An Agile Enterprise Reference Model
with a Case Study of Remmele Engineering

An Agility Forum Project - AR96-04 - December 1996

Rick Dove, Paradigm Shift International
Sue Hartman, The Resultant Group
Steve Benson, Paradigm Shift International

Bound hard-copy versions of this report may be ordered from
either The Agility Forum or from Paradigm Shift International.

Table of Contents

Preface

This document is both a Reference Model and a Case Study. It is intended for the executive, strategic planner, manager, consultant, and *business engineer* who is looking for a model based on a real example rather than an abstraction.

Though there are discussions on the methodology and tools employed in the construction of the model and the application to Remmele, this document is not intended as a guidebook for applying the tools and reference model structure to additional industries or companies—such will be the subject of subsequent documents.

Several definitions are in order to put the document in proper perspective:

- Agility – The ability of an organization to adapt proficiently (thrive) in a continuously changing, unpredictable business environment
- Change Proficiency – Competency at causing and dealing with change
- Agile Enterprise – A broadly change-proficient enterprise; an enterprise that exhibits competency at causing and dealing with change in the important competitive business practices of its business sector
- General Reference Model – Issues of change across a representative generic set of critical business practices
- Industry Reference Model – General reference model with maturity stages identified for industry-specific critical practices
- Case Study – Company-specific responses to the issues of change posed within a reference model, and a synopsis of maturity status

Section A: An Introduction to the Reference Model

Agile processes and strategic objectives for the agile enterprise have been the subject of a growing number of corporate investigations, research efforts, and government initiatives internationally since 1991; yet each year a more vocal demand for an enterprise-wide reference model is raised. This document answers that demand by providing the first comprehensive agile enterprise reference model.

Sponsored by the Agility Forum, this 1996 reference model project had two principal goals: 1) design a reference model structure that effectively captures and displays the essence of enterprise-wide competency at both proactive and reactive change; and 2) validate the design with a rich, comprehensive example that provides an instructive reference case for an entire enterprise. The purpose is to provide a defining profile with examples for business managers and executives responsible for strategic planning, operational management, and reengineering.

The reference model spans 24 interrelated critical business practices in 6 categories: strategic planning (3), business case justification (3), organizational relationship management (7), knowledge management (4), innovation management (4), and performance metrics (3). The seven organizational relationships focus on business units, employees, partners, suppliers, customers, information systems, and production systems. Each of the 24 practices is presented in a 3–5 page structure that provides: a generic definition, the framework and modules of a case-study practice that fits that definition, a set of generic proactive and reactive change issues, case-study responses for each issue, and finally, a change proficiency maturity synopsis that evaluates and displays the competency of the case example using the recently developed *Change Proficiency Maturity Model*.

Structure of the Agile Enterprise Reference Model

The case study providing the examples is of Remmele Engineering: a $100 million, four-division, five-plant, Minnesota-based machining company that serves aerospace, defense, electronic, medical, automotive, and electronic industries. Remmele was chosen very carefully for its observable broad proficiencies at change, discovered when the Agility Forum's Operations Focus Group conducted an analysis of production practices there in 1995 [1, 3]. It is important to understand that Remmele exhibits more competency at broad change proficiency than any other company we have examined to date and owes this competency to procedures that are instructive and exportable to companies of any size and in any business sector. Thus, the lessons to be learned from the Remmele case are not restricted in applicability to their specific industry, nor are they dependent upon Remmele's size or private ownership status.

We define an agile enterprise as one that is broadly change-proficient; i.e., it exhibits competency at causing and dealing with change in the important competitive business practices of its business sector. There are three key concepts involved in this definition: change proficiency, critical business practices, and competency. Each of these concepts and the analytical tools employed in the case-study development will be discussed briefly.

A five-stage maturity model framework was recently developed as a tool to assess existing corporate competency at change proficiency, as well as to prioritize and guide an Agility transformation or improvement strategy. The framework is based upon a progression through five stages of working knowledge and strategic focus for practices and procedures, with separate competency tracks for both proactive and reactive proficiencies. The framework is used to build a *Change Proficiency Maturity Model* for a specific business practice.
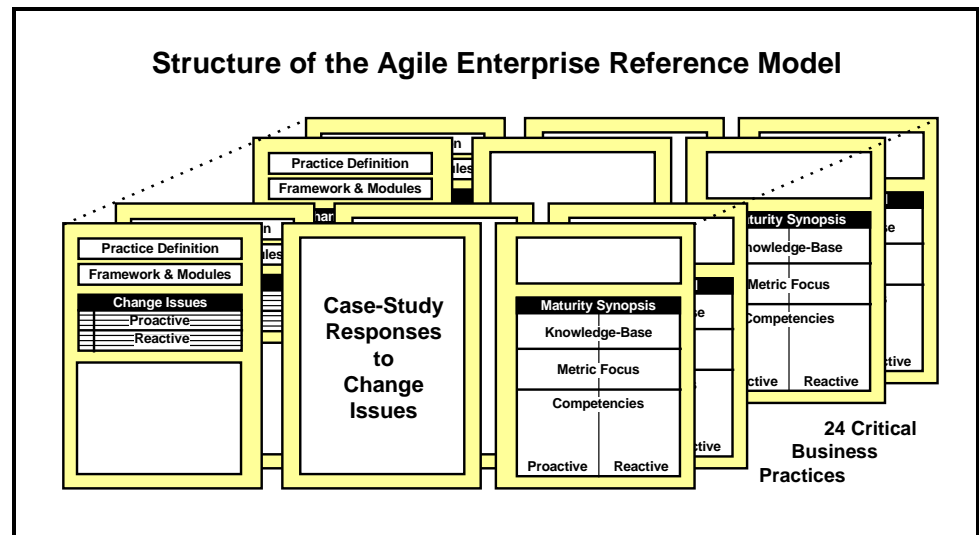
We focus on change proficiency as a necessary and fundamental enabler for the agile enterprise. We also recognize that an agile enterprise can be as simple as a portfolio management company that constantly reshuffles the inagile resources it controls, or as complex as a vertically integrated organization concerned about the Agility of each of its operating units, which in turn are concerned 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 they 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.

We do not gauge a company's progress toward timeless mastery at change proficiency by accumulating points for practices like teaming, mass customization, virtual partnering, integrated product/process development, and other such very important concepts of the day. Instead, 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 will become important tomorrow. Implementing today's competitive practices says nothing about the ability to implement tomorrow's.

The gauge of process mastery that makes a company timelessly agile measures a continuum from novice to professional at change proficiency. The nature of process improvement and mastery has become a major focus for many industries in the last few years. Maturity models developed by others for process mastery at total quality management (TQM) and also at software development have both provided role models for the *Change Proficiency Maturity Model* [7].

Important Definitions

1. Change Proficiency – Competency at causing and dealing with change.
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* to which the metric will be applied (e.g., *formation of partnership*).
4. Change Proficiency Measure – Time is measured in units of time, cost in units of money, robustness in predictability, and scope in lost opportunities and initiated innovations.

The framework shown in the accompanying figure is the foundation for the maturity model. 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. The key change issues for each critical business practice are developed using *Response Ability* analysis, which refers to a collection of analytical methods based on eight *Change Domains*, four in the proactive realm and four in the reactive realm [1, 5, 6].

The five-stage framework for change proficiency depicted in the accompanying figure moves from "accidental" to "mastery" as the business element under examination develops more competency at adaptation.

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

Change Proficiency Maturity Framework

	Stage	Knowledge	Metric Focus	Change Proficiency	
				Proactive	**Reactive**
Pre-Aware	**0: Accidental**	**Examples**	**Pass/Fail**	**Incompetent**	**Incompetent**
Required	**1: Repeatable**	**Concepts**	**Time**	**Creation**	**Correction**
	2: Defined	**Metrics**	**Cost**	**Improvement**	**Variation**
Advanced	**3: Managed**	**Rules**	**Robustness**	**Migration**	**Expansion**
	4: Mastered	**Principles**	**Scope**	**Modification**	**Reconfiguration**

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 a premium has to be paid. 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 by broadening the range of application.

Some level of competency in the change domains 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. On the proactive side, *migration* competency prepares an organization in advance to weather major transitions as non-events, while *modification* competency ensures that unique capabilities can be added and eliminated with relative ease. On the reactive side, *expansion* competency handles opportunities like production-rate doubling or necessities like staff reductions as painless events, while *reconfiguration* competency reassembles existing resources into new productive configurations easily. These more advanced stages generally require an underlying purposeful design rather than a mere diligent honing of skills.

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 are: grueling overtime, downsizing, multiple reengineering attempts, management fad-of-the-day, fire-fighting, and expediting.

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 an elusive desire. 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, though they may neither be called such nor recognized as such. 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

Pro Forma Examples

Change Proficiency Maturity Stages		
Stages	General Maturity-Stage Characteristics	Example: Maintaining Skilled Human Resources
0: Accidental	Stumble through change, recognition but no awareness	Hire who'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 & 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

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

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 a constant fluid motion.

To assess the maturity of a practice one identifies the knowledge base employed in decision support, the metric focus of active strategies, and the exhibited competencies in both proactive and reactive change—all relative to a previously determined set of change issues. Experience with the Remmele case study found no difficulty in reaching a clear assessment consensus among the three team members for each of the twenty-four business practices. Though it is generally expected that separate assessments of proactive and reactive competencies in a specific practice will result in two separate maturity levels, this was not the case with Remmele. In all instances the proactive and reactive competencies for a specific business practice were identical. The team believes that this is due to the content, strength, and pervasiveness of Remmele's specific corporate ideology, which addresses the concept of continuous change at its core.

It is not the purpose of this document to provide a training or users guide for employing the *Change Proficiency Maturity Model*. This tool and a deeper discourse on its application methodology is the subject of a forthcoming paper to be presented at the Sixth National Agility Conference in March 1997.

Twenty-Four Critical Business Practices—The Reference Model Armature

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.

A "short-list" framework of business practices impacting an enterprise's change proficiency critical in today's general competitive environment was recently identified. This framework is the result of workshops conducted by the Agility Forum's '95/'96 Agile Business Practices Focus Group and reflects the realities and concerns in sectors that include electronics, autos/trucks, aerospace/defense, chemicals/process, computers, software, business reengineering, and management consulting.

Critical Business Practices Framework	
1.0 Strategic Planning .1 Strategic Plan Vision .2 Strategic Plan Dissemination .3 Strategic Plan Buy-In **2.0 Business Case Justification** .1 Capital Investment Justification .2 Infrastructure Invest. Justification .3 Business Engineering Invest. Just. **3.0 Organizational Relationship Mgmnt.** .1 Business Unit Relationships .2 Employee Relationships .3 Partner Relationships .4 Supplier Relationships .5 Customer Relationships .6 Information Sys Unit Relationships .7 Production Unit Relationships	**4.0 Innovation Management** .1 Product Innovation .2 Process Innovation .3 Practice/procedure Innovation .4 Strategy Innovation **5.0 Knowledge Management** .1 Knowledge Portfolio Strategy .2 Knowledge Generation .3 Knowledge Capture .4 Knowledge Mobilization **6.0 Performance Metrics** .1 Leading Indicator Metrics .2 Operating Metrics .3 Valuation Metrics

The purpose of this framework was 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 broader-based change proficiency.

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.

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 framework employed here is not timeless, but rather timely: it is both actionable and a necessary next step in general progress today.

There are issues about the change proficiency of a given practice, as well as issues about that practice's ability to support a change-proficient 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.

This reference model project adopted as an armature the critical business practices identified in the '95/'96 workshops [4]. As a first application for this framework, the eight-month project effort naturally resulted in some refinement and modification to the original taxonomy, eliminating one redundant practice and strengthening definitions for many others.

One of the 24 critical business practices used in the reference model is *Strategic Plan Buy-in*. 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.
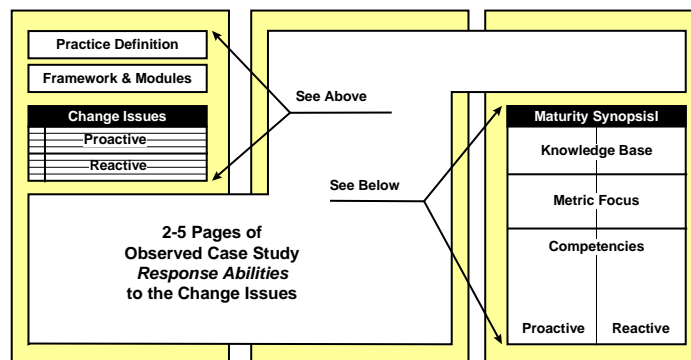
For instance: Clearly responding to a market demand created by Sun's Java and Netscape's browser, Microsoft's recent rabbit-out-of-a-hat Internet strategy is testament to the

---

Reference Model Business Practice Format
(Example from Remmele Case Study)

Critical Business Practice: 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	• 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

Practice Definition
Framework & Modules
Change Issues
Proactive
Reactive
See Above
2-5 Pages of Observed Case Study *Response Abilities* to the Change Issues
See Below
Maturity Synopsisl
Knowledge Base
Metric Focus
Competencies
Proactive   Reactive

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.

