Realsearch: A Framework for Knowledge Management and Continuing Education

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Abstract

This paper deals with insight as the deep form of knowledge we wish to develop about our business environments, and the form of knowledge we wish to transfer to others who are in business with us. More specifically, this paper describes an insight development process called *Realsearch*, and its application specifically to the analysis and design of highly adaptable business practices.

Realsearch is an issue-focused, principle-based methodology that first defines the nature of a problem before considering solutions. Solutions are then analyzed or designed according to a set of fundamental design principles. Insight is fostered with this cause-and-effect understanding, and communicated within an organization through means of a *local metaphor model* - which provides a graphic depiction of this cause-and-effect relationship for a known and respected local business practice.

One immediately practical application is for directing business process reengineering projects. Another is the capture and mobilization of corporate core competency knowledge. A third important application is in what we now call continuing education - at all employee levels. Insight provides a very different leverage over simple procedural learning and training. Formal education traditionally gives us new rules to employ, training traditionally gives us experience in applying those rules, workshops focus us (sometimes) on real and practical problems, and seminars expose us to someone else's thoughts. None have demonstrated the ability to provide insight consistently - so all have a marginal value by comparison.

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1. INTRODUCTION

As human beings we distinguish ourselves from other life by generating and applying knowledge. Our increasing population is building upon an increasing body of past knowledge - which increases the rate of new knowledge generation and speeds the decay of knowledge value - making the general business environment, which is built on knowledge, more unstable. Knowledge *is* the driving force of both proactive and reactive change. New knowledge demands to be acted upon; and when one business acts upon new knowledge others have no choice but to follow. Conscious knowledge management will return general stability in the long run. Short term it will provide preemptive advantage to those who master it first.

Insights are very powerful forms of knowledge, but very difficult to transfer to others. They stem from some internal understanding that is either too complex to convey in language or simply not consciously understood.

Our interest, therefore, is in helping people gain new knowledge at the depth of insight, within an environment dominated by constant change, an environment growing less tolerant of a time-out for learning.

Background

In the late □80s the National Center for Manufacturing Sciences (NCMS) pegged technology diffusion as a principal problem in American competitiveness [1]. On the surface, it simply took too long for new valid ideas to become adopted by industry. Underneath, it was evident that effective process knowledge and practice for diffusion did not exist. As one of the early government-funded partnerships with industry and academia this consortium put the problem high on its agenda, requiring all collaborative project work to be organized for application rather than (or in addition to) research and development. Real work in understanding the processes of technology diffusion remained wanting - the core of dissemination and adoption problems appeared to be social in nature and therefore difficult to fund and support through technology-focused channels.

Later, in 1991, government was the catalyst for the industrially led project facilitated at Lehigh University that resulted in the identification and definition of Agile Enterprise as a newly required competitive competency [2]. In 1994 DARPA through NSF breathed considerable life into this concept by significantly augmenting industry funding at the Agility Forum, the industrially led subsidiary of Lehigh University that grew from the 1991 project. The Agility Forum was so named precisely because it provided a forum for people from government, industry, and university to develop new knowledge about this new concept of Agile Enterprise. The forum-like structure was adopted and formalized so that people with similar interests but diverse experiences and problems could explore together a common set of problems - each bringing different needs and view points.

The author played a key role in the organization of both the NCMS and the Agility Forum approaches to collaborative knowledge development - first as Chairman of the NCMS Technology Review Board, and subsequently as the Agility Forum's first Director of Strategic Analysis. Coming later in time, the Agility Forum benefited from a more focused and structured approach [3], as well as a less restrictive funding environment. The principal focus was upon creating new and immediately actionable insights in the minds of participants.

Industry workshops typically bring together people with different backgrounds and different agendas - and this often leads to poor productivity as the group spends its time seeking common ground, or suffers for lack of it. We found that structuring a working group's activities with a fixed analysis process and a clear objective eliminates these problems; driving the activity toward discovery of new knowledge. We have also found it counterproductive to require consensus on the conclusions. The people who went back from the early Agility Forum workshops to implement what they had learned all went back with very personal ideas, formed from their own conclusions about the new knowledge that was developed.

The author has continued to refine these knowledge development/dissemination techniques as a concept now called *Realsearch*, as opposed to research, as it employs real people addressing real problems in real time to develop or increase a useful body of knowledge that they can employ immediately.

This paper describes the Realsearch process that has evolved from those early consortium and subsequent Forum workshops into a process focused on developing insight and managing knowledge. It is still a work in process; but one which is already showing results in an area that cannot wait for the *final* answer.

2. Objectives and Building Blocks

Objectives

The management of knowledge is emerging as the central theme in business today. We are beginning to realize that its application is the distinguishing factor among companies - but we don't know how to measure it or display it on the balance sheet. Nor do we know how to capture and package it so that we can spread it freely among employees. Nevertheless we know that it is what core competency is all about, and it is what competition is all about - for it is what the business is based upon.

We also know that knowledge is being generated faster than ever before, applied faster than ever before, and decaying in value faster than ever before. We have become concerned about managing knowledge as a business practice as a result.

Knowledge is a people thing. Though it may be technical knowledge we are talking about, it was a person who generated it, it is a person who has it, and it will be a person who tries to understand it - or decides not to. That's where the difficulty resides: People.

Realsearch is the name for a learning process we have been testing and refining. To date it has been employed in workshop format, generally with participants from mixed backgrounds and companies. The focus has been on business practices and processes, with the intent to learn why and how highly adaptable ones work, and to learn how to design new ones so that they, too, will be highly adaptable.

Our principal objective is to expedite the creation of insights about the value and nature of change-proficient business practices among a broadening base of people.

On the Nature of Insight

When do you do your thinking? If you are like me, it is principally when you're addressing a real problem. When do you get your insights? Mine generally come when I'm trying to solve a problem I haven't faced before, don't have a ready answer for, and don't know a formula or recipe or roadmap to employ in the process.

I think of insights as those nuggets of knowledge that are the shortcuts in our abilities to understand things clearly. They're like x-ray vision - they let us look at something and all the extraneous information just melts away; leaving only the essence that clearly explains what we are focused upon. Think of insights as *lean knowledge*. The best part is that most insights seem to stem from mental patterns so basic that they have broad applicability - knowledge patterns that are reusable under many seemingly different circumstances.

Nice stuff if you can get it. Geniuses seem to have a lot of it - that's how they make simple sense out of the things that baffle the rest of us. It's obvious we don't get it in school or we'd all have a lot more.

Why is this so important? The knowledge brought to bear on the job, whatever the job, determines how well it is done; and that knowledge, whatever it is, is getting obsolete faster and faster. So the manipulation and renewal of knowledge is a cornerstone of viability today - whether you're a company or a person.

The stuff of both personal and corporate core competency is knowledge, the leverageable stuff of knowledge is insight, and insight is possessed by people. So companies want to know how they can get more insightful people - either those who come with a storehouse of insights or those capable of developing them as needed.

Dan Seligman [4] suggests that intelligence is the attribute to look for, no matter what the job position or responsibility. "In jobs all across the skills spectrum, highest [IQ] test scores are associated with shorter training times, greater productivity, and lower turnover rates". Every job has an ideal IQ range, he says, and companies should attempt to fill those positions with people in the upper, rather than the lower, end of the range. He reminds us that Microsoft hires with this in mind: "promoting worker intelligence as a business strategy".

A study at Bell Labs disagrees. Robert Kelly and Janet Caplan [5] showed that among engineers a higher IQ didn't help - initiative and networks counted the most for productivity, and seven more "strategies" played important roles as well. Initiative: instead of simply identifying a problem, fix it. Networks: instead of simply asking others for help when stumped, cultivate respect among a group that trades in knowledge.

Interesting concept, this trading in knowledge. A source of indirect insight that allows a person to get beyond the roadblocker problems. It taps into many minds. It isn't teaming in the sense that we employ that term, yet it makes use of a team in the sense that we employ that term - it taps the knowledge of others who are willing to entertain your problem and provide a solution - or at least some ideas that could help enlighten your path to a solution.

After a certain age we begin to value experience over intelligence and a quick mind. Why? Because experience is a collection of ready-to-use insights indistinguishable from intelligence. Mere intelligence, on the other hand, must create an insight on-the-spot in order to solve the same problem equally well. Sometimes it can; but if you could find a way to increase your own pool of insightful patterns you would function at a seemingly "smarter" level. And if you could help others increase their collections of insights you would have about you a more effective group of people.

The point: it doesn't matter how the insight patterns get there (in your head), it only matters that you have them.

Remember the old plumber's justification for his high price for five masterful minutes of work: "$50 for whacking the pipe, $5,000 for knowing where to whack it". The plumber's knowledge might fit into one of three categories:

1. Maybe someone showed him where to whack it,
2. maybe he just "knew" where to whack it, or
3. maybe he understood why to whack it there.

