after being turned upside down. There were, instead, independent joint controls with very simple rules that could sense stimulus from the environment, including the actions of fellow joint controllers. Eventually the collection of independent decision makers/effectors learn which coordinated responses result in goal attainment. Again, simple rules capable of complex behaviors and new responses to unanticipated events.

What Brooks came to believe in later stages of his research was that the emergent behavior could not easily be determined in advance. That is, humans that designed the rule systems for the myriad of autonomous units could not predict the collective results. That makes it difficult if you're trying to design such a system to a precise behavior specification. On the other hand, it makes it possible for the system to cope with unanticipated situations.

We have examples all around us that say we can design emergent systems purposefully. The free market economy is one - though we constantly screw around with the core equations it is not necessary - but somebody always feels that there are better ways so we explore things like MIT's economic intervention, Sweden's socialized medicine, and the USA's anti-monopolistic laws. Actually, these perturbations act as mutation experiments that can make the economic organism more fit for epochal cycles.

These are examples of self-organizing systems. In the business world we see experiments with empowerment, teaming, listening to the voice of the customer, organizational learning, and other concepts as movements toward self organization - though not necessarily with that end in mind.

*The Unshackled Organization* by Jeffery Goldstein offers a highly readable and cogent discussion of self organizing enterprise: "Self-organization is not hierarchically driven. Instead it is a process of system transformation that is self-generating. Self organization happens when a work group or an organization is facing a challenge and is allowed to respond to that challenge in a spontaneous, unshackled manner....a work group or organization as a natural system will spontaneously know how to reorganize in the face of a challenge, *if the obstacles hindering its capacity to self-organize are removed.*"

Let's return to teams for a moment. A concept sweeping the corporate cultures of the world, and generally misunderstood. Goldstein says it well: "We need to be careful that we are not simply imposing a participative corporate culture on what was previously not a teamwork environment. Real teams emerge out of the process of self-organization. To be sure, the emergence of greater coordination and coherence in a system is similar to cohesive teamwork. A close look at self-organization, though, reveals that emergent coherence is not based on a premature consensus among the parts of the system, but is, instead, the result of the amplification of *differences* in the system. Read him for the examples. Read him to understand the linkage of non-

linear systems (*chaos theory*) to organizational complexity. Read him for the secret.

Chaos theory sounds like something that should explain the workings of today's organizations. It does, actually, with very valuable insight; but too deep for these two pages. Fractals are one of the aspects of chaos math that have gained general exposure, and the *Mandelbrot set* is the most famous fractal graphic. Named after the inventor of fractal geometry, the infinite complexity of the Mandelbrot graphic (seen in the accompanying figure) is obtained from a simple equation with three terms.

Overlaid on that graphic is the Collins and Porras quotation from *Built to Last*, the book that identifies a strong corporate ideology as the secret to long term corporate viability. In their research comparing numerous well known companies they showed how those with a strong ideology consistently outperformed those without; and they suggested that having a clear corporate ideology is so overwhelmingly powerful that its specific content is not important. Basically they see the ideology as the core values of the corporation that guide the decisions of all employees, creating an organizational result that emerges from the collective actions of truly empowered employees.

Collins and Porras show us that any ideology is better than none. But we have come to believe that the content of an ideology does make a difference, and that some ideologies are vastly better than others. We reached this conclusion upon completing an *Agile Enterprise Reference Model and Case Study* for the Agility Forum, where Remmele Engineering was examined across twenty five critical business practices for change proficiency. We chose Remmele as a case study because we saw that they exhibited broad-based maturity at change; but without any real understanding of the causes when we started.

To our surprise and delight, the more practices we analyzed and the more instances of change proficiency we examined, the more they all owed their adaptability to a very few common ideological beliefs plainly stated in the corporate Guiding Principles. Among those Guiding Principles are the beliefs in

constant change and continuous learning. These two, as well as a few others, form the generating function for the organizational entity called Remmele Engineering. Like Asimov's robotic laws and Brooks's distributed control, a simple set of ideological beliefs generates a highly successful response capability to unanticipated change. And like the Mandelbrot set, infinite complexity emerges from a few simple terms.

This work has led me to think of a well ordered ideology as the *Enterprise Mandelbrot*. The Reference Model contains Remmele's entire set of Guiding Principles. Sorting through them to find the core set that forms the generating equation can be an enlightening exercise.

Technology alone cannot make an enterprise change proficient - that is first and foremost dependent upon people making decisions. Self organization is the secret here; and the work by Collins and Porras taken together with the insights of Goldstein make the case and show the way. To implement those decisions, however, requires an architecture that enables and facilitates change. This first series of 24 essays laid a foundation of definitions, metrics, and analysis for change proficiency. Now, in the next series, we will focus on the implementation and design principles for self organization and high change proficiency.

## THE ENTERPRISE MANDELBROT

**“Companies seeking an “empowered” or decentralized work environment should first and foremost impose a tight ideology, screen and indoctrinate people into that ideology, eject viruses, and give those who remain the tremendous sense of responsibility that comes with membership in an elite organization. It means getting the right actors on the stage, putting them in the right frame of mind, and then giving them the freedom to ad lib as they see fit. It means, in short, that cult-like tightness around an ideology actually enables a company to turn people loose to experiment, change, adapt, and – above all – to act.”**

*(Built to Last, pg. 139.)*