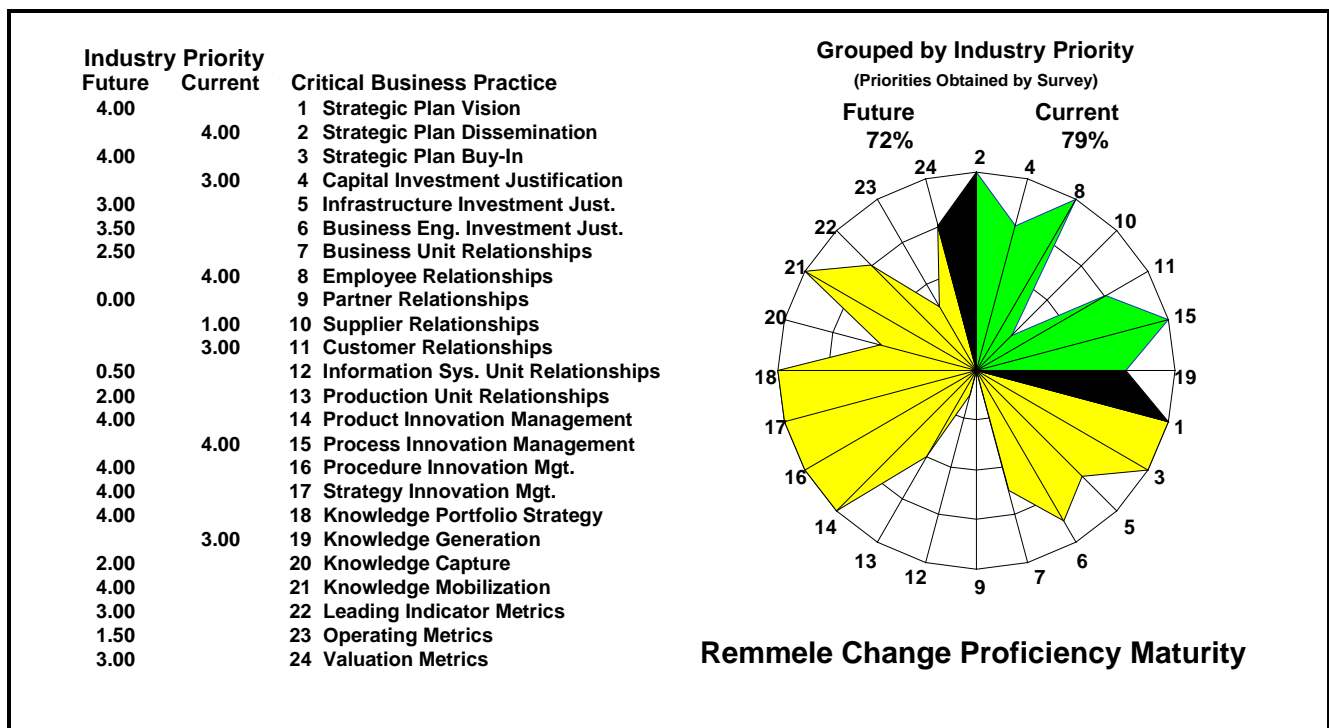| **Proactive Modification Competency:** Innovative contributions to the operating modes that satisfy strategic plans and vision occur as a matter of course, with employees exercising pre-screened skills and fulfilling expectations of their relationship to the organization. For instance, the station 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. |

---

ability of a billion-dollar company to turn on a dime. Microsoft accomplished this feat in less than a year. The important difference is in the corporate buy-in process.

In any specific industry sector some of these 24 critical business 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 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 synopsis description of this buy-in process at Remmele Engineering omits the back-up detail and implementation examples found in the reference model, 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; one which separates practices that are commonly recognized already in a business sector from ones which are still uncommon. The accompanying figure suggests how these two practice classes might 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.

Industry Priority		Critical Business Practice
Future	Current	
4.00		1 Strategic Plan Vision
	4.00	2 Strategic Plan Dissemination
4.00		3 Strategic Plan Buy-In
	3.00	4 Capital Investment Justification
3.00		5 Infrastructure Investment Just.
3.50		6 Business Eng. Investment Just.
2.50		7 Business Unit Relationships
	4.00	8 Employee Relationships
0.00		9 Partner Relationships
	1.00	10 Supplier Relationships
	3.00	11 Customer Relationships
0.50		12 Information Sys. Unit Relationships
2.00		13 Production Unit Relationships
4.00		14 Product Innovation Management
	4.00	15 Process Innovation Management
4.00		16 Procedure Innovation Mgt.
4.00		17 Strategy Innovation Mgt.
4.00		18 Knowledge Portfolio Strategy
	3.00	19 Knowledge Generation
2.00		20 Knowledge Capture
4.00		21 Knowledge Mobilization
3.00		22 Leading Indicator Metrics
1.50		23 Operating Metrics
3.00		24 Valuation Metrics

Grouped by Industry Priority
(Priorities Obtained by Survey)
Future 72%   Current 79%

Remmele Change Proficiency Maturity

In Conclusion

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, and a lot of other complicated stuff; and make sure that all the pieces and subsystems were compatible and functionally integrated. That's what has happened with this reference model and case study. We had the major subsystems conceptualized [5] and even some focused case examples documented [2], but until we tried to drive it down the road we hadn't addressed the integration and completeness issues.

This is a first attempt at integrating these concepts, and it was sometimes difficult to find precise meanings and interpretations for some of the business practice areas. We invite you to view these offerings as data and
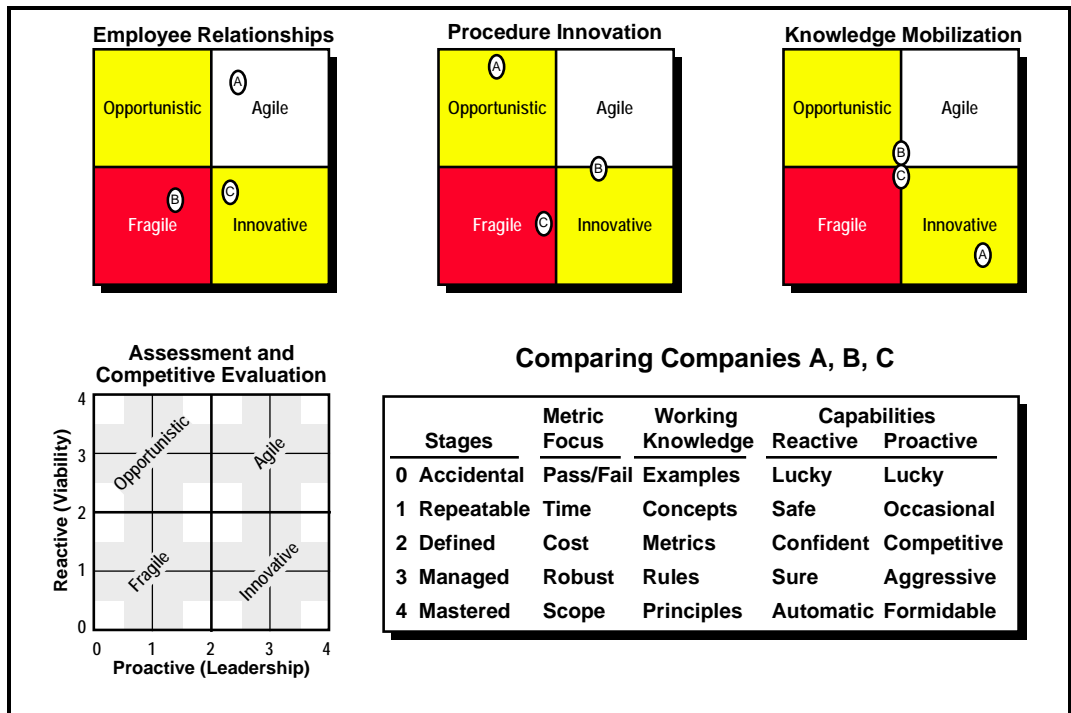
enlightenment, not as science and unambiguousness. There were times when we had to stop the (team-internal) debate in the interest of getting something done. Too many of the debates were circular and recursive, not leading to any unambiguous end-point. Well, such is life. If it were absolutely straightforward with a single correct interpretation there would be little left to the contest. Like people, there is no one correct yardstick that all can be measured against, some are better at some things then others, and the permutations are infinite. At any point in time one collection of strategies may be better suited for existence in a specific environment than another, but at another time or in another place the bets are different.

There are three elements in this reference "model": the first is an enterprise framework provided by the 24 critical business practices, the second offers a list of 200-plus objectives provided by the change issues, and the third gives examples of how one company, Remmele, successfully addresses most of these issues. Of the first: these 24 practices are presented as neither the only ones nor the particular ones that you might want to consider in your business, but they do provide a rich and comprehensive armature. Of the second: these 200-plus issues are not claimed to be universally appropriate; but they do provide a solid pro forma for any company to build upon. Of the third: Remmele's way is not the only way to attain change proficiency in the issues that face them—though we have come to believe that Remmele's reliance on an ideological infrastructure is a very powerful and perhaps even optimal way.

In addition to the reference model, we have included an assessment of Remmele's change proficiency maturity. We did this to discipline ourselves in the analysis and presentation of the reference model and also to verify that Remmele was in fact a role model of change proficiency.

Though we have tried to make each of the critical business practice sections reasonably stand alone, they are not totally independent, else they would each have to be much longer. Thus, reading about *Strategy Innovation Management* assumes the reader will also read the three related practices of *Strategic Plan Vision*, *Strategic Plan Dissemination*, and *Strategic Plan Buy-In*, as well as the three related practices of *Product Innovation Management*, *Process Innovation Management*, and *Practice/Procedure Innovation*.

We offer this reference model as a starting point to help you begin your own introspection. It identifies many key issues that must be addressed or at least considered when you set out to become more change proficient than you currently are. Importantly, it provides a means for competitive comparison and prioritizing improvement strategies. It also displays one company's approach to addressing most of these issues successfully.

Stages	Metric Focus	Working Knowledge	Capabilities	
			Reactive	Proactive
0 Accidental	Pass/Fail	Examples	Lucky	Lucky
1 Repeatable	Time	Concepts	Safe	Occasional
2 Defined	Cost	Metrics	Confident	Competitive
3 Managed	Robust	Rules	Sure	Aggressive
4 Mastered	Scope	Principles	Automatic	Formidable

Section B: An Introduction to the Case Study—Remmele Engineering Incorporated

They know what their competitors do, they know what their customers think, they know what technology has to offer, and they know what their capabilities are.

They know. The reasons they know are because they listen and because they continuously probe for the latest developments in all of these areas—and because they are genuinely curious and committed learners.

The company goal is to "Be the Best," the company T-shirt says "Pride in Quality," and the company people know how they stand in the industry. And yes, there is what appears to be some elitism here; but it stems from a shared ideology, the totally involved pursuit of objectives, and the active and open discourse that takes place among tightly aligned and highly competent teams, not from a sense of superiority. There is no arrogance here.

The biggest fear expressed by management during our analytical phase was that our report would hold them up as an untouchable paragon and create the seeds of hubris where none exist.

Management need not fear an onslaught of hubris from this portrait of the company. William Faulkner could have been explaining what drives Remmele when he wrote: "Don't bother just to be better than your contemporaries or predecessors. Try to be better than yourself." At most, this portrait will set a new mark to beat; but more than likely it will quickly become an aging snapshot in the history photo album.

History

The story and success of Remmele Engineering, Inc. (REI) are based on the vision of its founder Fred Remmele. In 1926, he immigrated to the United States from Heilbron, Germany. A skilled tool and die maker by trade, Mr. Remmele quickly found work in the Midwest, eventually settling in St. Paul. Over the next 20 years, he became a well-known and respected tool and die craftsman. During this period, however, he became increasingly disturbed by the disorganization of most machine shops. He also noticed that many employers displayed a lack of consideration toward their employees. When good ideas surfaced from the shop floor, they were often ignored by management.

In 1949 Fred Remmele put his ideas about managing a company to work. Along with Thomas S. Zastrow he started a tool and die business—the Fred L. Remmele Co. The firm was based on certain principles, including a respect for employees, a flexible and progressive management philosophy, a commitment to community service, and a desire to set the highest standards in both machining and in the design of custom machines.

In the beginning, the Fred L. Remmele Co. made custom equipment for producing curved printing plates, produced tools and dies, and did contract machining. Mr. Remmele's management style and the quality of his work gained him a steady stream of customers. Within a year, it was incorporated as Remmele Engineering, Inc. Within two years, it had moved to a new location and had 15 employees.

Over the next ten years, REI continued manufacturing custom-designed machines, including photo register equipment used in the printing industry and tape applying machines for 3M. REI also continued providing contract precision machining services.

As the company grew, Fred Remmele didn't forget those who helped make it a success. In 1956, he instituted the company's first profit-sharing plan. In 1962, Remmele Engineering moved again; this time to a 27,000 sq. ft. facility. To take advantage of the space, Mr. Remmele added $100,000 worth of new equipment. At this point, employment had grown to 55. By the end of the year, it had jumped to 75 and company sales exceeded $1 million.

The years between 1960 and 1980 marked a period of rapid expansion. In 1963, the company developed the fixtures that support the appliance during injection of foam insulation in refrigerators and freezers. It also developed machines to assemble typewriter ribbon cassettes, place magnetic tape on ledger cards, package carbon paper, and plate chain. In response to the growth, the company continued expanding—first to 44,000 sq. ft, then to 73,000 sq. ft. In 1970, the company purchased 67 acres near Big Lake, Minnesota. Eventually, it built two plants on the property.

Early on, Fred Remmele decided against borrowing to finance capital equipment. Instead, he used internal funding resources to acquire new machines and additional capabilities. The philosophy remains. Even today, the company finances virtually all its capital equipment using "inside" sources. Outside financing is occasionally used to purchase property and erect buildings.

In June of 1971, Fred Remmele retired as president of REI. He remained on the board until his death in 1981. Before he left the company, Fred Remmele made sure that it remained true to his vision of dedication to customers and employees alike. To that end, the company developed its own training center in 1974 and continued the machinist apprenticeship program that had been started in 1965. In 1975, it elected the first two members of an outside board of directors.

By 1976, REI reached $8 million in annual sales. To boost revenues, it set up a national sales rep organization. Within six years, revenues exceeded $26 million. Once again, the company added equipment and plant space, this time by purchasing a plant for its automation systems activities. In the late '80s, the company continued investing in equipment and people, often committing to a promising technology, then later finding the business to support it. By 1989 sales exceeded $60 million.

Today, Remmele Engineering has more than 475 employees and annual revenues of approximately $90 million. Its customers include computer companies, automotive manufacturers, the aerospace/aircraft/defense/space industry, and others. Even though the company is one of the largest job shops in the United States, it maintains the same philosophy that Fred Remmele began.

Operating Philosophy

Remmele's overall corporate goal is to be the "best in its field." The company also emphasizes customer satisfaction, employee satisfaction, profitability, and growth. To achieve these goals, Remmele has adopted several operating principles. These include:

1) Maintaining a small plant atmosphere: Remmele feels that good communication is important for profitable growth. To that end, the company guidelines state that the optimum desired employment at any one plant is 200 people and, to avoid excessive dependence and to limit risk, has guidelines that also limit the percentage of resources it will dedicate to one customer and the amount of business it will take in any one industry.