Category one is the least leverageable kind of knowledge (it's only information masquerading as knowledge) and the most prevalent form - a set of circumstances repeats itself and you can solve the problem because you've seen that one before. This kind is built over many years of exposure to working situations and is the basis of craftsmanship maturation as well as most formal education. "Here are some tools - I'll show you how to use them. Here are some applications, I'll show you how to approach them. Now go out into the world and use this information, and if you run into something different, seek advice from someone wiser".

Where do these wiser people come from?

Category two is the least predictable but generally the most prevalent form of insightful (rather than rote) knowledge. We exhibit genuine useful insight into the way some things work but we can't explain it, we just apply it. X-ray vision. We all employ this form of insight to different degrees every day in the course of just living. Those we call talented often exhibit this unconscious insight in their area of expertise.

Category three is the most valuable form of insightful knowledge because it is transferable. It has higher leverage than that which is unconsciously exercised by a single person with a gift. Remember we're talking insight here, we're not talking about an application of formulas and process that cranks out an answer. We're talking about people who come up with an answer in the absence of formula, and then show us how to do it too. In essence they have given us a new mental pattern that we use thereafter to filter all the things we see, along with any other such patterns in our mental library.

It's not really that simple. Installing a new insightful pattern needs a receptive mind - one that is struggling with a problem that this new pattern solves. One that accepts the new pattern because it recognizes the void that can now be filled. Someone cannot give you one of these patterns when your mind is not in the inquisitive state. Insights cannot be handed out willy-nilly.

Good teachers create this state in our minds before they show us the keys. I had only one such teacher in my entire educational experience. They are all too rare. Guided insight development is unlikely in the classroom: it requires extraordinary teaching insight and a set of thought problems natural in this artificial environment.

One way to get insight: Tackle a problem for which you have insufficient knowledge to reach a straightforward solution, and no readily available book or expert to consult. One way to accelerate the development of insight: Tackle these problems in the company of others equally in the dark and equally engaged in the discovery process. When are the best insights built? When you're equally in the dark about the problem as you are about the solution - this is why you

learn more from benchmarking outside your industry - you have to define the problem first - something we usually take for granted.

According to Kelly and Caplan, engineers at Bell Labs did it. The insight development was actually done by the Bell engineers themselves. They did have structured guidance; but they took charge of the initiative - defining the problem as well as the solution to higher productivity. They created their own state of inquisitiveness and developed their own insights into high-productivity knowledge-work. Powerful stuff - with full ownership. And then these same engineers turned around and organized self-discovery productivity workshops for all the other engineers. Unlike other forms of productivity training, Bell engineers that went through the six-week training experience continued to improve their productivity over time, rather then showing a short term, quickly decaying, post-workshop effect. They clearly had new leverageable insights - not simply new information.

Importantly, they used workshop exercises to apply the new knowledge they had discovered - and found out that fake exercises were not useful - so they brought in the real problems. They researched real problems with real people in real time. I call that *Realsearch*.

Building a Context

Not Invented Here - NIH - is a phrase we all understand from first hand frustration. An old Calvin and Hobbes cartoon put it straight. Talking to his teacher Calvin says: “You can present the material, Mrs. Wormwood, but you can’t make me care.”

Imparting new knowledge to others seems to grow in difficulty in direct proportion to its applicability. Why don't people recognize good information when it stares them in the face? Perhaps it is more fruitful to ask: How can we help people to care?

Eric Drexler puts his finger on it directly in his book, *Engines of Creation* [6]. He suggests that the biological immune system we are all familiar with serves a valuable function when it rejects the cell types that were not present at birth, like bacterial and virus invasions; and that an equally necessary system protects us on the mental plane. “The oldest and simplest mental immune system simply commands ‘believe the old, reject the new.’ Something like this system generally kept tribes from abandoning old tested ways in favor of wild new notions.” He goes on to give some solid grounding for the NIH syndrome, and finally notes: “This simple reject-the-new system once worked well, yet in this era of organ transplantation it can kill. Similarly, in an era when science and technology regularly present facts that are both new and trustworthy, a rigid mental immune system becomes a dangerous handicap.”

So it’s not just pig headedness after all. But maybe there’s a way to trick this immune system, to insert a new idea disguised as an old, familiar idea. Like suggesting that product flow through a factory has a lot in common with traffic flow at commute time - helping us understand that high "utilization" causes "accidents", which decreases throughput; and when utilization is really high the accidents cause accidents, resulting in even lower throughput. The power of the metaphor is mighty.

I remember one postmortem discussion at an auto plant when both union and management representatives decried the fact that their lean production training sessions were not working. People did some things differently after sitting through class but stubbornly refused to change others. They finally asked somebody why this was: “You guys don’t know what you’re talking about. If we do what you want you’ll see production go down.”

Spoken from the heart; but it wasn’t accurate. The class preached a new way to people who had unreceptive mental patterns, patterns that could not connect with the new information, patterns that were unable to recognize value in the new suggestions.

We all do it all the time. We understand the problem we have been working on, the problem we have found a solution for, so well, that we assume it is obvious to everyone. So we blurt out the solution and provide all its wonderful detail to people who haven’t traveled the same road, and aren’t prepared to value the same insight.

To transfer knowledge effectively, we must first create a context of understanding. We must build the patterns of understanding and value before we can hope to have new information embraced.

One masterful example: Jack Stack’s *Great Game of Business* [7] set out to teach every employee at a discarded International Harvester plant how to read and relate to the monthly corporate financial statements. What an uphill battle that must be - if you try it straight on: “When your shift is finished we’d like you all to join us for a two hour session on Balance Sheet reading”. What Stack did, instead, was to teach people how to build a personal financial statement, and how to build a financial statement for a family side business like baking muffins and making jams. He captured interest with a personal connection and latched on to existing value patterns before distributing company financial statements. And it works - you have only to read *Open Book Management* [8] to see how well this technique has spread throughout all types of companies.

So we use metaphors to connect new information to old trusted knowledge patterns. These are reusable, reconfigurable, scalable knowledge patterns.

Local Metaphor Models

Virtually every business unit within a company has a few practices that exhibit high change proficiency. Typically

these competencies emerge as necessary accommodations to an unforgiving operating environment. Maybe it's the ability to accommodate frequent management changes - each with a new operating philosophy. Or the production unit that automatically tracks a chaotically changing priority schedule. Or the logistics department that routinely turns late production and carrier problems into on-time deliveries. It might be a purchasing department that never lets a supplier problem impact production schedules. Or an engineering group that custom designs a timely solution for every opportunity or problem.

Every business unit has its own brand of tactical chaos it manages to deal with - intuitively - implicitly - routinely - automatically - without explicit process knowledge rooted in change proficiency. Yet at the same time virtually every business unit today is facing strategic challenges that cry out for this same innate competency.

To illustrate, we will use a practice from the General Motors Pittsburgh metal fabrication plant analyzed in our second workshop application of the Realsearch process. In brief: this plant stamps and assembles low volume, after-model-year, auto-body service parts. With responsibility for some 1000 assemblies the plant constructs a custom assembly line for a specific part, produces a few hundred doors maybe, tears down that assembly line and builds another in its place for a few hundred deck lids maybe (trunk doors) - and does this many times a day.

A one-page configuration diagram guides the production team in constructing an assembly line from common reusable modules of various types. The Appendix contains a 3-page *local metaphor model* that synopsizes the underlying principles at work in this just-in-time assembly line construction approach - graphically depicting the concept of assembling reconfigurable systems from reusable modules.

We have discussed the power of metaphors to create and communicate insight. The trick is to find a meaningful metaphor that can transfer this leverageable knowledge among a specific group of people. We accomplish this by creating a metaphor from a business practice that is well known (or at least accessible) and respected within the target group - hence the *local* designation.

Discovery Workshops

An effective technique for giving people insight is to involve those people in the actual knowledge discovery process. A structured approach for what I call *discovery workshops* is important, so that the group stays focused and achieves the objectives - both individually as well as collectively.

There is definite leverage in building new knowledge patterns when a discovery workshop takes place at a non-competitive site. Unlike benchmarking, where we want to see how a competitor does it, discovery workshops benefit when the shields are down, when the participants don't already think they know the subject cold and have strong filters already in place.

Through Paradigm Shift International I conducted a series of discovery workshops in 1997. These workshops would focus on identifying and understanding an underlying set of design principles for change proficient business practices.

Five years of probing at the nature of change proficiency with Agility Forum industry groups in real-life industrial settings provided a solid starting point. People from over 200 organizations had helped identify, postulate, test, analyze, and verify basic concepts and models for measuring and describing change proficiency across a broad base of business activities [9].

Ten design principles had been postulated previously, encompassing a framework/module architecture (see Appendix bottom of last page). Though there was studied work behind these concepts they had yet to be vetted in meaningful business settings. More to the point, they had yet to be packaged into a useful and understandable body of knowledge.