According to Remmele's management, this philosophy has a number of advantages. It helps management maintain close working relationships with their customers as well as their employees. It encourages diversification of jobs and customers. It allows Remmele to maintain a nurturing environment. It gives employees the opportunity for recognition based on their contributions, and that leads to high morale. It also allows Remmele to avoid dramatic declines that come from having "all their eggs in one basket."

In addition, keeping the plant small enables customers to know everyone involved in their job. For their part, the employees feel a sense of "ownership." Recently, a prospective customer visited one of Remmele's plants unannounced and met with the group supervisor and machine operator, as management was otherwise engaged. The operator showed the customer how he was going to approach the project and showed his thought preparation with a software package that displayed the tool path he had worked out. The prospect became a customer, impressed that Remmele's operators knew exactly what they were going to do from a technical perspective during the estimation and proposal stage.

When a plant grows too large, Remmele will spin off one of its capabilities into an independent operating unit. This helps maintain an entrepreneurial atmosphere, sense of excitement, and team spirit within the company. Employees want to know "When are we going to split off and become our own plant or division?"

2) Encouraging Employee Loyalty: The company's overriding philosophy is "We all succeed or fail together." Remmele tries to empower everyone. For example, when the company was deciding whether to establish high velocity machining capability, it formed a committee of a half-dozen people, four of whom were machinists, to make the recommendation. The committee searched the world for the best equipment available, eventually visiting machine manufacturers in France and Germany, and talking to their customers. The committee returned with a recommendation that was presented to all divisional employees by the machinists on the committee.

To insure availability of the highest skilled machinists, and encourage the learning environment, Remmele invests as much as $100,000 in apprenticeship and training programs for new employees. The company also provides 100% tuition reimbursement for every employee, in any field as long as it is related to some function at the company.

Remmele is a non-union shop that believes in paying its employees a competitive wage. Remmele competes for highly skilled people where journeyperson machinists can earn $50,000 per year or more. In addition, the company maintains a profit-sharing program based on corporate profitability.

The company values its employees as family and will reduce hours to avoid layoffs. It conducts a yearly attitude survey. It will give employees as much responsibility as possible. For example, machine operators in one division are also responsible for purchasing, quality control, and machine maintenance. In essence, they are in charge of their own performance and their own success. To that end, Remmele employees are often involved in the hiring process. Typically, those who will work with a potential employee will interview and help make the hiring decision.

For their part, employees are encouraged to suggest improvements and develop solutions to customer problems or demands, instead of waiting for solutions to come from management. They are also expected to return the company's loyalty through their performance on the job, in keeping with the corporate goal to "Be the Best" in its field.

3) Practicing the Art of Informed Risk: Remmele encourages its employees to make decisions based on knowledge. Mistakes and even losses are accepted as part of the learning curve.

The company invests heavily and constantly in new technologies and is recognized by both competitors and customers for its leadership here. Typically the company will commit millions of dollars to a new technology or piece of equipment, and to the learning curve, before taking the capability to market.

Recently a five-axis machine was purchased without any exhibited interest from customers to influence the decision. It had been using three-axis capability for some jobs that could use a five-axis machine effectively, and they perceived a potential market for five-axis machine application. After learning and experience with the new equipment developed knowledge and skills, the company promoted the capability to current and potential customers. This led to the new tooling "design and build" segment of its business.

In another example, a particular part needed more cost-effective production. Both the customer and Remmele looked for ways to reduce or eliminate assembly time and the need for assembly equipment. Remmele spent a year and half exploring process technology alternatives. The knowledge the company gained not only helped them address the customer's needs but served to increase machining speeds in applications throughout the company.

Their eye is always on the long term. When learning is combined with perceived potential they will subsidize a loss. Its Automation Division was carried through several years of money-losing operation when conditions changed that removed a traditional market. Belief in the people and the perception of long-term value, coupled with hard-working attempts at different approaches, now pays off as the plant has returned to profitability.

Organization and Lines of Business

In 1996 Remmele Engineering consists of five plants grouped in four divisions. They are a privately held company with shareholders among the descendent family of Fred Remmele, who turned over the presidency in 1971 to Ron Pfleider, a long-time customer at Franklin Manufacturing. Mr. Pfleider was succeeded in 1976 by Mr. Remmele's son-in-law, Bill Saul. Mr. Saul is now semi-retired and chairman of the board. In 1984 Mr. Saul turned over management of the company to the current president Tom Moore and others notably not of the founding family. Management is clearly responsible for the operation and strategic direction of the company at this point and enjoys a relationship with its board similar to that of a public company.

The General Machining Division has two plants. Plant 10 produces low quantity or small lot runs in a 111,000 sq. ft. facility that incorporates design/build of tooling, fixturing, and fabrication and utilizes five-axis machining and other advanced equipment to produce parts up to 10 tons and 10 feet. Plant 40 is a 153,000 sq. ft. facility that produces low volumes and large parts (up to 75 tons and 100 feet) and features a 100 ft. CNC 7-inch milling and boring machine and a five-axis mill with 63 feet of travel.

The Repetitive Batch Machining Division is housed in Plant 20, a 49,000 sq. ft. facility dedicated to repetitive batch manufacturing of medium-sized parts and assemblies in medium volumes. It specializes in parts that can fit within a two-foot cube and features machining centers and flexible manufacturing systems with operating speeds up to 40,000 RPM.

The Production Machining Division is housed in the 60,000 sq. ft. Plant 30 facility. It features a focused-factory cell concept that does a lot of dedicated outsourcing and can produce high volumes of precision machined parts. It is particularly suited to work in the two-foot-cube-and-under category, with special capabilities for miniature precision machined parts typically under one cubic inch in size. The plant also features a class 100 clean room.

The Automation Division is in the 87,000 sq. ft. Plant 50 and houses engineering and design services for developing one-of-a-kind factory automation equipment and systems. The facility contains design, fabrication, parts machining, assembly and testing capabilities.

In Conclusion

Remmele showed some initial concern that we would paint them as too accomplished, taking the edge off their continued quest. Later, when reviewing our maturity assessments, the opposite reaction occurred: Some of the management team felt that they were not showing as good as their striving-to-be-the-best should produce. We suggested that they were so far ahead of anyone else that this didn't matter and that this whole area of change proficiency is not an area that has a history of focus as yet. We also observed that things were moving so fast that our snapshot of Remmele's status was already fading. In the eight-month project effort we witnessed information technology strategy come a long way in the direction of greater change proficiency maturity, we witnessed a high velocity machining experiment turn in to a new line of business, and we witnessed one division that had lost important sustaining business come back with a vengeance.

Principles play the key role in Remmele's achievements, and we refer to collections of these principles as frameworks for many of the individual *critical business practices*. No attempt has been made at this point to reduce the principles to a minimal but sufficient set in each of these cases, as that exercise is beyond the scope of this work—but nevertheless a very promising avenue of exploration.

Yes, they are mainly a family-owned business, but don't make the mistake of dismissing them as a role model because you are a massive publicly-traded corporation. Here is a laboratory you can observe.

No numbers can capture and compare an agile enterprise any more than a single figure of merit can compare two living organisms for viability in untested circumstances; such a thing is organic by nature. We go through this numeric exercise to discipline our thoughts and broaden our exploration—much like many view the exercise of Baldrige application rather than actual implementation as the value. It is a mistake to think that there is anything absolute about the figures of merit we will show. Developing them and showing them, however, is thought-provoking and leaves behind a richer understanding in the wake.
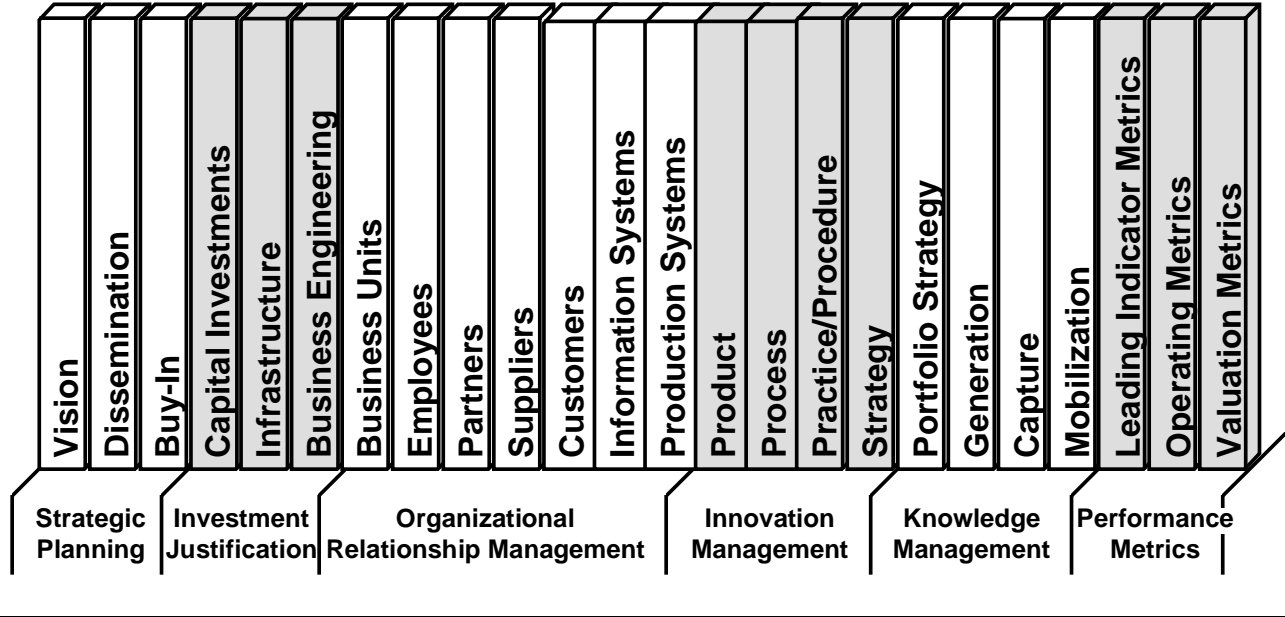
Please pardon the multiple use of specific stories in the case study. Many are so rich in detail and implementation breadth that they provide good example material across many different business practices. The points being made, however, are different in each use.

So read on, and see an agile enterprise in action. It is not always on top of everything—but it has practices in place to recognize and attend to those areas that fall from grace—and the constant pressure of unrelenting change requires constant vigilance, as no area is brought to the top once and for all.
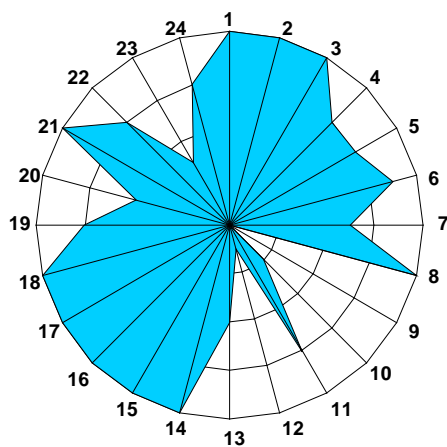
Section C: Integrated Reference Model and Case Study

Twenty-Four Critical Business Practices for Agility

General Cross-Industry Priorities - 1996

Vision | Dissemination | Buy-In | Capital Investments | Infrastructure | Business Engineering | Business Units | Employees | Partners | Suppliers | Customers | Information Systems | Production Systems | Product | Process | Practice/Procedure | Strategy | Portfolio Strategy | Generation | Capture | Mobilization | Leading Indicator Metrics | Operating Metrics | Valuation Metrics

Strategic Planning | Investment Justification | Organizational Relationship Management | Innovation Management | Knowledge Management | Performance Metrics

Remmele Change Proficiency Profile

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

Maturity		Critical Business Practice
4.0	1	1.1 Strategic Plan Vision
4.0	2	1.2 Strategic Plan Dissemination
4.0	3	1.3 Strategic Plan Buy-In
3.0	4	2.1 Capital Investment Justification
3.0	5	2.2 Infrastructure Investment Just.
3.5	6	2.3 Business Eng. Investment Just.
2.5	7	3.1 Business Unit Relationships
4.0	8	3.2 Employee Relationships
0.0	9	3.3 Partner Relationships
1.0	10	3.4 Supplier Relationships
3.0	11	3.5 Customer Relationships
0.5	12	3.6 Information System Relationships
2.0	13	3.7 Production System Relationships
4.0	14	4.1 Product Innovation Management
4.0	15	4.2 Process Innovation Management
4.0	16	4.3 Procedure Innovation Mgmnt.
4.0	17	4.4 Strategy Innovation Management
4.0	18	5.1 Knowledge Portfolio Strategy
3.0	19	5.2 Knowledge Generation
2.0	20	5.3 Knowledge Capture
4.0	21	5.4 Knowledge Mobilization
3.0	22	6.1 Leading Indicator Metrics
1.5	23	6.2 Operating Metrics
3.0	24	6.3 Valuation Metrics

1.1 Strategic Plan Vision: A vision of the organization in the future in terms of its opportunities, capabilities, personality, achievements, operational modalities, and other such descriptive elements—and the strategies for attaining it. Generally applicable Agility issues include the creation of a vision that is in synergy with forces already in motion which have potential to restructure industry profoundly and maintaining that vision in relationship to a changing environment.

The foundation for the corporate vision is explicitly stated in the corporate mission and strategic policy statements (see Appendix) and is compatibly reinforced with the implicit corporate culture. Within this evolving framework an annual planning process develops explicit strategies to support immediate opportunities and promising innovations.

Proactive Change Proficiency Issues	
Creation	• Creating a profound vision synergistic with forces of change in the industry
Augmentation	• Improving the vision with additional detail and useful boundary metrics
Migration	• Maintaining consistent core vision in changing environment and as corporate capabilities mature/evolve
Modification	• Thoughtfully adding new synergistic elements to the vision over time without appearing faddish
Reactive Change Proficiency Issues	
Correction	
Variation	• Interpreting the vision for maximum effect at different plants/divisions with different opportunities
Expansion	• Increasing the number of strategies pursued as the company grows, without increasing the risk
Reconfiguration	• Reinterpreting the vision and quickly assembling strategies to satisfy appropriate surprise opportunities

Creating a profound vision synergistic with forces of change in the industry
- "Visionary companies are premier institutions—the crown jewels—in their industries, widely admired by their peers and having a long track record of making a significant impact on the world around them. The key point is that a visionary company is an *organization*—an institution. *All* leaders, no matter how charismatic or visionary, eventually die; and all visionary products and services—all 'great ideas'—eventually become obsolete. Indeed, entire markets can become obsolete and disappear. Yet visionary *companies* prosper over long periods of time, through multiple product life cycles and multiple generations of active leaders."[1] Appropriate words to put this practice in perspective as carried out at Remmele.
- In Remmele's case the corporate vision goes well beyond a statement of long-term goals and strategic intent to provide a comprehensive operating ideology. The corporate statements on mission and strategic policies (see Appendix) define the corporate vision in explicit actionable terms and notably lean heavily on a platform of being best in an environment of continuous change and constant learning. Principles guiding the annual strategy development and review include clear objectives, defined success metrics, tactical implementation plans, specific responsibilities, and accountability.
- Their goal is to be among the best few in their business at both total revenues *and* profit margins—tough since the best margins are generally turned in by small $2–3 million shops with niche specialties, captured customers, or focused competency.
- Remmele sees themselves in the metal-cutting business, though they dabble now and then with cutting ceramics and composites. They see a $15–20 billion industry that has a lot of turmoil (customer's design engineers get points for eliminating machining requirements), yet they see no need to broaden their activities into plastics or near-net-shape metal working (as yet). They do, however, have an automation division that builds custom factory automation equipment and was supported through several years of loss because it was valued as an entree into another business while being synergistic and counter-cyclical with the core business, which helps keep the company on an even keel.
- Though Remmele's nurturing of a strong ideology pre-dates the book *Built to Last* [2], they cite it as having some influence, probably in focusing and strengthening their resolve that a strong functional ideology is a valuable thing.

Improving the vision with additional detail and useful boundary metrics
- Metric guidelines make the issues very precise: To ensure good communication the company shall consist of small focused plants of 200 people or less; to manage risk no plant shall have greater than 30% from a single customer, and the company shall not have greater than 30% from any industry sector; capital investment will equal at least the prior year's depreciation, pre-tax margins should exceed industry averages in order to fuel

aggressive capital investment; growth planning will constrain itself to a risk-manageable 10%-per-year average; the apprenticeship program requires 40 people to serve projected needs.

Maintaining consistent core vision in changing environment and as corporate capabilities mature/evolve

- Whereas common industry practice would welcome new business that is totally absorbing and doesn't require any more marketing, Remmele has on more than one occasion limited how much they would do for a customer in order to keep from being overly dependent. When they were smaller they stayed away from automotive markets for this reason. Recently a major prospect moving its production from Europe to the U.S. wanted Remmele to do all of their parts—Remmele declined because it couldn't staff the opportunity properly without draining good resources from other parts of the company and putting them into a dedicated unit that was outside their strategic policy guidelines. Remmele has even turned down additional business from existing customers when it exceeds their guidelines, knowing that they will help create a competitor that can be subsequently played against them. One division that is currently underutilized and losing money as a result is refusing opportunities to fill the plant with jobs that won't meet profit targets—knowing that these will be long-term commitments which will preclude the taking of a better job found later. Strategic policies are appreciated for their long-term values.

Thoughtfully adding new synergistic elements to the vision over time without appearing faddish

- In today's buzzword-rich reengineering frenzy, mission statements and strategic plans are full of politically correct objectives and laced with statements about exceeding customer expectations. Dutifully displayed on the walls of American companies, these plaques rarely resemble the company that the employees know. At Remmele you will find the Mission, Guiding Principles, and Customer Satisfaction Statements (see Appendix) on the wall, and you'll also see them enacted in the daily actions of virtually every employee. These three single-page statements are written from the heart of the company and reflect operating reality rather than a wished-for image.

Interpreting the vision for maximum effect at different plants/divisions with different opportunities

- Interpretive variation is facilitated by visions defined with boundary metrics. "Boundary systems are based on a simple, yet profound management principle that can be called the 'power of negative thinking.' Ask yourself the question, 'If I want my employees to be creative and entrepreneurial, am I better off telling them what to do or telling them what *not* to do?'"[2] Each plant at Remmele has latitude on interpreting the vision to fit it to the realities of their specific market, as well as grace periods during growth and unusual situations. The company is objectively persistent but not dogmatic about its strategies and time tables. And importantly, the vision and strategy contain specific boundary metrics couched as guidelines.

Increasing the number of strategies pursued as the company grows, without increasing the risk

- The annual planning process has continued to evolve each year as the company grows and now generates a comprehensive planning document with strategies, time tables, and accountability for each corporate functional unit and operating division. These detailed plans are "synopsized" in a digestible strategic overview that rolls the evolving core vision forward, describes the current state of the business and immediate action plans, and serves as a highly candid annual report to the shareholders. Over time, new divisional units have been split off from mature divisions as new lines of business have developed. The basic corporate vision sets up these new units as autonomous empowered operating entities, thereby cloning the ability to develop and manage strategic pursuits in line with the company vision.

Reinterpreting vision and quickly assembling strategies to satisfy appropriate surprise opportunities

- Remmele's entry into the miniature precision-machined parts business ultimately occurred when someone approached them with an opportunity, but they were able to take advantage of the opportunity only because a previous self-initiated unsuccessful attempt had built a knowledge base of technology and methodology that could be quickly deployed. They discovered in the earlier unsuccessful attempt that small parts are built with very different technologies and methods than those employed in the core machining business, which necessitated a broader interpretation of the corporate vision than had previously been held.

Change Proficiency Maturity—Strategic Plan Vision Mastered Stage (4) for Both Proactive and Reactive Change Proficiency
Principles Knowledge Base: The principles employed in the development and evolution of a profound vision at Remmele are found primarily in the Guiding Principles statement (see Appendix) and have themselves evolved as an integral part of the vision. Notably, they include operative statements about customer satisfaction, employee satisfaction, growth, community service, and profits.
Scope Metric Focus: The annual planning and visioning process is well past the point where time and cost of development and evolution are a concern, as the effort is consistently effective and considered a necessary part of employee participation and learning. The process is robust with clear, pervasive, and comprehensive methods that enable virtually all participants to contribute effectively and in reasonable concert with the eventual outcome—few surprises occur. The scope of the vision and its actual practice has broadened over the years to encompass virtually all aspects of the organization and its various relationships including: employee satisfaction, customer satisfaction, community service, and stockholder satisfaction, as well as excellence and growth in the markets they pursue.

Proactively Formidable—Modification Competency:	Reactively Automatic—Reconfiguration Competency:
Proactively Formidable—Modification Competency: Vision and strategy are reviewed, refined, and modified annually by formal procedures that involve virtually everyone in the company. "Being the best in their industry" is the stated goal element of the vision today and was articulated relatively recently as a way to capture the way the company was actually driven. Achieving growth through a "well planned, effective marketing program" is another example adding to the vision, where both a means and a distinctive approach in their industry are installed at the core of the organization's personality.	**Reactively Automatic—Reconfiguration Competency:** The learning culture and respect for knowledge often results in Remmele experimenting with and developing strategies as well as technological know-how that turn out to have no immediate value. These are not considered failures but are stockpiled for later use and refinement when appropriate opportunities provide the earlier missing ingredients. At the same time, the vision is always open for thoughtful reinterpretation when an appropriate but unexpected opportunity presents itself. Their entry into the small parts business was enabled by a previous unsuccessful attempt and necessitated the embracing of methods and technologies very different from the established core business at the heart of the corporate vision.

[1] J. Collins and J. Porras, *Built to Last* (New York: Harper Business, 1991), p. 1.
[2] R. Simons, "Control in an Age of Empowerment," *Harvard Business Review*, March–April 1995.

1.2 Strategic Plan Dissemination: The process of making members of an organization aware and appreciative of the organizational vision and strategies. This process is one of information and knowledge transfer and does not involve agreement or disagreement. Generally applicable Agility issues include the breadth of dissemination throughout the organization; the accommodation of both improved understanding as well as substantive changes in the message when appropriate; and the ability to bring new membership in the organization up to speed quickly.

The foundation of the dissemination practice at Remmele is the explicit emphasis on trust, open communications, and informed risk-taking found in the Guiding Principles (see Appendix). Within this framework specific messages are disseminated through a variety of channels such as the employee newsletters, the Strategic Overview, the employee's handbook, management talks, and frequent interactive meetings. In general, a mature dissemination practice is distinguished by a broad selection of channels that can be used effectively for complex and sensitive messages.

Proactive Change Proficiency Issues	
Creation	• Creating an effective process that communicates to all without wasting time and productivity
Augmentation	• Communicating deeper understandings
Migration	•
Modification	• Communicating new changes without appearing rudderless
Reactive Change Proficiency Issues	
Correction	• Correcting miscommunication and shortsighted plans before damage is done
Variation	• Communicating fast-breaking events of import before the rumor mill creates misinformation
Expansion	• Bringing new employees up to speed with everyone else quickly
Reconfiguration	• Utilizing newsletter and other non–work-disruptive channels effectively for important messages

Creating an effective process that communicates to all without wasting time and productivity
• Remmele's president conducts an all-hands meeting at each plant twice a year, which generally involves two to three sessions in order to cover everyone on all shifts. In the spirit of fully open communications, these meeting sessions are 1½ hours in duration, start with a 30-minute brief presentation about results and the business plan, and then answer anonymous questions that have been collected on cards and read aloud by someone appointed to that task. People ask tough questions, like "Why do people in the office get coffee and we don't on the floor?", "Why did we buy three computers when the old ones looked OK?", "How much do the stockholders remove from the business?", and "Why are we spending money flying to China when there's plenty of business here in the USA?".
• Increasingly, some key dissemination occurs by virtue of direct employee involvement in the decisions that affect them. For instance, hourly employees' input is solicited by management in preparation for the annual general pay increase decision. Information is shared regarding business prospects, pay actions of other companies, company wage rates and benefit programs compared to competitors, the effect of the company's merit pay program on total wage expenses, and changes in the local cost of living index. With access to the same information management considers, employees are asked to anonymously recommend the general increase amount to senior management. The results of their input are published with the announcement regarding the general increase decision.

Communicating deeper understandings
• At Remmele, the complete corporate Strategic Plan is available to any employee, as is the more digestible Strategic Overview (see Appendix). Both documents show implementation procedures and metrics tied to objectives. One employee newsletter features comprehensive financial and performance reporting as well as insightful discussion on strategic issues and plans authored personally by management. Face-to-face dissemination practices at Remmele feature and encourage open questioning in order to facilitate deeper and more comprehensive understandings. Candid and active face-to-face communication is common at the divisional level. For instance, one division manager holds an all-hands 30-minute monthly meeting that features presentations by management team members. These meetings typically review the preceding month, the upcoming month, and the strategic action plans. Monthly departmental meetings are also held, typically one hour over lunch. Questions are submitted ahead of time, supervisors provide written answers, and then all of these are reviewed. When attempting to consolidate the department meetings and eliminate the company meeting, a resounding consensus attested to the values of these exchanges felt by the employees. At this

division weekly plant management staff meetings are also held, last approximately two hours, and post discussions and decisions on the plant bulletin board afterward. Variations of these face-to-face open dissemination meetings occur in all divisions.

- Long before the concept of "open-book management" was touted in a book by the same name [10], Remmele valued and employed the essential concepts: "Open the books! Yes—you need to teach employees to understand the budgets and the income statements and the cash-flow analysis and the balance sheet. That's the first step in helping them to think and act like business people rather than hired hands….Opening the books means a whole lot more than just announcing quarterly results the way publicly traded companies do. It means communicating *all* the relevant information, monthly or weekly or daily, to people in every plant or department or store or unit within a company….Open-book management gets people involved and helps them take responsibility rather than shirk it. It's a way by which everyone in the business can hold each other accountable."[1]

Communicating new changes without appearing rudderless

- In general, basic evolution in strategy and vision occurs on a scheduled annual basis and never violates the underlying corporate ideology, though evolutionary changes may sometimes require a reinterpretation of implicit beliefs or even explicit guidelines. The semi-annual presidential all-hands meetings and the frequent interactive communication sessions with divisional management involve a high degree of thoughtful questioning that requires management to explain and justify the rationale for decisions of interest.

Correcting miscommunication and shortsighted plans before damage is done

- High meeting frequency generally nips problems in the bud. Mistakes, what they cost, and how they happened are freely shared. Open questioning on decision justification is encouraged and practiced, often with the thought process that goes into a decision under intense scrutiny and not so much the decision that results from it. The real sin is to have made a decision without thoughtful and knowledgeable homework. Notably, there are specific monthly "communication council" activities aimed at sensitizing management to the problems created among other employees when decisions are not addressed in open forum in advance, or when decisions and events are not adequately communicated after they occur.
- Shedding light on the broader set of issues, as well as the Remmele example used here: "If two people exchange knowledge with each other, both gain information and experience linear growth. But if both then share their new knowledge with others—each of whom feeds back questions, amplifications, and modifications —the benefits become exponential."[2]

Communicating fast-breaking events of import before the rumor mill creates misinformation

- Though dissemination meetings occur at regularly scheduled intervals, the company is focused on the principle of open information dissemination and not lost in the formality of following a scheduled procedure. The Production Machining Division (Plant 30) is a good example of this principle in action: When a major sustaining job approached abrupt program termination the plant faced under-utilization and an operating loss, causing knowledgeable concern about the progress of new business activity and the security of job positions. Though Remmele moves people to other plants where possible and has a policy of reduced hours rather than layoffs, employee meetings include discussions about the potential need to remove positions if the health of the total unit becomes seriously jeopardized. With negotiations on program termination timing and heightened new business activity, fast breaking news was conveyed immediately to the affected group even before the implications were understood. Often management had to answer questions with a straightforward "I don't know"—believing this to be the best approach in a time of uncertainty and insecurity. Ideologically, the company believes that employees should be involved in the decisions and events that affect them.