This, then, was the task at hand. But it was not viewed as a task for academics, nor as an academic task. Though the rigors of the scientific approach could yield more precise definitions, more precise mathematical models, and more defensible conclusions - the results would lie in books and reports with too much math and too little application. Initially, this was a task for business people who had problems to solve and opportunities to grab.

The Process—An outside Realsearch team works side-by-side with local personnel (who may also be part of the traveling *Realsearch* team) to examine two practices that exhibit high change proficiency. For each practice the structured analysis process builds a model of the change proficiency issues (proactive and reactive response requirements) and the architecture (reusable modules, compatibility framework, system engineering responsibilities). Then we examine these architectures for local manifestations of ten specific design principles.

The combined results produce two *local metaphor models* for change proficiency - *local* in that they are present at the plant site and respected intuitively for their capabilities - *metaphor models* in that the analysis explicitly illuminates common underlying principles responsible for this change proficiency.

Then we examine a third area of strategic interest that isn't yet designed, or must become more adaptable, and employ the metaphors to guide the application of design principles. This exercise at GM's workshop, for instance, was focused on designing a process for capturing and mobilizing core competency knowledge.

3. FRAMEWORK AND PROCESS

We borrow and adapt the concept of *activity maps* from Michael Porter [10] to give a pictorial representation to the Realsearch process. Realsearch as we currently practice it has five themes (shaded bubbles in Figure 1) which constitute its strategic framework, and seven process elements (white bubbles) which support these themes.

Framework themes are the main concepts that collectively distinguish this Realsearch approach from some other methodology for learning and insight development. They are the *what* of Realsearch. This thematic framework should remain relatively stable over time, though some evolution is expected.

Key process elements are the actual primary activities or functions that define the themes in their execution, and represent *how* the themes are achieved.

The connecting lines show strong support among the units, and strengthen consistency and coherency to the extent that there are multiple connections.

Key Process Elements

Realsearch is an issue-focused, principle-based process. In Figure 1 process elements are clustered into three groups: tools, tasks, and team makeup.

Change-Issue Focused—Realsearch focuses on developing the questions before embracing answers; defining the problem before accepting solutions. Change proficient business practice has been the focus for the first application of the Realsearch process; as a consequence the activity has employed a methodology for defining problems in terms of their change-proficiency requirements [11]. The key concept here is that the item to be analyzed or designed must first be profiled as a set of issues to be resolved. The Appendix contains a short-listed version of the change proficiency issues identified during the analysis of an assembly process at General Motors.

For example: At Rockwell Avionics, where we were exploring the design of a *program realization process*, we came eventually to understand that the primary issues were not at the operational and organizational levels, but rather with the pending crises of knowledge-worker shortages faced by all technology intense businesses. When the problem is viewed from this angle the nature of a good solution is completely different.

In the Realsearch workshop consensus is sought (but never demanded) on the problem definition and not on subsequent solution designs. The emphasis on a common problem definition is important so that all solution design activity focuses on a common set of requirements.

RRS Principles Based— The ten RRS (Reusable, Reconfigurable, Scalable) design principles are specifically focused on building adaptable systems (see bottom half of iconic model in Appendix A). In general, however, any set of comprehensive design principles would provide the necessary fundamental concepts for open interpretation. No two people are likely to employ fundamental knowledge to precisely the same ends. Principle-based design invites collaborative learning as each participant goes away with a deeper but very personal understanding. Principles are tools rather than recipes.

The design principles provide enough structure for both the analysis and the application exercise work to channel the workshop activity toward its objective; but not enough structure to allow comfortable passive participation. Finding evidence of the principles in a practice being analyzed and employing them in the design of a new practice is thought provoking work. Basing the participant activity on fundamental principles rather than on recipe steps creates an environment in which people must actively think and struggle with new concepts.

The primary objective of the *Realsearch* 1997 Discovery Workshop Series was in fact aimed at testing and refining this set of principles. The insights we hoped to generate would be based on these principles. The new knowledge the workshop series intended to create was the refinement and applicability of these principles in different business

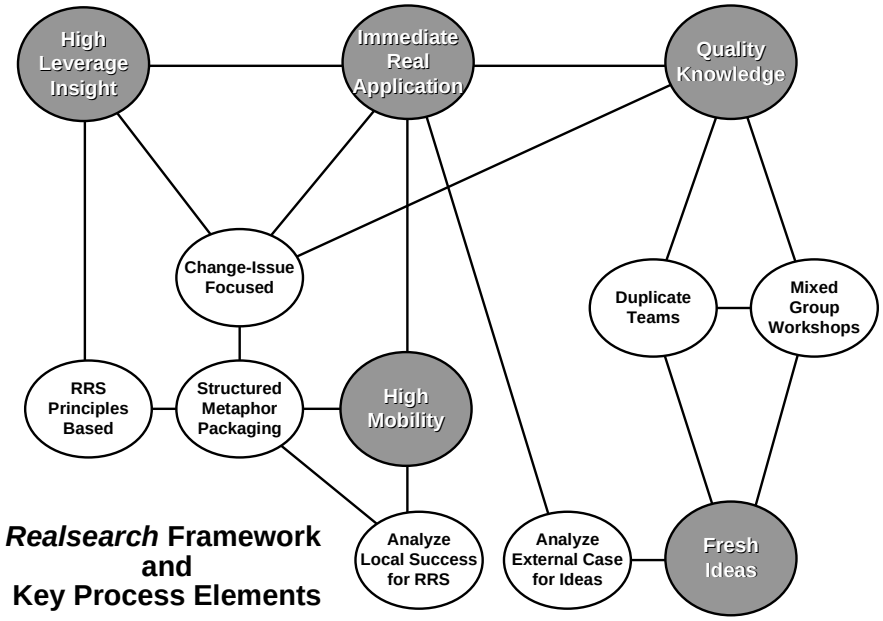

Figure 1

environments. For instance, our second workshop at General Motors analyzed two production practices that had the most blatant examples of RRS principles employed - which resulted in some major terminology refinement. These highly evident examples helped us re-articulate the principles in more communicable terms.

Structured Metaphor Packaging— Realsearch employs the concept of metaphor as its principal tool for communicating insightful knowledge. The *local metaphor model* in the Appendix is an example of the structured packaging used in the 1997 Discovery Workshop Series. In this instance we are trying to communicate a business practice as responding well to a set of defined change issues because its design is based on RRS principles - which encompass both a framework/module architecture and the designation of persons responsible for maintenance and evolution - and facilitates the plug-and-play construction and reconfiguration of systems (business practices).

A *local metaphor model* is not expected to communicate an insight into a specific practice all by itself. It is intended rather as a map of the knowledge pattern people will learn when studying the business practice, and as a map to be overlaid on other practices subsequently analyzed or designed.

Analyze External Case for Ideas— The initial task activity undertaken in each our 1997 Discovery Workshops was the review of three or four written articles. In general, the activity here is intended to introduce new thoughts relevant to the subsequent analysis and application exercises. Though there may be other ways to accomplish this same end, written articles have some distinct advantages: they can be sent out in advance, they can carry the weight of expert authorship, and people can be assigned to present their salient points and lead a group discussion about them. We sent them in a pre-reading package to all participants, and selected one "experienced" participant to lead a group discussion at the beginning of the workshop. Discussion leaders were sent a guideline on how to conduct an interactive discussion and how to open it with a personal review of what they discerned as relevant. With three articles to be reviewed, three participants got drafted into the leadership rank: learning is accelerated by teaching.

Generally the articles were chosen for the indirect but basic light they could shed on the upcoming application exercise. Thus, when we intended to explore the design of a *program realization process* at the Rockwell Avionics workshop we didn't choose articles that dealt directly with that subject; but rather one that dealt with corporate-culture work styles and another that dealt with controls appropriate for an empowered organizational structure. Both introduced very new view points to the participants, both provided ideas that influenced the analysis and application work, and both were praised as valued knowledge assets by the participants. Had we chosen instead articles that presented case descriptions of designs by others we would have encouraged a polarized reaction: if we favored what we read we would tend to stop thinking and construct our best design from pieces found in others, if we disliked what we read we'd waste time justifying our rejection.

Analyze Local Success for RRS— The second task activity in our workshops is to analyze something done well by the workshop host - where *well* in our case meant in a highly adaptable fashion. The intent is to show that a practice which is familiar and respected owes its value to a design based on the very principles we are trying to develop an appreciation for. In general such practices may have been consciously designed for adaptability but have rarely been designed with fundamental principles in mind. Exposing the presence of the principles is the first tangible understanding for first-time participants, and moves implicit knowledge into the explicit category for those familiar with the practice being analyzed.

At this point it becomes easier to suggest that these principles can be employed consciously in a purposeful design of another practice - they are not foreign concepts after all. The analyzed practice becomes a local metaphor in this light - one that can be pointed to for precedence when suggesting that another practice would benefit from the application of one or more of the RRS principles. Importantly for the Realsearch process, this sets the stage for the subsequent application exercise.

The first of the 1997 workshops was held at LSI Logic, where we analyzed a product design system called Coreware, which allows LSI engineers to design a large portion of new semiconductor chips by stitching together pre-tested and reusable circuit modules and sub-modules from a library. We also analyzed their order fulfillment system which assembles a custom-selected team from a pre-qualified pool of sub-contractors for each order LSI gets. Both analyses were rich in RRS principles - and both provided good metaphors for attacking the application exercise: large program management as seen in plant construction projects. It turns out that a successful semiconductor company today is as much in the plant construction business as it is in the semiconductor manufacturing business. Looking at plant construction projects as a corporate core competency, and borrowing ideas from both the Coreware system and the sub-contractor management system changes the whole perspective on plant construction projects.

Mixed Group Workshops— Good *Realsearch* results require a conscious attention to team makeup. Composing a genuinely-valuable closed corporate Realsearch workshop is difficult at best, and the smartest people in the most successful companies are the worst: they think they're open minded. Bringing outside participants into a corporate workshop adds considerably to the view points and the experience base that is brought to bear. Better yet is an open membership Realsearch team that is involved in a defined-objective, multi-workshop series. Corporate culture and corporate political reality are insidiously strong influences of what is acceptable to consider. When outsiders are included as respected participants the knowledge obtained

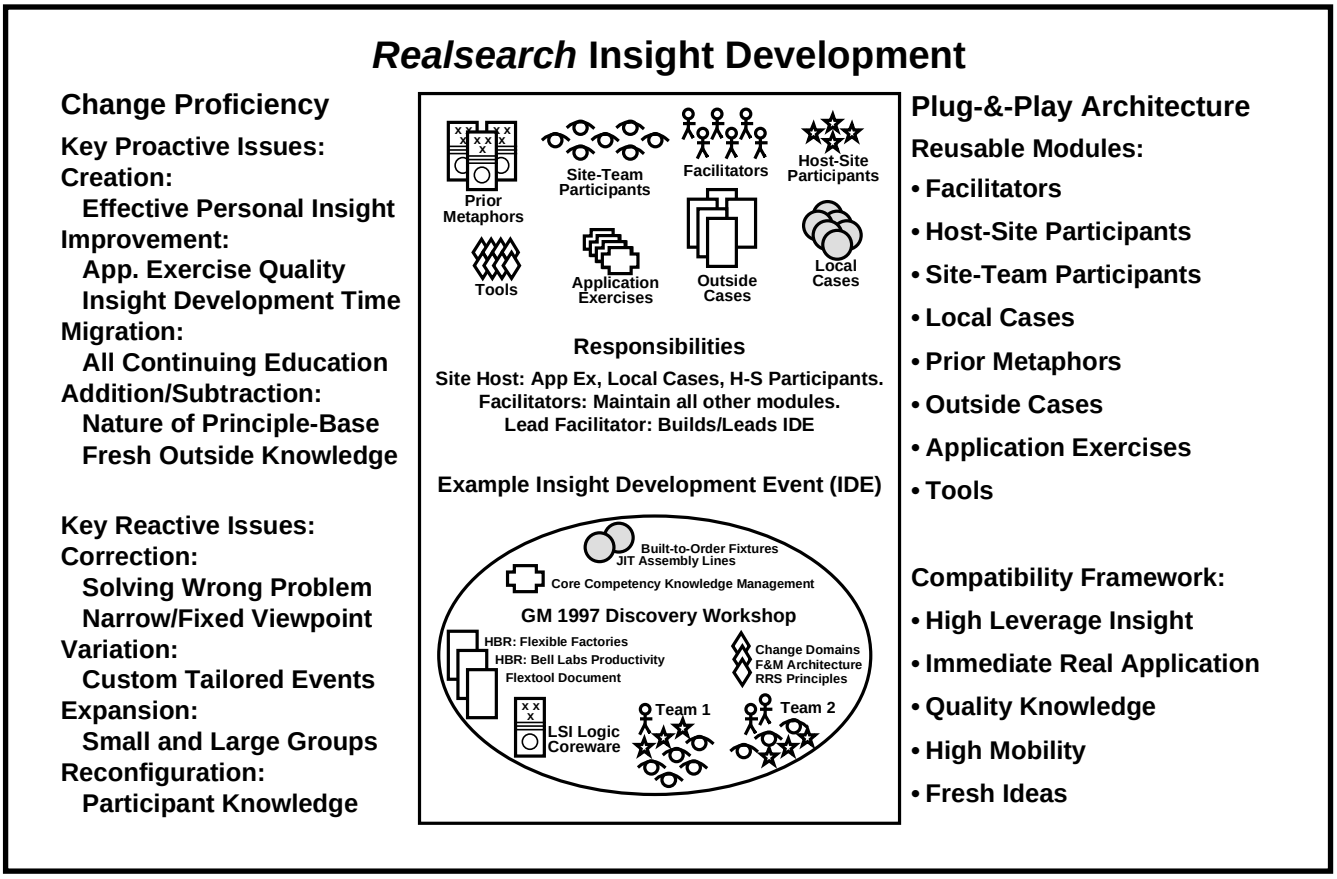

Figure 2

from analysis and applied in exercises is considerably broadened.

All participants must be genuinely interested in the pursuit of the Realsearch objectives, and in a position to employ the knowledge for immediate value - else the group suffers from tangential agendas. Participants should be screened for this interest.

Participant experience should also be mixed when possible. This allows some to take leadership roles, which helps them develop their understanding of the knowledge being explored; and sends a message of confidence to first-time participants that the confusion will clear eventually. This mixture of experience levels benefits both new and old-hands at the process because it keeps the questions honest - and questions without answers don't go away.

Duplicate Teams— Break-out groups in workshops are not a new concept. The conflict: Keep them small so everyone can and must participate; but don't have too many or there won't be enough time for full-group brief-outs. We balance this conflict by seeking a total participation of 10-20 people at any one workshop. For three-day workshops we find that breaking the full group in half for break-outs works well; though we will subdivide these two groups when total participation hits the high end of the range.

Duplicate teams means that both break-out groups work on the same break-out objective. This is important in the Realsearch process as we are seeking to develop/refine a specific body of knowledge (RRS principles in our initial workshop series) by attempting to apply it. Working with new and incompletely understood concepts leads to a certain confusion as well as to different interpretations. Both conditions foster a broader exploration and questioning. Having two teams work toward the same objective has never yet produced duplicate results - and usually produces complimentary results. Other important reasons for duplicating the activity: sometimes one group will get totally lost and make no progress, sometimes one person will dominate a group and take it someplace strange, and sometimes group chemistry follows a different agenda.

Most importantly, we are trying to develop a familiarity with the knowledge being explored at the depth of insight - in each participant. Insight comes from personal hands-on struggle, not from listening to someone else debrief another group's conclusions. Everyone must explore the same ground.

4. Testing the Approach

At this writing five of the planned eight workshops are completed, and the objectives of the series appear close at hand.

Principal Goal

Develop a *physics* of adaptability for business practices and processes to guide strategic, operational, and improvement planning.

Principal Objectives

- Refine a set of design principles which effectively guide the development of highly-adaptable business strategies and operating tactics.
- Identify effective approaches for implementation and management of these strategies and tactics.
- Provide a vocabulary and conceptual base which effectively communicates the nature, value, and purpose of change proficient strategies and tactics to all employees.

Approach

- Two highly adaptable business practices within an organization are examined in the first day-and-a-half of a 3-day Discovery Workshop. A structured analysis procedure guides participants on a search for candidate principles responsible for the observed change proficiency.
- The second day-and-a-half is devoted to a "real problem" exercise; applying the principles developed in the opening period to something at the host site that is either too rigid or yet to be designed.
- Four-to-seven people within the host organization are complimented with five-to-fifteen people from other organizations - limiting total participation to approximately 20 people. Participants do the actual discovery work and analysis, guided by a facilitated process that drives the effort toward the objectives.

Expected Benefits

- Participants are on the ground floor of new knowledge development and, more importantly learn to apply it at the same time it is developed. Hosts have the added advantage of analysis and application suggestions for areas of personal and direct value - and can subsequently carry the application activity forward to a new business solution. An application exercise is not carried to completion in the three-day workshop - but does illuminate paths to follow for those host personnel interested/responsible for a solution.

Participant Profile

Participants were recruited continuously while open slots remained. A constant influx of new thinking and values was actively sought to keep the ideas and objectivity fresh. In general, this series welcomed anyone who fit the following profile:

- Preferably a decision maker, manager, and/or organizational influencer involved with business practice and/or operation process issues.
- Had a curiosity and willingness to actively explore the activities being analyzed.
- Agreed to attend a minimum of two workshops.
- Agreed to digest the pre-reading and participate in the development of conclusions.