Bringing new employees up to speed with everyone else quickly

- The general corporate plan is well documented, discussed at length in pre-hiring interviews, and made available to new people. The employee handbook is brief yet reasonably comprehensive on the expectations of and respect due an employee, the newsletters carry a surprisingly candid and detailed body of useful information with back issues readily available and most importantly, employees relate to each other as a family, offering advice and help to new employees freely. In the end, actions speak louder than words, and the new employee has quick and ample opportunity to witness open communications in action at meetings where their peers speak, question, and demonstrate the reverence for informed decision making.

Utilizing newsletter and other non–work-disruptive channels effectively for important messages

- The pervasively felt ideological culture of open communications and trust, constant learning, and accountable empowerment permit some important and even complex information to be effectively disseminated in other than face-to-face channels. A long history of explaining and sharing financial details with employees and a recent push to implement some of the financial training techniques discussed in the book *Open-Book Management* [10] have made the corporate newsletter an effective dissemination channel for this otherwise arcane and complex information. The newsletter is also effective at conveying discussions and a deeper understanding of strategic issues and plans, due partly to the fact that knowledgeable management actually does the writing (no ghosters employed) and partly to the employee's receptivity and desire for involvement and knowledge. These same factors have made the corporate Strategic Overview and even more detailed Strategic Plan effective channels for reaching many employees with important details.

Change Proficiency Maturity—Strategic Plan Dissemination Mastered Stage (4) for Both Proactive and Reactive Change Proficiency	
Principles Knowledge Base: Open communication and involvement of the people in the decisions that affect them are the principles that govern this practice. Though dissemination meetings occur at regularly scheduled intervals, the company is focused on the principles and not lost in the formality of following a scheduled procedure.	
Scope Metric Focus: Time and cost of dissemination activities are not a concern to Remmele, as the information clearly helps people contribute more productively and the channels are highly effective: virtually no one feels that meeting time is ill-used or ineffective, and written forms of dissemination have become highly useful and utilized. The dissemination process is robust due to complete openness, methods that encourage honest and tough questioning, and ready access to the Strategic Plan documents and details by all employees. Emphasis is now placed on sensitizing more people to the effects, methods, and values of good communications and to broadening the involvement of employees in the decisions that affect them.	
Modification Competency—Proactively Formidable: Buzzwords like lean, agile, TQM, kaizen, and others are not employed as justification or road maps for modifying the vision or adding new strategies. New strategies are explained as a knowledge base that freely extracts lessons and concepts from known industry programs without accepting them blindly or as total packages. Pursuing a Baldrige Award, for instance, was a strategy employed at one time—which stopped when they felt they had gleaned the real value available from the preparation exercise. Communicating the intent-to-pursue strategy and then communicating the intent-to-abandon short of the award inspection were both accomplished with full understanding in the workforce and were not received as jump-on-the-bandwagon or rudderless decisions.	**Reconfiguration Competency—Reactively Automatic:** Though dissemination meetings occur at regularly scheduled intervals, the company is focused on the principle of open information dissemination and will freely reconfigure meetings and schedules to accomplish the objective when circumstances warrant. When reduced work at one plant caused employee concern about the progress of new business activity and the security of job positions, stand-up, real-time interactive meetings were immediately convened any time events occurred that had relevancy, even when all of the implications were not fully understood.

[1] J. Case, *Open-Book Management* (New York: Harper Business, 1995), pp. *xx–xxi*.
[2] Quinn, Anderson, and Finkelstein, "Managing Professional Intellect," *Harvard Business Review*, March–April 1996.

1.3 Strategic Plan Buy-In: The process of gaining a sense of ownership for, and a commitment to, pursue an organization's vision and strategies by the members of the organization. This is a stronger and more desired form of *dissemination*. 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. Highly mature practices freely reinterpret the relationships between strategic concepts and local and personal implications when appropriate opportunities arise.

Proactive Change Proficiency Issues	
Creation	• Creating a sense of ownership and commitment to the vision
Augmentation	• Improving the ability of people to understand and implement the vision and strategy
Migration	
Modification	• Encouraging innovative self-directed vision and strategy fulfillment
Reactive Change Proficiency Issues	
Correction	• Helping employees that have difficulty with accepting responsibility and commitment
Variation	• Encouraging different manifestations at different plants when situations warrant
Expansion	• Gaining ownership among new employees quickly
Reconfiguration	• Moving people freely without impediment from different operating modes and incentive programs

Creating a sense of ownership and commitment to the vision
- The employees display a great sense of pride in the company and an expectation to function as accountable contributors, exhibiting a strong family identity and common team spirit. This ideological commitment appears rooted in the corporate Guiding Principles (see Appendix) and touches everyone with the increasing emphasis on involving all people in the decisions that affect them. It is clear that management has not abdicated the responsibility for certain key decisions—like how much will be allocated for capital—but these decisions are only reached *after* a great deal of serious employee input is formally obtained. For instance, periodically a database of competitive pay scales is developed by looking at other companies and various national sources. Until the late '80s a management committee would analyze this data and make general increase recommendations to the president. Now, all employees are given this data along with a form letter to the president that allows them to make a thoughtful and knowledgeable recommendation. Experience shows that the majority of people deliver a well-reasoned number that is considered carefully by the management group. In recent years the approved increase has been consistently within half a point off the averaged employee recommendation.
- One manager offered that psychological ownership is powerful and apparent here and the essence of Remmele's success: "People here are so much in charge of what they are doing that they can hardly help but feel ownership. People are employed with the expectation that they will probably be here forever if things work out, and that imposes on Remmele the need to provide tools that will help them be more valuable to the organization. This is the management mind-set".
- Commitment and buy-in are also supported by the tools of open information and rewards tied to company success, discussed in detail elsewhere. "Companies in which everyone helps make money will outperform companies in which only a few people at the top see that as their job. In the new economy, creating a company of business people is the ticket to survival—and prosperity…Open-book management doesn't make everybody equal. It just assumes that everybody on the payroll has a stake in the business's success—and that companies work better when people understand that stake."[1]

Improving the ability of people to understand and implement the vision and strategy
- Exemplifying the involvement-in-decisions-that-affect-you point, as well as showing how the company supports personal knowledge development that enables ownership and deeper understanding: One division manager recently took four machinists on a world search for the best high-velocity machining equipment. They shopped heavily in Germany and France where they spent time talking to customers and users. This involved

considerable time for each person away from revenue-generating work and required them to sort through the data and develop a recommendation, which they justified to other employees as well as to management. These people are now the resident experts on high-velocity machining and are responsible for integrating the capability into Remmele, and they own the decision.

Encouraging innovative self-directed vision and strategy fulfillment

- Trust-based relationships are actually alive and well at Remmele and quite solid because they are practiced universally in all relationships—not just for the inner circle of management or employees, but also for community, suppliers, and customers. When asked what was unique about working at Remmele, one shop worker offered: "We take pride in our work, look at the T-shirt slogans (*Pride in Quality* displayed on a few chests), and that's what we take to heart. We don't like anything going out the door less than perfect, and we'll talk to the customer about it honestly if he wants us to ship before we have it the way we want it."

Helping employees that have difficulty with accepting responsibility and commitment

- When asked what would happen if a new employee gets through the recruitment screening and turns out to be on the less-engaged or less-prideful side, one shop worker said: "It wouldn't happen." Another offered: "We'd talk to them and help them get up to speed." A third finished with: "Eventually they'd see that they didn't fit and leave voluntarily, and if all else failed the supervisor would invite them to leave."

Encouraging different manifestations at different plants when situations warrant

- Though the core ideology and corporate strategy establish a foundation, separate divisions are expected to interpret and implement strategic plans in a context that suits achievement best in their markets. The Production Machining Division, for instance, is organized around "focused-factory" cells dedicated to a single customer's requirement and has evolved a strong cross-functional–team work mode that accepts responsibility for maintenance, purchasing, recruitment, and other typical support functions among the cell's operators. Whereas station operation in a cell does not require the same capabilities that a machinist employs in another plant, it allows time for active responsibility in a broader set of business support functions. By dispatching these functions within the cell team, support overhead is minimized and employees gain a broader set of skills and an understanding of business operation.

Gaining ownership among new employees quickly

- Highly effective information dissemination practices, recruitment screening for self-motivated people, and an active help-your-fellow-employee-learn-the-ropes environment bring new employees up to speed quickly. All employees help the new people learn and practice the company way. Cell teams in the Production Machining Division, for instance, decide which new team members they will accept. They help each other come up to speed and take pride in saying that nobody has failed to fit in as yet.

Moving people freely without impediment from different operating modes and incentive programs

- Though there are some uncomfortable differences for veteran employees between the operating modes and skill sets used in the Automation Division (Plant 50), the Production Machining Division (Plant 30), and the three other machining plants, enough employees exhibit a willingness to go where the company needs them to satisfy the mobilization flexibility the company sometimes needs. Even at the apprentice level: one of the stated differences about Remmele apprentices was their willingness to go where the company needed them. On the incentive front, everybody participates in corporate profit sharing, based on total corporate results, with a floor that guarantees 3% of pay minimum will be contributed to the retirement plan. Anything available above that can be taken as cash or put into the retirement fund at the employee's discretion. Higher paid top management has a cap on the amount of profit sharing from this plan. The plan's focus on corporate results facilitates moving people among plants when appropriate.

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

Principles Knowledge Base: The Strategic Policies (see Appendix) contribute explicitly: Involve people in the process of making decisions that affect them, provide for decision making and problem solving at the most appropriate level, encourage risk taking, and 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 plant objectives is not a concern, as the corporate ideology responsible for most of this "practice" is virtually invisible, it just happens. Robustness is likewise 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 they need to take on increased responsibility.

Modification Competency—Proactively Formidable	Reconfiguration Competency—Reactively Automatic
Modification Competency—Proactively Formidable: 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, unless customer approval is needed.	**Reconfiguration Competency—Reactively Automatic:** 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 employ its people and is considering a wide range of real prospects that may require a buy-in and operating mode different than previous experience. Past examples necessitating such re-thinking include both "clean room" and "miniature machining" activities which had no prior precedence, were considerably different than the experience base, and required reinterpretation of strategic concepts into local and personal implications.

[1] Case, pp. 38 and 44.

2.1 Capital Investment Justification: The formal argument for making a significant investment in a depreciable item that will provide a wide latitude of capability and capacity alternatives quickly and with minimal cost. Here the emphasis is on a procedure that enables the acquisition of agile equipment and other agile capital items, though an agile procedure itself is also necessary to insure that it too can evolve. Typical Agility issues across industry generally include production and support resources with narrow capacity bandwidths, restricted capability ranges, and complex or rigid interfaces that optimize costs for specifically targeted output, but severely limit the ability to take advantage of additional opportunities and satisfy changing requirements.

At Remmele this practice has a solid foundation in the Strategic Policies' (see Appendix) emphasis on growth, technological excellence, and knowledge-based informed risk, serving as the framework for allocating investment resources to capital requests that satisfy strategies and investment guidelines. In general, highly mature practices will reconfigure resources and investment guidelines to fit a broad range of capital areas and opportunities.

Proactive Change Proficiency Issues	
Creation	• Permitting capital investments that specifically accommodate an unpredictable business environment
Augmentation	• Reducing risk and increasing return
Migration	• Keeping up with new technology and new process
Modification	
Reactive Change Proficiency Issues	
Correction	• Investment decision turns out to be incorrect: market doesn't materialize or technology is insufficient
Variation	• Different plants want different things, each on their own growth curve
Expansion	• Business is capital-intensive and growth requires increasing investments
Reconfiguration	• Adding equal capabilities for investment in areas other than machining and process technology

Permitting capital investments that specifically accommodate an unpredictable business environment
- Capital equipment is "cost justified" in the traditional financial sense only when it is being acquired specifically for reducing costs. The majority of capital investment at Remmele is for equipment expected to open or expand market potential, and that potential is the focus of the justification process. Capital is allocated among competing requests not on the basis of financial justification numbers, but rather on the strength of accumulated knowledge and the resulting gut feel of the people involved in the decision. Ultimately the president, with board of director concurrence, approves the annual total capital budget and allocation plan, but does so in consultation with the cross-divisional management committee responsible for recommending the annual capital plan. Remmele's president directly attributes their high hit rate on successful market entry to the fact that they don't justify on rate-of-return financial data alone, but rather on a broadly shared and deep-studied knowledge base. Recognizing the unpredictable nature of their markets (aerospace decline, computer disk-drives using less machining, etc), capital is funded from profits only, never from borrowing. So cash availability can be the limiting factor on next year's business—but uncertain or mercurial markets will not catch the company over-leveraged.
- Supporting Remmele's knowledge-based intuitive approach: "Whenever we allow ourselves to ignore the truth, the computer becomes the ally rather than the enemy of our conceptual errors. Those who live by the numbers may find that the mathematically inspired techniques of modernism have sown the seeds of a destructive technology in which computers have become mere replacements for the snake dances, the bloodlettings, the genuflections, and the visits to the oracles and witches that characterized risk management and decision making in days of yore."[1]

Reducing risk and increasing return
- Capital equipment for the General Machining and Repetitive Batch Divisions (Plants 10-20-40) is generally bought before any jobs are secured or sales activity begun, in order to reduce the risk associated with the learning curve for brand new technology. Investment decisions recognize equipment and technology that have multiple uses, such as five-axis machines that can do three-axis machining—so if the bleeding edge potential cannot be realized there are alternative ways to productively employ the new resources.
- The company ideology leans heavily on the concept of informed risk: There is a lot of tolerance for making mistakes if you have done your homework; but you will get called on the carpet if you cannot demonstrate and communicate a serious homework process. This ideological pressure comes from everywhere, not just from above: the people in the shop have questioned why computers were purchased and want to know what was

behind the decision. When equipment was purchased for the Production Machining Division that didn't work out, management had to spend a long time explaining to the shop people how they had reached the unfortunate decision. "Decision making is a real key factor in what we do," so the decision-making process is constantly scrutinized by everybody.