Three-Day Structured Approach

Five to fifteen participants from other companies joined with four to seven participants from the host site in order to broaden the generated knowledge and objectivity. Each workshop was three days in duration at a single site. Participants other than site personnel had agreed to come to a minimum of two workshops in order to provide some "experienced" participants in the process.

On the morning of the first day we reviewed the basics of change proficiency and the analysis procedures specifically related to the site and areas to be explored; and overviewed the host-site business context. Assigned pre-reading on workshop objectives, analysis methodology, and host profile was used to facilitate quick focus in this first day's activities and preclude the need for lengthy basic overviews. Pre-reading also included three-to-four articles chosen from the general business literature that addressed issues useful for the analysis and application exercise. Participants with prior workshop experience were assigned roles as discussion leaders for the articles.

On the afternoon of the first day we began the first of two analysis activities - typically including a tour or demonstration of the area being analyzed. Sometimes people other than host participants would be brought in to present and discuss the area under analysis. In the evening of the first day the group was split into thirds to attack a one-hour homework assignment just before a group dinner. The homework assignments were chosen to exercise the analysis methodology and extract key issues from the article reviews for presentation on the second day. The group homework session and dinner were also used to open up the social channels of group participation, boosting productivity.

On the second day the second analysis was conducted in the morning and the application exercise was begun in the afternoon. Importantly, this devoted half of the time to actual application of the learnings obtained in the opening half of the workshop.

The end of the third day always concluded with a review of the process - which invariably led to changes in the subsequent workshops. For example, the initial two workshops had only the third day scheduled for the application exercise, with the first two spent in analysis and preparation. Participants wanted more accomplished during the application period, and also felt that the learning process was accelerated.

A structured analysis approach was employed to ensure that the objectives were met, and that the necessary data and knowledge were identified. Each participant had responsibility for personal conclusions at the end of the workshop, and received comprehensive documentation of the workshop proceedings in real time.

The facilitator's documentation responsibility occurs at the conclusion of the entire eight-workshop series - when a generic synthesis of all the data will be generated. This document will deal with the nature of a common set of adaptability principles applied across the wide variety of business practices outlined in the next section.

Workshop #1, LSI Logic, Gresham, OR, Apr 15-17, 1997

Pre-reading assignments:

- "The …… Optimal Number of Suppliers", Bakos and Brynjolfsson, MIT.
- *Japan's Software Factories*, the Introduction, Cusumano, Oxford University Press, 1991.
- "Prepare Your Organization to Fight Fires", Karl Weick, HBR, May-Jun '96.

Analysis #1: Re-Usable Product Design— "Coreware" is a proprietary product/service that streamlines the development of custom-designed ASICs for any customer. Coreware helps a designer quickly design a new ASIC by stitching together reusable sub-circuit modules and developing only that new material not already in the vast reusable module library. Coreware can be employed by LSI designers or provided to the customer's designers - at customer discretion - or a combination of LSI engineers and customer engineers may work together.

Analysis #2: Reconfigurable Order-Fulfillment Teams— When LSI started as a Fab-less (no internal manufacturing) operation all customer contracts were satisfied by assembling a custom team of sub-contractors. LSI maintains and constantly updates an active data base of internationally-located suppliers. These suppliers are quickly assembled into a team for each outsource-manufacturing contract taken on by LSI. LSI has since built internal fabrication capability and these plants are placed in the supply-chain mix along with external sources. This quasi-virtual-enterprise assembly and management facility is located in Hong Kong and is the central operational unit for the company.

Application Exercise: Large Complex Program Management— After extracting the underlying principles we will then attempt to apply these principles to a real problem at hand. The Gresham manufacturing facility is a $1 Billion + project in process, expected to begin test production in August and revenue generation in the last quarter of '97. Developing the factory information and control system is just one of many major activities going on in this start-up program. The date for scheduled production was pulled forward by six months only a few months ago. Though all of the various activities feel that they will be finished on time, the concern is for the integration of the effort. A boiling dynamic right up to the day of production. How might the principles of change-proficient systems be brought to bear on this program is the exercise we will employ on the third day of the workshop.

Workshop #2, General Motors Metal Fabrication, West Mifflin, PA, May 6-8, 1997

Pre-reading assignments:

- "Time-Based Competition, The Product-Process Linkage...", Kosmala, Body Assembly & Mfg, IBFC '95.
- "What Really Makes Factories Flexible", David Upton, HBR, Jul-Aug '95.
- "How Bell Labs Creates Star Performers", Robert Kelley and Janet Caplan, HBR, Jul-Aug '93.

Analysis #1: Flexible Check Fixturing— 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, like the new laser machines offer, but relief had to be found. The plant invented a unique modular fixture scheme that utilizes a common grid-work base plate with part-specific holding "details" that snap into "retainers". Details are machined in-house quickly and inexpensively, and then stored in a shelved shoe-box sized tray. Classic Reusable/Reconfigurable/Scalable concepts are evident in the design and should provide an ideal case-study for identifying underlying principles.

Analysis #2: Small-Lot Assembly Lines Built Just In Time— The "A Assembly Area" consists of highly adaptable people and highly adaptable workstations - custom reconfigured to assemble specific hoods, deck lids, fenders, and body sides for 60+ different vehicle models all in the same area - with welding, hemming, adhesive application, and press-piercing as principal processes. Most of the fixtures and processes were developed at the plant in order to efficiently accommodate such high variety. Though our analysis will necessarily look at individual workstations and fixtures, the focus will be on the total A-Line process concept rather than on individual elements.

Application Exercise: Knowledge Capture and Mobilization— The application exercise deals with one of the most important problems facing all companies today: how to make good intuitive knowledge in one part of a company explicit so that it can be taught to new employees

and taken to other parts of the company. Turning this plant's innate tacit knowledge about highly adaptable process design into explicit knowledge that can be transferred effectively to new employees and employees at other GM plants will be our focus.

Workshop #3, Rockwell Avionics and Communications, Cedar Rapids, Iowa, June 30 - July 2, 1997

Pre-reading assignments:

- "Sun Shines by Taking Out Time", James Carbone, Purchasing Magazine, 9/19/96.
- "Control in an Age of Empowerment", Robert Simons, HBR, Mar-Apr '95.
- "What Holds the Modern Company Together", Rob Goffee and Gareth Jones, HBR, Nov-Dec '96.
- "The Trouble With Teams", Fortune, 9/5/94.

Analysis #1: Flexible Small-Lot Electronic Board Cell— The four machines and 16 people who work in this *Universal Process Center* are highly flexible - producing numerous printed circuit products in prototype and batch quantities ranging from 1 to 180 per day, with a large number of component parts, and a mixture of old and new technology. Machines include a high speed chip shooter, a screen printer, a general surface mounter, and a convection reflow oven. The team that works in the center is crossed trained and responsible for both quality and comprehensive maintenance.

Analysis #2: Cross Functional Teaming— Three teaming concepts will be analyzed:

a) Integrated Product/Process Development (IPPD) Teams combine Engineering, Production Ops, Program Management Office, and Business Development/Marketing to balance system design requirements.

b) Integrated Product Teams (IPT) are responsible for product manufacture, delivery, and improvement. Currently nine IPTs support more than 30 different product lines. Each includes a manufacturing specialist, facilitator, production control coordinator, quality control engineer, industrial engineer, IE technician, manufacturing electrical engineer, collateral engineer, components application engineer, quality assurance engineer, and finance.

c) Commodity Teams (CT) are one of the linkages between the IPTs and the IPPDs. These cross-functional teams have core representation from Purchasing, Engineering, Applications Engineering, and Procurement Quality Assurance Engineering; with the ability to add other specialists as needed. CTs are focused on best value, improvement, and long term supplier alliances; and jointly develop technology roadmaps with preferred suppliers that emphasize continuous improvement, trust, and sharing.

Application Exercise: Program Realization Process— Though significant benefits have been realized from the above mentioned teams, there is difficulty with inter-team interaction. This is becoming a significant problem as customers demand quicker time to market and want more customized product, and technology life-cycles and product life-cycles continue to shrink - resulting in more new product introductions to the factory each year.

Workshop #4, Pratt & Whitney Space Propulsion, Jupiter, FL, August 26 - 28, 1997

Pre-reading assignments:

- "Successful Change Programs Begin With Results", Robert Schaffer and Harvey Thomson, HBR, Jan-Feb '92.
- "Getting the Most out of Your Product Development Process", Adler, Mandelbaum, et al, HBR, Mar-Apr '96.
- *Accelerating Innovation*, Chapters 2-6, Marvin Patterson, Van Nostrand, 1993.

Analysis #1: Flexible Engineering/Supplier Relationships— In order to support the aggressive schedule demands of typical development programs Pratt's engineers work flexibly with purchasing, suppliers, and production well in advance of final design and drawings, making many commitments from sketches based on layout information. Procedures are in place to reasonably mitigate the risk incurred with these early commitments. Due to the informal nature of this process, extremely close coordination with suppliers is required, as well as a good deal of trust between project engineers, purchasing agents, and suppliers.

Analysis #2: Kaizen Improvement Process— Initial team success in dramatically improving the ability of the Space organization to respond to dynamic customer schedules and reduce the cost of engine production has led to an expanding Kaizen improvement commitment. Since then, initiatives in cycle time reduction, procedural issues, environmental health and safety, and others have forged an adaptable improvement process that is constantly improving itself as it learns and applies new techniques with every initiative. Our focus will be on the adaptability of the Kaizen process itself - as practiced at Pratt - and not on any particular initiative. Issues of particular interest include training, cultural change, commitment, incentives, structures that enhance change, follow through, and back-sliding.

Application Exercise: Engineering Risk Mitigation— Though significant benefits have been realized from the concurrent engineering process, there are still cumbersome aspects of early release associated with high risk areas. One challenge is to speed up the engineering analysis process, so that adequate information is available to iterate the design. Technological advances and adaptable approaches to modeling and analysis tools for thermal, flow, fracture, crack growth, stress, and other considerations are a major focus here, and procedural issues are equally interesting.

Workshop #5, Concurrent Technologies Corporation, Johnstown, PA, October 1-2-3, 1997

Pre-reading assignment:

- "IT Outsourcing: Maximize Flexibility and Control", Leslie Willcocks and David Feeny, HBR, May-Jun '95.
- "Customer Intimacy and Other Value Disciplines", Michael Treacy and Fred Wiersema, HBR, Jan-Feb '93.
- "What is Strategy?", Michael Porter, HBR, Nov-Dec '96.

Analysis #1: Management of Knowledge and Technology Development— CTC is principally in the on-demand intellectual-property knowledge creation and diffusion business, and deals in a wide range of scientific and technological disciplines. Competitively they offer major cost advantages to alternative sources for outside analysis and development work for two reasons: a) their low overhead permits a low multiple on professional costs, and b) they have a strong *management of technology development* discipline that typically finds and follows the optimal solution path. It is this latter practice that the analysis focuses on. Important techniques employed by CTC include mechanisms for finding the most appropriate internal professional skills and experiences, for finding and modifying/reusing previous applicable work, and for staying abreast of applicable technology developments in the external community.

Analysis #2: High-Flux Program-Management Organizational Structures— CTC currently has seven directorates - each responsible for specific customers and programs. New incoming programs and projects are generally staffed in a matrix-managed structure until the next directorate reorganization occurs (at least twice yearly), and are then assigned to a specific directorate. Skilled resources within the total CTC community are available to any of the directorates according to where their skills are best applied.

Application Exercise: Seamless Spot-Market Knowledge Work— CTC is expanding its focus on commercial markets and looking for new ways to provide analysis and development services as an outsource service provider. They wish to serve a wide variety or industries and a wide variety of customers, yet appear to each individually as a comfortable extension of internal capabilities. Thus, we will explore the design of an adaptable "plug compatible" interface between enterprises that eliminates or reduces all barriers to outsourcing critical knowledge work, and delivers the full capabilities of CTC to its customers and partners on an as-needed, when-needed basis. The focus will be on a design that facilitates the creation of a custom enterprise interface as each relationship will have different barriers to overcome.

5. CONCLUSIONS

Self discovery is a powerful way to assimilate and appreciate new knowledge. Working groups from industry that explored the early concepts of change proficiency at the Agility Forum sent people back to their companies with new visions of possibilities and new ideas on how to realize them. Many of them are making something happen in their companies as a result. Not because they heard a seminar. Not because they read a book. And not because they sat around a table and kicked around a few ideas. But because they tried to make sense of something that little was known about, and did it in the company of others with different backgrounds who also wanted a new knowledge and sense of understanding.

At this point the author suspects that the *change* issue-focus and *RRS* principles-base can be fruitfully employed as the basic analysis and application structure for any Realsearch application focused on business practices. This suspicion arises after seeing many different types of business practices comprehensively described as responding to a set of change issues. The change-issue structure is a tool that can fit almost any problem. Likewise, the RRS principles provide a reasonable general structure that appears to have broad applicability. Both are tools to make you think about the problem and the solution in broader terms.

Every workshop ended with a postmortem on the process. Suggestions for improvements as well as confirmation of good procedures were made each time, and many of the improvement suggestions were implemented immediately in the following workshop. Comments heard frequently focused on the high quality of the review articles, the desire to see new participants brought up to speed quicker (perhaps with off-line pre-tutoring or simply more in-depth basics at the workshop opening), and the desire for more specific break-out instructions and procedures.

Important things we learned in the first five workshops:

- Limit the analysis activity to a single practice so that all tools can be exercised by the entire group. Our attempts to analyze two practices, in two half-day sessions, never produced a complete analysis of any one practice. There just wasn't enough time. An entire day can be devoted to a single analysis. This requires, however, a more careful subject selection to ensure it provides a rich learning experience.

- Drive the analysis activity to produce, and leave behind, a complete strawman iconic model (one-page structured synopsis - see Appendix). Complete in the sense that both the iconic diagram and the observed RRS principles for a specific practice are developed and organized as a single-sheet hand-out. Strawman in the sense that quiet minds can later refine and augment what is necessarily the one-day blitzkrieg output of a committee.

- Be very careful about mixing participants from different companies that are doing business with each other. If there are unresolved issues between them, the group chemistry can defocus the Realsearch activity.

- Single-time participation should be discouraged. Wrestling with new knowledge in the Realsearch process cannot produce comfort, let alone insight, in a single exposure. By necessity a workshop host may have more participants present at the workshop they host than they field to other workshops in the same series. But hosting a workshop without fielding participants to other workshops diminishes greatly the value of the hosting experience. For one: the locally-specific knowledge generated during the workshop remains raw and unfinished as there is no follow-through. For another: though the host participants generally get good actionable ideas during their workshop, the Realsearch knowledge-focus remains confusing and provides no leverage.

- Initially we devoted a single day to the application exercise, with a day-and-a-half spent on the analysis activity of two practices. Once an experience base was developed participants, and especially workshop hosts, wanted more time spent on the application exercise. The day-and-a-half we now spend on the application exercise seems satisfactory. Having cut back on the time available for analysis, however, has resulted in a need to focus the analysis on a single subject rather than two.

Comments below are from participants. Some were unsolicited spontaneous email messages collected during the course of the workshop series, others were solicited as feedback on the Realsearch process specifically for this paper. We are still learning how to improve the process, but the written and verbal feedback indicates that something useful already exists.

John Bricklemeyer, Eastman Kodak (two weeks after his first workshop at GM):

"I thought that the session at GM was excellent. It was very timely for me as I have been able to utilize many of our learnings around guiding principles, particularly as they relate to a flexible manufacturing environment. I think that this site was an excellent example of how to use "out of the box" thinking to solve problems without spending huge sums of money to develop technologically complex solutions. The types of innovation that I saw at GM has caused me to approach many of our activities in a different manner in order to more fully utilize the assets that we already have in unique ways.

Jack Ring, working with Miles Burke Technologies:

"The Change Drivers and RRS principles are key features of a new methodology for the engineering of businesses as complex, adaptive systems. This methodology will be tested [in a product to be introduced by Miles Burke Technologies] in 1998 to determine whether it overcomes the deficiencies of current practices in BPR and Management of Change in commercial businesses and virtual enterprises such as Value Chains.

"Heretofore, learning environments have been largely limited to the teaching paradigm -- lectures, case studies and laboratories. This paradigm does not create a community with consistent intents, objectives, mental models and tenacity. The Realsearch approach facilitates not only analogical reasoning but also gets participants to the level of principle-centered reasoning.

"Industry, government and academia are facing an era of complex, adaptive systems. It is essential that we learn how to design and operate such systems. Musicians can learn at Julliard. Architects can learn at the Bauhaus. Physicians can learn at Mayo or Menninger. Systems practitioners have had nowhere to go that can immerse them in the Problem and help them experiment with Solutions. Realsearch creates an environment and provides the co-facilitation that maximizes adult learning.

"In every workshop, participants have come to realizations and conceived candidate solutions that surprised themselves. This is applied creativity -- innovation.

"The Underlying Principles, to paraphrase a Chinese Proverb: tell me and I forget, show me and I misunderstand, let me try it and I remember, help me have a success and I will apply it.

Dan Henke with Pratt & Whitney:

"The workshop forum provides a method to assess a number of management systems with a common set of rules and semantics. The review process is not intended to provide an immediate “flash of light” leading to perfect solutions, but rather to gain a deeper knowledge of how management systems work to provide adaptability in the business arena.