Keeping up with new technology and new process

- Remmele's investment guidelines favor new, top-of-the-pyramid technologies—those that offer new and under-served markets which can sustain the margins necessary to fuel the capital and learning-curve investments. A proactive commitment in the form of technical resources and market-search provides a grasp of emerging opportunities. This process has led to the current push-the-envelope investments in high-velocity machining, flexible manufacturing systems, and lights-out operation. Conversely, Remmele turned down a major job opportunity that required too much "new" process technology. It was new to Remmele, as they had no real in-house experience with screw machines, but old in terms of technology—and not leverageable into leadership competitive capabilities. Had the customer been better known to Remmele they might have accepted the risk. "It's a question of knowing that the customer will work with you when you try things that you are not experienced with. We prefer customers who understand about the new-process learning curve."

Investment decision turns out to be incorrect: market doesn't materialize or technology is insufficient

- Remmele has been known to sell off new technology quickly when it has become apparent that the motivating potential cannot be satisfied—sometimes because the technology is not ready for the application they had in mind, sometimes because the suspected market does not materialize for them quickly enough. In any event, the company is highly conscious of capital limitations and will convert disappointing experimental equipment to cash quickly for reinvestment in other promising areas.

Different plants want different things, each on their own growth curve

- Depreciation plus 40% of generated profits are suggested to the divisional managers as a capital investment guideline. On occasion, some programs require major and disproportionate capital investment relative to the divisional guidelines, such as the high velocity machining program for the General Machining Division. When this occurs it is evident that the company is capital-restricted, as some divisions must settle for less so that another can utilize more than the overall guidelines suggest.

Business is capital-intensive and growth requires increasing investments

- Corporate guidelines consider debt instruments as too risky for capital investment funding: The nature of the business is capital intensive, and investing through debt is a seductive path to being owned by the bank. As a result, strategic policies restrict business to that which returns healthy margins to ensure an adequate pool for investment; and specify that capital investment each year will at least equal the prior year's depreciation. Actual investment amounts have consistently exceeded this depreciation minimum by a large margin. Supporting this Remmele practice: "The most important management act is the allocation of the company's capital. It is the most important because allocation of capital, over time, determines shareholder value. Deciding what to do with the company's earnings—reinvest in the business or return money to shareholders—is, in Buffet's mind, an exercise in logic and rationality….If the extra cash, reinvested internally, can produce an above average return on equity, a return that is higher than the cost of capital, then the company should retain all of its earnings and reinvest them. That is the only logical course. Retaining earnings in order to reinvest in the company at less than the average cost of capital is completely irrational. It is also quite common."[2]

Adding equal capabilities for investment in areas other than machining and process technology

- The Remmele capital investment practice is highly effective but narrowly focused, being heavily biased by the intuitive grasp that management develops for emerging machining technologies and markets. The industry is now on the verge of employing information technology as a competitive infrastructure for both customer interaction and for internal operations. To secure necessary capital, information technology investments will compete for the same pool of funds and will not compete evenly until the same breadth and depth of knowledge gathering and sharing is brought to bear.

Change Proficiency Maturity—Capital Investment Justification
Managed Stage (3) for Both Proactive and Reactive Change Proficiency

Rules & Responsibilities Knowledge Base: The identification, acquisition, and sharing of knowledge about emerging markets, advanced technologies, and their potential synergy is specifically assigned each year as part of the corporate strategy and action plan, and in the search for emerging technologies there are two full-time dedicated and highly talented resources actively consulting across all divisions. The resultant understandings enable divisional recommendations and intuitive decisions based on informed risk rather than numbers by the capital investment management committee. The investment practice itself, however, is our real focus here, and the responsibility for the nature and management of that practice rests with the president. The knowledge base of rules governing the practice includes investing at least as much as last year's depreciation, using profits and not debt as a funding source, buying emerging technologies before they become commonplace, demanding comprehensive knowledge about both technology and potentially applicable markets, involving lots of people in the knowledge assimilation and debate in advance of a decision, and committing sufficient resources to the pre–market-entry learning curve.

Robustness Metric Focus: The central appreciation for the role of capital investment at Remmele has spurred the development of a robust process, one that makes few poor decisions and has multiple recovery avenues in such rare instances. The underlying ideology of continuous learning and knowledge development values, rather than begrudges, the time involved in learning, and the application of highly qualified and dedicated resources to the technology-watch optimizes both the time and cost to the company of reaching informed decisions. By the same token, these dedicated resources broaden the corporate knowledge base to reduce the chance of uninformed decision making. These technical strengths are combined with an equally intense and continuous search for emerging markets, as well as a periodic analysis of existing and declining markets—further broadening the predictability of capital-investment success. Informed risk is the operative catch phrase at the company, and the stress on the "informed" part is precisely aimed at making the process robust.

Migration Competency—Proactively Aggressive: Remmele has an excellent and active forward-looking process for discerning emerging technologies and markets. High-velocity machining is the largest investment being made in this area currently, but capital is also being directed at leadership technologies for flexible systems and lights-out operation. At the same time, an active pre-investment, knowledge-gathering, and strategy-development activity is underway for a corporate information technology architecture. Migration competency is also evident in the sometimes two-year learning-curve investment made in advance of initial sales activities, developing high skill in the emerging areas before they are taken to market.	**Expansion Competency—Reactively Sure:** The fact that growth as well as simply maintaining Remmele's position and image in the marketplace are dependent on continuous and increasing capital investment serves to focus management understanding about these issues, especially the generation and allocation of annual funds. The current high-velocity machining program is focused on a single division, yet it has the dominant share of available corporate capital. All divisions support this unbalanced application of funds because they understand that investments in high-potential emerging markets by one division will ultimately increase available funds for the other divisions.

[1] P. Bernstein, "The New Religion of Risk Management," *Harvard Business Review*, March–April 1996.
[2] R. Hagstrom Jr., *The Warren Buffett Way* (New York: John Wiley & Sons, Inc., 1995), pp. 80–81.

2.2 Infrastructure Investment Justification: The formal argument for making an explicit investment in reconfigurable infrastructures for 1) human skills and knowledge, 2) information technology, and 3) organizational culture and procedures. These three infrastructures are singled out currently because they determine the ability to make and implement appropriate and timely decisions throughout the organization: people use their skills and knowledge to make decisions, information technology provides decision-making and implementation support, while culture and procedures (or policy) motivate and focus the activity. Here the emphasis is on an investment practice that permits and values the development and acquisition of reconfigurable infrastructures, though an agile investment practice is also necessary to insure that it too can evolve. Infrastructures are entrenched de facto standards that run the risk of impeding future needs if they are difficult or impossible to change. The principal issue for business case justification is generally the quantification of values associated with the costs of reconfigurableness.

A reconfigurable infrastructure enables and supports transformation and mobility of its individual elements; e.g., new skills and knowledge are easily developed or moved from one organizational area to another, implicit cultural motivating factors and explicit policy constraining factors are constantly questioned and modified for applicability, and available computing and communication tools evolve at the same rate as the organizational needs. At Remmele this practice has an ideological foundation articulated in the Strategic Policies' (see Appendix) emphasis on constant change, continuous learning, informed risk, and accountable empowerment.

Proactive Change Proficiency Issues	
Creation	• Permitting reconfigurable infrastructure investment
Augmentation	• Reducing constraints and increasing motivation of desired employee behavior
Migration	• Anticipating emerging competitive requirements
Modification	• Applying the procedure to other infrastructures that become important (like information technology)
Reactive Change Proficiency Issues	
Correction	
Variation	• Different plants want different things, each on their own growth curve
Expansion	• Company is machining-equipment–focused—how can infrastructure compete for funds
Reconfiguration	

Permitting reconfigurable infrastructure investment
- Not too many years ago business debated the financial values of a higher quality product, under the belief that increased quality added cost somewhere that must be shown as more than offset by reduced costs somewhere else. Now it is common practice to view quality as the entry-level ante, knowing that you don't get to play the game without it. The debate has moved from financial justification and numerical cross-over points to one about methods—the value of quality has become intuitively understood. At Remmele, the value of reconfigurable infrastructure is similarly understood at the intuitive level: major investments are made in continuous skill and knowledge development, and major investments are made in the culture and policies of the organization, with virtually no financial justification or cost accounting. In short, the investment practice is simply to do the best possible informed-risk job at: a) maintaining relevant people skills and knowledge and b) maintaining a cultural and policy environment that maximally exercises the skills and knowledge present.
- Though Remmele is not a company that follows fads and popular paradigms, the book *Built to Last* has had an obvious impact on them, at least in affirming their intuitive understandings that a strong cultural ideology is valuable beyond the need for formal justification. Again, we see that typical financial returns are not the justification procedure, but rather a knowledge-based intuitive expectation that value exists in a systematized process–approach to building and maintaining the business infrastructure. Corporate culture and policy reveres learning, change, and knowledge, and demands excellence—which justifies a four-year apprenticeship program that is as much cultural indoctrination as it is skill development, a screening-intensive recruitment process that selects for cultural compatibility, a broad-based annual planning activity that revisits the fundamental Strategic Policies, and a pervasive open communication that questions everything. One executive sums up the value of the intensive recruitment process: "People ask us why we are successful—I tell them its because we start with the very best people."
- Investments in the skills and knowledge infrastructure are seen in the educational assistance program that pays full costs upon course enrollment (not contingent upon grades) for anything usable in the company; the quality and continuous improvement of the four-year apprenticeship program; the newly inaugurated,

individualized, personal-development program for all managers, and the sending of more than 50 people (of 475 total employees) to the bi-annual machine tool conference.

Reducing constraints and increasing motivation of desired employee behavior

- Improvement of the infrastructure investment practice happens in Remmele at the grass roots. For instance, though quite significant, Remmele does not attempt to record training or knowledge-development expense, nor use such numbers as operating or performance metrics. "Numbers have an influence of their own. They can cause the substitution of quantity for quality, or put top-down pressure on something that instead should be real–problem-solving motivated." This operating philosophy reduces risk from improperly motivated investment decisions and does not impose a line-item budget constraint on the amount of training investment. Open communication and solicited feedback on skill development programs and policies, coupled with the ideological driver of constant learning and "Be the Best, provide a strong and constant improvement process.

Anticipating emerging competitive requirements

- Information infrastructure is recognized as an emerging area of competitive importance: New management has been brought in to help develop corporate strategy, and two separate outside consulting groups were engaged to assist in planning.

Applying the procedure to other infrastructures that become important (like information technology)

- Though the emerging importance for an information technology infrastructure is appreciated, and the values of reconfigurableness are just as viscerally understood as for the skills and policies infrastructures, there is not yet the same broad-based deep knowledge that is the pivot point of the informed-risk investment practice. Perhaps the difficulty stems from the company not yet being holistically engaged in this process—they appear instead to be sitting in judgment on the result: consultants were not channeled with a set of strategic business requirements, so instead they focused on state-of-the-art technology and recommendations that could be filled by consultant services. Though this approach is all too common throughout industry, at Remmele it would never have been considered in the development of the apprenticeship program, or any other area considered truly important.

Different plants want different things, each on their own growth curve

- Plant 30 (focused-factory Production Machining Division) and Plant 50 (Automation Division) are considerably different from the traditional plants 10-20-40 that focus on machining. At Plant 30, where work stations employ machine operators as opposed to machinists, a structured program to assess individual needs is in place to identify and direct subsequent skill training. The infrastructure investment practice accommodates this local variation as easily as it now considers different approaches for Plant 50, where an engineering education is the norm and different modes of skill enhancement and knowledge maintenance are needed.

Company is machining-equipment–focused—how can infrastructure compete for funds

- For the most part, infrastructure investments are funded from operating expenses—the maintenance of skills and knowledge as well as the maintenance of culture and strategic policies are ongoing activities integrated with the operating modes of the business. Though future investment in an information technology infrastructure may handle the *wetware* (significant personnel skills and knowledge development) in this same manner, hardware and software will undoubtedly compete for capital funds traditionally reserved for machining equipment and process technology. The infrastructure investment practice at Remmele is highly effective as applied to date. Soon it will be tested against the new and different requirements of an information technology infrastructure—which will require a significant expansion of the collective knowledge base and introduce an initial surge and new continuous-replenishment requirement on capital funding.

Change Proficiency Maturity—Infrastructure Investment Justification Managed Stage (3) for Both Proactive and Reactive Change Proficiency

Rules & Responsibilities Knowledge Base: Accountable process owners exist for the infrastructures that are recognized as important. Responsibility for the cultural and strategic policies infrastructure is clearly accepted by the president, not by title but rather by personal mission and predilection. Accountability for the work-in-process information technology infrastructure rests with the corporate MIS director. Responsibility for the skills and knowledge infrastructure is more diffuse, with clear accountability for skill development in the human resources director, for technology knowledge development in the director of advanced manufacturing-engineering, and for market knowledge development in the director of marketing. Yet at the same time divisional managers are responsible for application of the practice, and all employees accept responsibility for continuous and relevant learning. Our focus here, however, is on the investment practice itself; and the accountable party appears to be the president functioning from a knowledge base of rules that includes: constant learning is necessary in a changing business environment, measuring and recording *indirect* metrics like training hours are counterproductive, and corporate infrastructure standards should enable rather than constrain business units and individuals pursuing corporate goals.

Robustness Metric Focus: As in general decision making at Remmele, *informed risk* is the operable strategy, where the *informed* part is aimed directly at making the process robust. In this practice the time and cost to reach an informed decision are principally determined by the development and maintenance of an applicable and relevant knowledge base. The initial development and assimilation of a completely new knowledge base for a new infrastructure, such as that currently in process for information technology, will typically consume noticeable but affordable time and cost: the practice is objective driven, the techniques escalate as perceived deadlines approach, and the recognition of satisfactory functional knowledge is ubiquitous. In any event, the result is generally broad-based assimilation, which makes subsequent maintenance and application a continuing corporate-wide affair that appears to be non-intrusive and second-nature thereafter. Knowledge is often maintained by assuming an active leadership role in relevant community, government, and industry association activities such as: helping to establish industry skills standards, sharing best-practices with case-study databases (this study just being one of many), helping to produce general distribution video tapes, high school outreach, and more.