"....the forum [workshop] gave me the tools to look at the various systems I have worked in and apply a structured method of assessment about what made them effective and vice versa. We are in the midst of reorganizing the PW Space Propulsion Business Unit and I have consistently attempted to infuse the knowledge gained from attending the forum [workshop].

Pete Holmes with Pratt & Whitney:

"Even at this early stage, there is a change initiative that can be related to our workshop findings: Empowered IPD (Integrated Product Development) teams. I think we will begin to see action plans take form over the next few months.

Nicole Deblieck of Rockwell Avionics and Communications:

"The groups have done a good job looking at relations, interfaces, and systems which are generic to all organizations, but with enough detail to be useful to the host company. Many times during the workshop I have noted ideas about my projects, which have been generated

during either the presentations or the breakout groups. I was pleased to see you working to generate a graphic to capture the key ideas. The workshop structure works well with the pre-reading, whole group presentations, and break-out sessions. The first two examples give enough time for group dynamics to be sorted out and some understanding for new participants on the concepts.

"I am currently working and planning ways to implement these new concepts on my current projects. I do find myself looking at all sorts of systems, work and non work, as frameworks and modules and evaluating how well they work. It has definitely affected the way I think of organizing interfaces, and systems.

Lisa Bogusz of Rockwell Avionics and Communications:

"I'm having a very interesting time with the development of a new product set to launch in 1998. We planned to release a sort of half-step of what the ultimate product will be, and follow that up the following year with the actual product. It took me about a half second to call forth my Agile principles and realize that we will get nothing reusable, scaleable, or reconfigurable out of this. Much to my surprise, after some discussion we agreed that it wasn't the right approach. We see this as an opportunity to implement some agile practices not seen here before.

Howard Kuhn of Concurrent Technologies Corporation: (Immediately following their workshop which explored new positioning strategy.)

"The most immediate impact of our workshop was to recognize the need to emphasize the role of our Fundamental Knowledge Base as a distinguishing feature of our capabilities. This will be a key ingredient in future marketing activities. In addition, we recognize that the ability to nurture this capability will be a major success factor in the future as knowledge workers, knowledge management, and knowledge exploitation take a more prominent role.

Patrick Kraus of Procter & Gamble:

"The workshops have been quite useful in generating thoughts related to my situation without necessarily trying to generate these thoughts. For me, this occurs for 2 reasons. First, I am physically disconnected from my problem because I am not in my office. Second, the workshops create a learning and question-asking environment that allows a participant to question things that he or she otherwise would not question.

"As a participant, the workshop environment (Realsearch) is the initial 'proving ground' for new skills that might not otherwise be taken out for a test drive. The workshop offers an intensive, but relaxed atmosphere to test out these new concepts and tools without risking judgement from your parent company before you are ready for it.

"I thought the CTC articles were especially useful. They provide a good 'warm up' to the Analysis and Application exercises. I think your instructions to the reviewer are useful in focussing the review to a well-defined end point.

"I would prefer working only one 'Analysis' exercise so that we can carry it through the entire process (change issues, 10 principles, system definition, module definition, strawman diagram). I would like to see more focus on how the 10 principles manifest themselves in a known system. I think focusing on one 'Analysis' exercise will accomplish this.

"I would like to see the output of the 'Analysis' to be a strawman diagram [*local metaphor model*]. This would help focus the effort toward a concrete deliverable as well as summarize the findings of each break-out group so that a participant has some documented examples of using process before he/she returns home.

"It might be worth some more 'up front' time to go over the work process. I realize that many people have been through many sessions, and they might feel that this is wasted time. I think everyone would benefit.

In Summary

Does the Realsearch process work? Does it produce a facility with new knowledge that has the depth of insight? How long does that take?

My observations are that little is evident after a single workshop, the light goes on during the second workshop, and something approaching insight occurs for some in the third and for many in the fourth exposure. At three days per workshop that's something like 9-12 days invested in high-leverage business-related learning with immediate application. Our sampling experience at this point is too small to make any strong claims, however.

Realsearch is not a recipe driven concept by design: 1) we need ways to differentiate our businesses, not conformity that eliminates competition, 2) the nature of the complexity we deal with requires complexity-compatible response, 3) though people are generally uncomfortable in the hard work of deep thinking/learning activity, that is what produces insight.

The future will continue to evolve the strategic themes of Realsearch and refine the process. We want to find effective ways to expand to larger groups and IntraNet delivery. We are still learning, but common ground revolves around a focus on real and interesting problems, mixed participants, running parallel teams, building local metaphors, issue-focus/principle-base, making people think and create new insight patterns.

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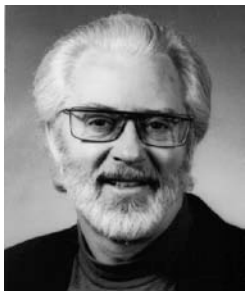

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Appendix A
A Local Metaphor Example

A structured presentation of the salient features of a respected process familiar to local people.

ASSEMBLY LINES BUILT JIT

Look through Fred Mauck's eyes for a moment. You work in the GM stamping plant outside of Pittsburgh that specializes in after-model-year body parts. Your principal customer is GM's Service Parts Organization. They might order '73 Chevelle hoods quantity 50, '84 Chevy Impala right fenders quantity 100, or '89 Cutlass Supreme right front doors quantity 300. Your plant stamps the sheet metal and then assembles a deliverable product. Small lots, high variety, hard-to-make-a-buck stuff.

Every new part that the plant takes on came from a production process at an OEM plant that occupied some thousands of square feet on the average; and the part was made with specialized equipment optimized for high volume runs and custom built for that part geometry. To stamp a new deck lid (trunk door) part you bring in a new die set - maybe six or seven dies, each the size of a full grown automobile, but weighing considerably more. And you bring in assembly equipment from an OEM line that might consist of a hemmer to fold the edges of the stamped metal, perhaps a pre-hemmer for a two-stage process, dedicated welding apparatus for joining the inner lid to the outer lid, adhesive equipment for applying mastic at part-specific locations, piercer units for part-specific holes, and automated custom material handling equipment for moving work between process workstations.

You got a call a few weeks ago that said your plant will start making the Celebrity deck lids, and production has to start in 21 days. Not too bad - sometimes you only have four days. For new business like this your job is to get the necessary assembly equipment from the OEM plant, reconfigure the equipment and process to fit your plant, and have people ready to produce quality parts in the next three weeks. Others are responsible for the die sets and stamping end of the production process.

In the last 12 months this happened 300 times. In the last five years you've recycled some 800,000 square feet of floor space in OEM plants for new model production. At this point you have assembly equipment and process for some 1000 different parts - but no extra floor space ever came with any of it.

And no extra floor space materialized in your plant either. Good thing you haven't needed it - the core competency here is rapid new-part starts, and small-lot, high-variety production - in a business that is traditionally based on high volume economics - and you've learned to do it without the usual capital budget. Eight years at this has evolved some pretty unique techniques - and a pretty unique culture as well.

You don't do this by yourself - you're a team leader that may use almost anyone from anywhere in the plant. At this point almost everyone is qualified to help bring in new work - surviving under these conditions has developed a can-do/let-me-at-it attitude almost everywhere, and a shared understanding of how to do it.

Eight years ago the plant went to a single job classification in production, cross training everyone on everything - a press operator one day might change dies as well, the next day work in the assembly area building hoods in the morning and fenders in the afternoon - and the following day go off to another plant to review a piece of equipment or part for how to bring it back.

For this new business Jim Lesniewski wanted to do the initial recon. He went on the last trip too, experimenting with his video camera. Now he thinks he's ready to do a perfect taping job. He got the idea himself while trying to bring several jobs at once back from another GM facility. This environment encourages self initiative.

In addition to taping the operational assembly process he added close-ups of key equipment pieces this time. In the debrief review everyone saw the same thing at the same time - there was almost no debate over what to bring back and what to ignore - and you got a jump on the equipment modifications by seeing what was needed in advance. Some time ago the value of having a good cross section represented in these reviews became evident: nobody gets surprised, everyone shares their knowledge, and when the equipment arrives the modification team is prepared.

Two keys at this stage: knowing what to bring back and knowing what modifications to make.

This new deck lid would be handled by bringing back the hemmer only; ignoring the mastic application machine, two welding robots, the welding fixtures, two press piercers, the shuttles, the press welders, and the three automated material handling fixtures. Basically bringing back a foot print of 200 square feet from a process that covered 2500 square feet. The rest will go to salvage disposition while the hemmer goes to "hemmer heaven" - that place in your plant where some 200 different hemmers hang out until needed.

That you only need the hemmer is where a key part of the plant's unique core competency comes to play. Rather than build a growing variety of product on some sort of omnipotent universal assembly line, a line that grows to

accommodate next year's unpredictable new business as well as the last ten-to-twenty years of legacy parts, this plant builds a custom assembly line for each product - and builds that assembly line just before it runs a batch of, say, 300 hoods. When the hoods are done you tear down the assembly line and build another one for fenders, perhaps, on the same floor space - and then run 500 or so fenders. Tear that down and build the next, and so forth. The same people that built the hoods build the fenders, and the deck lids, and the doors, and the .... and tomorrow some of them will be running a press, changing press dies, or running off to evaluate the next incoming equipment opportunity.

Necessity is the mother of invention - and the driving force here is the unrelenting requirement to increase product variety - without increasing costs or making capital investments. But fundamentally, for assembly, the scarcest resource is floor space.

Yes - a newly built customized assembly line for each and every small-batch run, every time, just in time.

The plant has six assembly areas, and can build any part in any of those areas. Usually you like to do the deck lids in the "A" area, though, as it has the most flexibility for welding.

While you were waiting for that new hemmer to arrive you designed the process system configuration. Betty Garrison and Denny Hanko usually do this as a team. Once they figure out which assembly modules are best and how they should be spaced, Betty and Denny put together a configuration sheet for the assembly system by cutting and pasting standard icons for each module and running it through the copy machine.

It wasn't always this easy, but you've learned a lot over the years. You build these assembly systems according to the one-page configuration diagram in Betty's three-ring binder - in real-time from reusable modules. Modules are easily moved into place and they share common interface standards and quick disconnects. On the average it takes about 15 minutes to break down the last assembly system and configure the next one.

First rule: Nothing is attached to the floor permanently. If it can't be lifted and carried easily by anybody it will have wheels on it, or as a last resort, fork-lift notches.

A typical deck lid assembly sequence might hem the outer skin, mastic some cushioning material to the inner skin, then weld a brace into place, and finally weld the inner skin to the outer skin in 30 places. In the process the material has to be turned over once and some gauging is done. The assembly system configuration might call for two three-foot roller tables in the front to receive the inner and outer pieces - think of these as hospital gurneys, on wheels, with rollers on top so the "patient" can be rolled across the table to the next station when the designated operation is complete. Next in line for the outer skin is the hemmer - it's on wheels too, and it's quick-connected to a standard controller off on the side out of the way. Yes, the controller is on wheels too. The outer skin is lifted into the hemmer with the aid of an overhead TDA Buddy - one advantage of doing lids in the "A" area: two TDA Buddies hang from the ceiling grid. When deck lids are assembled in another area a variant of the roller table is used that includes lifting aids. After hemming, inner and outer skins move to four-foot roller tables under the welding guns. The configuration sheet shows how many guns are active, where to position them, and which tip variant to install. All told there might be 12 simple icons on the sheet positioned in a *suggested* geometry.

A hemmer is a very specialized piece of machinery. When it comes to this plant it loses most of its specialness - and becomes plug compatible with all the other modules in the just-in-time assembly family. Importantly, the integrated controls are removed and quick-connect ports installed to interface with the one standard electronic/hydraulic controller used for all hemmers. It is modified if necessary to work with one of the six standard control programs. Maybe a seventh will be added some day, but six has covered all needs so far. Finally, the set-up sequence for the hemmer is typed up and attached to its side - better there than in a file drawer.

Hemmers are pooled in hemmer heaven awaiting their time in the assembly area - each one being individually part specific. Other pools hold variants of standardized modules that have use in multiple assembly systems: twelve different types of roller tables, two types of quick-connect weld guns, three types of weld tips, one standard controller type, six standard downloadable controller programs, and other reusable standardized items.

Whatever the configuration sheet shows is quickly carried, rolled, or forked into place, quick-connected or downloaded if required, and ready for action. The assembly area has an overhead utility framework that enables the adaptability below; providing tracked weld-gun hookups, quick-connect power and air, light, and water. The operating atmosphere is not unlike the hospital operating room - except patient throughput is a lot faster - fast enough in this case to satisfy service parts economics.

It is common for production team members to make real-time changes to the configuration when they find a better way - better is better, and everyone knows what that means.

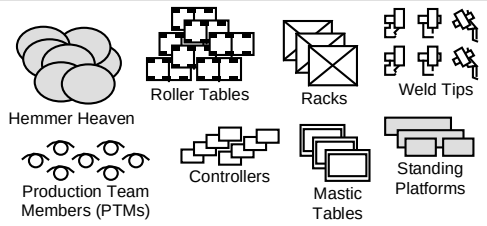
Rule two: People rule. These assembly systems take advantage of the fact that people think better and adjust better than automated positioning devices, cast-in-stone configuration sheets, and ivory-tower industrial engineers. People bring flexibility when they are enabled and supported, but not constrained, by mechanical and electronic aids.

Iconic Model: Small-Lot Auto Body Assembly Lines Built JIT

Change Proficiency

Key Proactive Issues:
Creation:
Assembly line construction
Improvement:
Space productivity
Migration:
New performance metrics
Addition/Subtraction:
PTM staff changes

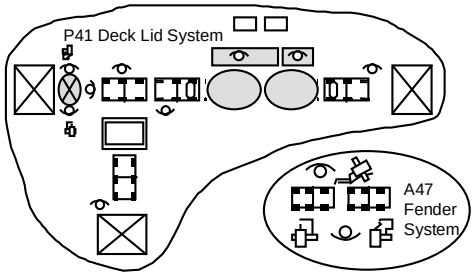
Key Reactive Issues:
Correction:
Labor/mgmnt relations
Variation:
System set-up time
Expansion:
Space availability
Reconfiguration:
Flexibility culture



Reconfigurable-System Engineering

Configuration Team Builds/Obtains/Modifies Most Modules, Evolves Specific Framework Standards, and Designs Assembly System Configurations.
Production Team Builds and Tears Down Assembly Systems.

System Examples



Reusable Modules:
- Cross-trained PTMs (Production Team Members)
- Roller tables
- Weld tips
- Hemmers
- Controllers
- Mastic tables
- Racks
- Standing platforms
- Et al ....

Compatibility Framework:
- Overhead support grid
- Physical space
- Utility standards
- System compatibility rules
- Unit compatibility rules
- Plant flexibility culture
- Local union contract

Selected Observations of System Design Principles	
Self Contained Units: System composed of distinct, separable, self-sufficient units not intimately integrated. • Hemmers with set-up data sheet, quick-disconnect sockets, and wheels. • Modules enumerated above plus: Standard control programs, multiple assembly areas, special fixtures, mastic templates, weld guns.	**Flexible Capacity:** Unrestricted unit populations that allow large increases and decreases in total unit population. • Number of simultaneous assembly configurations limited only by assembly area space availability. • Number of modules limited only by contiguous storage space availability and access logistics for remote warehousing.
Plug Compatibility: System units share common interaction and interface standards, and are easily inserted or removed. • Unit Compatibility Rules (hemmers): no integrated controllers, standard controller interface, use 1 of 6 standard controller programs, common piping/wiring, quick disconnect fittings. • System Compatibility Rules: Nothing attached to the floor, everything carry/roll/fork portable, etc.	**Unit Redundancy:** Duplicate unit types or capabilities to provide capacity fluctuation options and fault tolerance. • Eight identical controllers. • Cross-trained production team with one work classification. • Multiples of roller tables, mastic machines, standing platforms, racks, weld guns, weld tips, assembly areas, etc.
Facilitated Re-Use: Unit inventory management, modification tools, and designated maintenance responsibilities. • Configuration Team has responsibility for hardware/software module acquisition/modification/maintenance/inventory and for evolution of associated compatibility framework. • Management & Union share joint responsibility for PTM classification and cross-training.	**Evolving Standards:** Evolving, open system framework capable of accommodating legacy, common, and completely new units. • Used to leave useless wiring/switches/etc on incoming hemmers, now strip all un-used legacy items to eliminate maintenance confusion. • TDA Buddies added to overhead support grid in Area A. • Intuitive flexibility culture is now being explicitly formalized.
Non-Hierarchical Interaction: Non-hierarchical direct negotiation, communication, and interaction among system units. • Production Teams free to make process changes w/o seeking permission or approval. • Free communication permitted and encouraged among: tradesmen, engineer, supervisor, and customer.	**Distributed Control & Information:** Units respond to objectives; decisions made at point of knowledge; data retained locally but accessible globally. • PTMs (Production Team Members) make real time decisions on process configuration improvements and changes. • Operation sequence sheet attached to hemmer (facilitating easy movement to anywhere in the plant).
Deferred Commitment: Relationships are transient when possible; fixed binding is postponed until immediately necessary. • Process lines assembled JIT for production. • New-part acquisition/transfer team is not designated until a transfer opportunity requires action.	**Self Organizing Unit Relationships:** Dynamic unit alliances and scheduling; open bidding; and other self-adapting behaviors. • People show initiative in solving problems and making operating improvements on their own - because risk is encouraged and occasional failure is expected.