Migration Competency—Proactively Aggressive	Expansion Competency—Reactively Sure
Migration Competency—Proactively Aggressive: Proactive leadership participation in industry groups and associations exposes Remmele to the latest thinking and future expectations in their industry. They also conduct a formal competitive analysis annually and customer and employee surveys that alert them to emerging needs. The need to create a strategic information technology infrastructure was recently identified through these means, as were modifications to existing infrastructures like the recent addition of the individualized personal development program for management.	**Expansion Competency—Reactively Sure:** Both the skills and knowledge and the culture and policies infrastructures are principally funded from operating expenses. Individual and specific allocations have not had to compete for limited fund pools—exemplified by the lack of a specific training budget line. Operation and maintenance of these very real practices are virtually a transparent activity—they are incorporated as the means to accomplish principal business objectives rather than masquerading as an objective unto themselves. Modulating the application of funds or accommodating a surge requirement has never been a direct issue. With the coming advent of an information technology infrastructure, the general investment practice will have to broaden to accommodate a capital-outlay component—a scope issue that will develop higher level competencies.

2.3 Business Engineering Investment Justification: The formal argument for allocating resources to both the management of change and the management of change proficiency. This might include such things as the funding of designated change agents in the company, setting up a department of reengineering, or instituting an internal skills-development department. De facto investment in business engineering includes the efforts put into strategic planning, business acquisition, business spin-off, careful recruitment and skills training, reengineering for operating practices or cost reduction, or even product development that opens new markets. The principal issues here are the recognition and valuation of the need for competency at *continual* business transformation and the commitment of sustaining resources to the critical areas that typically today include: business strategy, organizational structure, culture and policies, skills and knowledge, and information technology.

Though there is value to be gained from a reconfigurable investment practice, our main concern here will first be on a practice that encourages investment in the design and maintenance of a reconfigurable business—the essence of agile enterprise. A reconfigurable business will easily transform its direction, its resources, and its methods to remain both viable and innovative in an unpredictable business environment. At Remmele this practice has an ideological foundation articulated in the strategic policies (see Appendix) statements about constant change, continuous learning, informed risk, decentralization, and accountable empowerment.

Proactive Change Proficiency Issues	
Creation	• Developing recognition of, and valuation for, business engineering investment opportunities
Augmentation	• Optimizing the economics of the existing business design
Migration	• Anticipating changes in the business environment that require response
Modification	• Applying the practice outside of current expertise areas
Reactive Change Proficiency Issues	
Correction	• Investment decision turns out to be incorrect: bureaucracy or similar functional impediment created
Variation	
Expansion	• How can business engineering compete for funds?
Reconfiguration	• Avoid the "institutional imperative," and design with the best available knowledge

Developing recognition of, and valuation for, business engineering investment opportunities
- This investment practice is woven into the fabric of the corporation and is virtually indistinguishable from daily operating practice. One example begins with the annual planning session within marketing, which generally includes a brainstorming session on growth strategies. Some ideas involve new markets—the thrust into international markets came this way—with most ideas coming about because an existing customer gave visibility to new potential. Marketing presents this to top management where a vote designates the ones that will move to the serious research phase, which generally begins at the library. They query the extensive (75+) sales rep organization to identify specific prospects in each market under study, and they study annual reports and other corporate information that the reps obtain. Industry associations for targeted sectors are contacted, and conferences and trade shows are visited; which typically broadens the prospect-base under study in each potential market. The marketing director contacts peers in other companies, and even competitors, to ask what they know about the market. On occasion outside expertise is engaged to investigate market potential. This is classic marketing at its best—not often conducted so rigorously in any company, and rarely in Remmele's industrial sector.
- The advanced manufacturing engineering management function at Remmele is another prime investment example. This function includes a full-time resource dedicated to bringing new technology information into the company, is expected to stay on top of the cutting edge of development elsewhere and understand when an outside technology or procedure is applicable inside, and then help the inside people reach the same conclusion.
- A new high velocity machining (HVM) business was being created at Remmele as this analysis of the company was being conducted. The business engineering activities were an integral and indistinguishable part of the ongoing investigations into new technology/market potentials. Successful equipment testing and learning-curve development on customer-deliverable work, coupled with a quickening in market development, led to the requirement for next steps—what to do with it, and how to do it. The cross-functional HVM team of 12 or so people swung into exploitation mode, built a business plan with alternative scenarios, and made a recommendation.

Optimizing the economics of the existing business design
- "The basis of successful value protection is optimizing the economics of the existing business design"[1] writes Adrian Slywotzky in *Value Migration*. Remmele has a constant drive to improve the existing economics of ongoing production rooted in the same principles that drive its search for new markets and new technology. A typical part of the bidding exercise includes identification of expected methods for improving costs over time. In one major customer-dedicated focused factory at Plant 30 there were significant reductions in average production over time as the end-product neared the end of its useful life. With the constant search for new technologies and approaches, over time the cell team was able to reengineer the focused-factory process and operating methods significantly to retain reasonable margins even as volumes decreased.

Anticipating changes in the business environment that require response
- At Remmele, marketing and technology personnel throughout the company conduct frequent and periodic cross-divisional meetings to look for potential innovations and early signs of value migration within their markets. These groups actively investigate, learn, and plan exploitation of new areas before they become common place or mandatory. When the time is right, they can deliver new technology through new business structure to new markets with experience. This is a major change for most companies, but business-as-usual here.
- Remmele takes an active role in Department of Labor and Department of Education programs for the development of industry-driven specific skill standards, both for internal training programs and also to feed education institutions. The National Institute for Metalworking Skills is heading this activity with strong board-level and program participation by Remmele, which also offered examination of its apprenticeship program as a role model. A principal goal is third party certification, which will establish portable skill and competency levels. With this forward look, Remmele has committed its apprenticeship program to producing nationally recognized and certified Level 3 (the highest level) graduates.

Applying the practice outside of current expertise areas
- The evolving apprenticeship program at Remmele is a resounding success at engineering the critical skill base of the company—something that sprang naturally from the founding machining roots. The company recognizes the value of this proactive program and is now asking how it might take a similarly effective role at developing management skills and engineering skills needed for continued growth. Effective project managers, for instance, are critical yet hard to find; and no development path in the company has prepared others to assume these positions. These development needs have been recognized and, as a result, a project manager trainee position has been created to help prepare employees for advancement to the project manager position. In addition, many of Remmele's current managers, including senior managers, have had development assessments conducted by outside specialists in the interest of identifying and addressing individual needs, resulting in individual development plans that are monitored as part of the annual performance review process. Emphasis recently has shifted to leadership competencies. Behavioral anchors were developed for each leadership competency, and an assessment of those competencies is currently being piloted as part of the performance review process. As with individual development plans, it is expected that leadership development plans will be developed that may include off-the-job experiences calculated to develop skills— like taking on an association workshop chairmanship, coaching softball, or leading a cub scout group.

Investment decision turns out to be incorrect: bureaucracy or similar functional impediment created
- Remmele has an inherently self-healing system, one based on autonomous decentralized empowerment that buys into the business design and then takes responsibility to make it work. Bureaucracy hasn't found a foothold here simply because it has no users—were it to appear it would probably be ignored to death.

How can business engineering compete for funds?
- The funding for active business engineering is buried in the very fabric of the company and funded from operating expense. For instance, the HVM program–team designed a completely new business unit to meet an unexpected speed-up in market-development, yet the cost of this HVM business "engineering" defies capture as the result simply emerged from existing knowledge and ongoing debate among team members, all of whom are expensed against a variety of operating functions: production, supervision, advanced manufacturing engineering, and marketing. The machinists are simply expensed against the plant's operations budget, as a good bit of their knowledge development is generated by making parts that are in fact delivered to customers.

Avoid the "institutional imperative," and design with the best available knowledge

- At Remmele, the historical legacy has developed from a machining culture that reveres the deep skills that master machinists acquire and provides a support structure around these resources so that they can focus on the exercise of these revenue-generating capabilities. Yet the high velocity machining program, emerging from the traditional business of machining, developed a business plan that recommended Plant 30-like focused-factory operation—where everybody is not only cross-trained on all production workstations, but also assumes responsibility for the broader-based business functions such as maintenance and purchasing. That the "machining culture" would so readily adopt ideas developed in the "lesser skilled" cell operating environment, especially ideas that take time away from the exercise of machining skills, is testament to the ideological depth of learning and knowledge assimilation.

Change Proficiency Maturity—Business Engineering Investment Justification **Managed/Mastered Stage (3.5) for Both Proactive and Reactive Change Proficiency**
Rules & Responsibilities Knowledge Base: The investment in business engineering is ongoing and diffuse throughout the organization: focused-factory machine operators in Plant 30 will design improved production processes and operating procedures, new market investigation teams will design a completely new business structure to take advantage of accelerating market development, and management with corporate-wide debate will continuously refine the underlying strategic policies to motivate beneficial autonomous behaviors. Responsibility and accountability for continuous business engineering on an issue-by-issue basis is clear: MIS director for information technology, human resources director for skills base, president for organizational structure, management team for strategy, president and marketing director for culture and policies, and the directors of advanced manufacturing engineering and marketing for knowledge. Though there is a common set of driving *principles* shared by most business engineering initiatives, they are more aptly called rules at this point as they are not universally applied: Involve people in the decisions that affect them, develop and communicate relevant and comprehensive knowledge, accountable empowerment, and "maintaining an innovative environment through challenging the status quo, embracing change, and encouraging informed risk taking" (quote from the Guiding Principles section on Growth in the Strategic Policies—see Appendix). **Principles Knowledge Base:** The foundation for change proficiency maturity is strong, and only shy of the mastered stage for lack of scope at this point: the principles included in the rules list above have not yet taken hold in the development of an information technology infrastructure, for instance.
Robustness Metric Focus: This decentralized knowledge-driven investment practice has demonstrated its abilities to respond quickly with, for instance, the recent HVM program–team design of a completely new business unit to meet an unexpected speed-up in market-development. The cost of this HVM business "engineering" defies capture, as the result simply emerged from existing knowledge and ongoing debate among team members, all of whom are expensed in a variety of operating functions (production, supervision, advanced manufacturing engineering, and marketing). Robustness stems from the broader involvement up-front of the people involved in making an investment work after the fact and the basic requirement for knowledge-based decisions. **Scope Metric Focus:** Involving more people in the application of this investment practice across a broader spectrum of business activities is evident in the initiative for deeper business understandings, like the more formal "open-book" financial training; and in the growing appreciation for Plant 30–style broader business understandings, like the HVM-team recommendation for a cross-functional focused-factory structure. There is still difficulty, however, in adding a new technically-deep knowledge area with the same breadth of participation and assimilation that machining and production process enjoy.

| **Migration Competency—Proactively Aggressive:** Warren Buffett [12], revered for his acumen at investing in companies, and one of the worlds richest people as a result, claims he will not invest in companies that are making major changes—he does of course—but what he looks for is a company that rolls through change as a non-event—which is the very essence of good *migration* competency. Ongoing investment in learning about emerging technology and markets prepares Remmele to enter new markets with new business structures and technologies as a business-as-usual occurrence.
Modification Competency—Proactively Formidable: The Remmele investment practice functions more on principles than rules, and as a result demonstrates some capability to evaluate new and different "business engineering" investments within the same practice: the management development program, for example. Adding a new technically-deep knowledge area like information technology, however, doesn't yet enjoy the same broad-based involvement that underlies the basic investment practice. | **Expansion Competency—Reactively Sure:** Obtaining more funds for necessary business engineering activities is not an issue at Remmele. On the one hand, most such activity is part-and-parcel of standard operating practice and funded by divisional operating expenses without line-item recognition. On the other hand, if visible areas such as advanced manufacturing engineering or information technology infrastructure design require additional personnel or outside expertise, the value of knowledge acquisition and dissemination is balanced against the risk of making poor decisions—and the policy of informed risk dictates.
Reconfiguration Competency—Reactively Automatic: The company's ability to reconfigure the application of funds as well as the application of knowledge in business engineering activities is rooted in the total involvement of the employees and their apparent belief that a job done right is the only job done. Ideas from one division are readily employed in another, and the nature of expense-funding accommodates priority or focus changes transparently. |

[1] A. Slywotzky, *Value Migration* (Boston: Harvard Business School Press, 1996), p. 288.

3.1 Business Unit Relationships: The inter-relationships that exist among the various operating units that constitute the organization, as well as the relationship these units have with the organization as a whole. Units might be departments, lines-of-business, production plants, divisions, groups, subsidiaries, or other accountable business entities. Generally applicable Agility issues include the breadth of relationships permitted with units outside the organization, autonomy to choose and negotiate inter-relationships among units within the organization, degree and nature of centralized functions and organization-wide standards, size of operating units, reassignment of unit functions and responsibilities, outsourcing/insourcing, functional core-competency development, and acquisition.

Business unit relationships at Remmele are governed by the Strategic Policies (see Appendix) and their emphasis on empowerment, autonomy, growth, risk management, and plant-size guidelines. The top-level business units include the centralized corporate functions and the four divisions (in five plants); within the plants there is a similarly structured relationship among the program/project manager business units, and within the program management units at the Production Division there is a similarly structured relationship among focus factory cells.

Proactive Change Proficiency Issues	
Creation	• Establishing a self-organizing business-unit creation environment
Augmentation	• Growing a new business unit to self-sufficiency and on to unit margin objectives
Migration	• Developing top management successors; developing effective customer replacement
Modification	• Integrating non-traditional units such as Production Machining and Corporate Information Systems
Reactive Change Proficiency Issues	
Correction	• Fixing badly performing units
Variation	• Effective access to specialty spot-use resources outside the business unit
Expansion	• Developing new program/project managers and divisional managers
Reconfiguration	

Establishing a self-organizing business-unit creation environment
- The reader is referred to Appendix D that contains an excellent and necessary description of the organizational structure and organizing principles which will not be repeated here.
- Though Plant 30 was gained by acquisition, strong ideology at Remmele has made it difficult to add business units through acquisition: incompatibilities in culture and valuation are generally too great. This realization has come from experience and has strengthened the focus on creating an environment that generates new business units from existing ones. "We started out with machining and with automation as a single business in one plant (Plant 10). Some people ended up specializing in the parts and assemblies made for the automation group—so when more work came in and the place got crowded, these two different businesses were split and the Automation Division was spun-off (Plant 50)—with two separate P&Ls right away. But the cultural identity was still one company, just in two locations. The first real recognition of 'differentness' occurred when the third unit was formed by acquisition (Plant 30)—which created some 'we-they' feeling. Eventually Plant 30 split, creating Plant 20 when it was decided that the work-cell (Production Machining) business and the flexible equipment (Repetitive Batch) business are really very different: Work-cell equipment is specialized and may be sold off after the job goes away, whereas flexible equipment is applied to many jobs. The people are different too: different types of operators are needed for small-part-month-after-month vs. the operator who must run many different types of jobs with frequent and different setups. We have come to look at this spawning process with greater understanding and respect as each event occurs; with more decentralized autonomous empowerment concepts reflected in our Strategic Policies (see Appendix) as the years have passed."
- "Back in the '50s Fred Remmele felt that relationships with a customer were better if a Project Manager was the single-point customer interface, who also had full responsibility for the relationship as if it was his only business. The Project Manager concept started when Remmele was only a $3 million business. As plants spun off, it became evident that Project Managers could not be centralized at Plant 10 (where everything started), and instead had to be in the plant that did their work. Eventually we recognized that Project Managers in different plants required different skills. At Plant 30 you had long-term management and little new business work, whereas the Plants 10/40 Division needed just the opposite. There were also differences in working with portable carryable parts vs a heavy or large part that needed a crane—how you schedule and manage those

jobs was very different. This meant we really had different kinds of project managers. Project managers have to be real self-motivated, as they are responsible for building a business without much direct management."

- When one of the shop people involved with bringing in new high-velocity machining technology was asked: "What's unique about this place?", the prompt answer was: "It splits into two before it gets too big. People in the weekly meetings are asking when our place is splitting and why it hasn't happened yet." Someone interpreting this answer later suggested that people in the plant can't help but see that there is no room for the high velocity machining equipment unless some of the existing activity vacates the building—and there is a candidate business-in-the-making there that is close to striking out on its own.

Growing a new business unit to self-sufficiency and on to unit margin objectives

- Whenever a major new type of job is secured by Remmele, whether for a new or existing business unit, a process is invoked by marketing which identifies similar types of needs and companies throughout the United States likely to have those needs. If justified, a target account program is developed and sales reps are involved in further research and market penetration activities. For some time now there has been an e-mail network specifically set up for the sales representative interactions with the company, and this network is one of the tools used to monitor and modify these market penetration programs in real-time.

Developing top management successors; developing effective customer replacement

- Typically the head of a company in this industry is a technologist and not a marketer, most likely a machinist in background. That is not the case at Remmele, where strong marketing experience is evident in senior management. What is equally evident among senior management is natural "people-person" skills backed up by a deep visceral feeling for the values, development, and maintenance of the ideological core of Remmele. Whether consciously done or not, there is active business engineering at work here; with senior management guiding the explicit formulation and refinement from predecessors of the key corporate practices: accountable empowerment, decentralized autonomy, informed risk, project management, professionally classic sales and marketing, open communications, broad employee involvement in decisions and the annual planning activity, and so forth. Importantly, management takes an active role in helping others understand and utilize the core principles at Remmele. Though it is clear that the ideology is well understood and embraced broadly throughout the company, developing and maintaining it is a special skill that may be difficult to replace. Recently the company has recognized the need for growing management capability internally and has instituted an individualized personal development program aimed at producing the skill sets needed for Remmele's future growth and succession.
- Customer replacement skills are especially necessary in a business that does customized outsourcing. The focused-factory cells at Plant 30 typically make sizable commitments for multiple years to individual customers and build dedicated production cells to satisfy those commitments. Contracts that run their course and don't result in renewal or next-generation succession can remove a sizable amount of monthly revenue and surplus an equally sizable amount of valued human resources. Plant 30 has recently dealt with just such an occurrence and now understands the necessity for an ongoing replacement strategy that greatly shortens the disruption period. At this writing the gap is well on its way to being filled by several new programs in new markets.

Integrating non-traditional units such as Production Machining and Corporate Information Systems

- The Production Machining Division (Plant 30) functions quite differently from other Remmele divisions. The focused-factory work-cell concept has caused this plant to train people in numerous skills, like purchasing, maintenance, and other business functions, while machinists in other plants tend to have more traditional machinist training, not including some of those business skills. Similarly, machinists at the Automation Division (Plant 50) often gain skills in machine assembly that are not common in the other plants. Remmele's continuing growth and the changing business environments will require that such different skill sets, including information technology, be recognized and valued for the advantages they bring to the company overall, and that some of these skills will be transferred between divisions.

Fixing badly performing units

- "Patience, Perseverance, Leadership, Teamwork" are banner slogans that graced Remmele's celebration when the Automation Division came out of its slump. Remmele stuck with this division through several very difficult years. The decision to fix it rather than close it rested on many factors. Though the company's stable employment commitment played a role, employees could have been transferred to the other growing divisions.

More decisive was the value placed on business diversity, and that this division provided entrée into a first-class customer base for the other divisions. Also there was a belief that the problems were of their own making and that it was possible to succeed in the business. "The business had grown up making some things that were variations of a common theme. We got good at it and kept doing it. Then markets disappeared all of a sudden, and we didn't have anything. All of a sudden we had to succeed on one-of-a-kind jobs, and we didn't have the necessary skills. Then we took some long-term jobs that turned out bad. We had to regroup and start over and go back to a customer base that we had disappointed. Also we had a managerial strength problem. We had the time to fix it. We knew all of those people as family and didn't want to mess up here—we just had to find a way. All the while various things were tried, and new management was engaged and held accountable for corrective action. A conscious decision was made to get it fixed, and perseverance was practiced. The division is reborn in a different image now and quite vigorous." It is worth noting that the intense focus and concern on this division's return to health did not cause the company to suspend its principles of autonomy and empowerment while holding new divisional management accountable.

Effective access to specialty spot-use resources outside the business unit
- Internally, Remmele provides a centralized resource that actively maintains a current knowledge base of leading-edge process and equipment technology and makes these resources available to other divisions in need of special expertise. Externally, Remmele outsources NC programming—though recognized as important, there has been no compelling reason to bring it all inside and set up dedicated capabilities.

Developing new project/program managers and divisional managers
- The corporate Human Resources group has recently instituted an individualized personal development program for all people in management positions of any kind—from the president to the shop-floor supervisors. An outside firm with expertise in the field assists in annual one-on-one consultations to help establish objectives and strategies for personal development in the ensuing period. The impetus for this program arose with the realization that Remmele had excellent technology training programs but generally had to bring some project and program managers, as well as divisional managers, in from the outside, as there were no in-house training grounds to develop management skills. Interestingly, the Production Machining Division started its focused-factory concept in 1989, where people in the cell take on broad business management responsibilities in addition to the cell operation activities. There is no evidence that this approach has been consciously employed as a management training ground—perhaps because its operating modes are devoted to a different type of business than the other divisions. The example of employee empowerment, however, has been recognized throughout Remmele.

Change Proficiency Maturity—Business Unit Relationships **Defined/Managed Stage (2.5) for Both Proactive and Reactive Change Proficiency**

Metrics Knowledge Base: Remmele has a solid metric-based appreciation for the adaptability that stems from a decentralized autonomous unit organizational structure. They respect the robustness brought to the corporate entity from separate units pursuing different and counter-cyclical markets; they understand that small unit size (under 200 people per the Strategic Policies) helps support fast unit response while decision-making costs are kept to a minimum; and they are conscious of the time it takes to find competent unit management, as well as the costs of doing this poorly.

Responsibilities Knowledge Base: A responsibilities knowledge base is starting to emerge. Corporate Human Resources now has assigned responsibility for installing and managing an individualized personal development program, with the objective to develop managers in-house.

Cost Metric Focus: Getting new business units to the self-sufficiency point has the advantage of leveraging the entire corporate cadre of sales representatives who are actively focused by corporate marketing on targeted opportunities. This strategy is both time- and cost-effective.

Robustness Metric Focus: Many of the predictability problems are understood, with some already handled competently: Entering new markets enjoys a good success record from solid knowledge-based decision making, the business unit architecture and mix strengthens the viability of the group, and the cash management and investment practices mitigate risks and potential threats. Areas currently recognized as needing help: the Production Machining Division is in the early stage of strategy development for stabilizing contract termination-replacement transitions, and the creation of the management development program is expected to make management appointments more predictably successful.

Augmentation Competency—Proactively Competitive: New types of jobs trigger a corporate marketing process that identifies similar opportunities and targeted companies. An e-mail network with all field sales reps is employed to quickly identify and penetrate new prospects in similar firms. **Migration Competency—Proactively Aggressive:** Recently the company has recognized the need for growing management capability internally and has instituted an individualized personal development program aimed at producing the skill sets needed for Remmele's future growth and succession. This program has not yet been called upon to produce results. Plant 30 actively develops broad skills sets useful to developing managers; but there is no evidence that this has been employed as an explicit management training ground.	**Variation Competency—Reactively Confident:** A process for sharing technical knowledge between plants is maintained that can provide any division with leading-edge knowledge and expertise. When a division runs into a technical problem or an unfamiliar customer opportunity, these people assist other business units. The depth, breadth, and currency of this consulting expertise in machining and process technologies is recognized by competitors and customers alike as unique and valuable. **Expansion Competency—Reactively Sure:** Opportunities to open new business units and add program and project managers to increase business volume have not been easily met in the past, as there has been no internal spawning ground for these skills. These limitations have been recognized, and a training program that focuses on developing these resources internally has started.

3.2 Employee Relationships: The working inter-relationship that exists among all people engaged by the organization directly as individuals, as well as the relationship those people have with the organization as a whole. Agility issues generally applicable across industry include creating a sense of ownership and responsibility, delegating and distributing control and responsibility, reassigning tasks and responsibilities, improving and imparting new skill sets and knowledge, and workforce right-sizing.

Employee relationships at Remmele are governed by the Guiding Principles (see Appendix) and its emphasis on employee satisfaction through economic security, trust and open communications, continuous learning, concern for individual needs, involvement in decisions, and a clean, safe working environment. An employee handbook adds detail to the meaning of these principles and spells out what should be expected by both the company and the employee. Reconfiguring these relationships generally means changing the people and/or skills assigned to various responsibilities, development programs, teams, and reward systems.

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

Obtaining top-quality people; creating a sense of team, ownership, and responsibility
- During the recruitment and interviewing activities lots of talk happens up-front to fit people with the culture and weed out the wrong ones. Common screening procedures test for like-minded people who expect serious work, a sense of family, and constant learning. Picking the right people is a key factor, so lots of testing happens. Though the recruitment screening is formal and specific, the qualifications are for broad values and ethics rather than dogma and background. The company actively seeks self motivated innovative problem-solvers that think for themselves. "We discuss continuous learning as the job, commitment to continuous improvement, empowerment and the responsibility it brings, that getting ahead is attached to skill and ability, that people come to own their work very overtly, about access to information, about challenging people, and that the Remmele reputation is to solve tough manufacturing problems, so we need the best and the brightest."
- An annual employee satisfaction survey questions peoples' opinions of policies as well as general attitudes. "People are so precious to the business that you have to preserve and protect them. People are told that they will have to work as much as needed when the work is present and in return the company will staff leanly to protect their jobs; reducing the work when business is poor rather than laying off. So the work-week is the variable and everybody expects that. Employee surveys have always had over 90% say: 'Yes, keep doing that,'—even the old timers—who, for the most part, do not ask for full hours in tough times because of seniority."
- A Remmele manager comments: "The pyramid chart is alive and well here, and layers of management are not being taken out; but people are involved in the decisions that affect their livelihood, and have always been dealt with from a position of trust."
- The machinist's Apprenticeship Program starts with a two-year vocational trades education before they are hired by Remmele and admitted into the program. Upon admittance they receive six-months of apprentice training-credit for the vocational education. They then spend two and a half years rotating through the five Remmele plants at six months each, then a final year of internship in one plant—for total of four years. In their final six-month rotation at the Repetitive Batch Machining Division, when they are familiar with CNC equipment, apprentices are assigned personal non-supervisory machinist mentors for each machine they are assigned to operate. Mentors are responsible for providing the day-to-day direction and assistance necessary to assure the completeness of training. Mentors regularly evaluate the apprentice's progress, and apprentices regularly evaluate the mentor's effectiveness as a trainer. These formal two-way performance reviews assure that training is effective and appropriate. Apprentices rank their plant preferences for the final year of training at the completion of the last six- month rotation, and their preferences are instrumental in deciding their assignments.

- Everybody participates in corporate profit sharing based on total corporate results, with a minimum guarantee that 3% of wages will be contributed to the retirement plan. Anything available above that can be taken as cash or put into the retirement fund at the employee's discretion. Higher paid top management has a cap on the amount of profit sharing from this plan. Additional bonuses are available for project/program managers based on specific job profitability, and for other key people based on plant or company profitability depending on the nature of their responsibilities.
- One employee commenting on the small-plant strategy offered: "People want to know everybody in the plant and have a good relationship as a family." Though there are no formal corporate teaming support structures or standard training classes, people team naturally and very effectively. This is likely based upon the fact that ego-based individualism is bred/selected out, a sense of family is strong, ownership is pervasive, and the reward system does not favor individualism or create an internal competition. Consultants are brought in on occasion to help train special team skills when necessary and have been employed at the Automation Division as well as the Production Machining Division, which is organized around focused-factory teams associated with a specific customer. The bi-annual meetings of Remmele people and sales reps incorporates specific training on development and operation of *selling teams* that will interface with customer's *buying teams*.

Improving personnel skills
- Though Remmele's observation of cost accounting data shows that approximately 4% of payroll is reinvested in formal training of hourly employees, much more is spent on less formal means and not captured specifically as an expense item: There is a strong suspicion that tracking these investments overtly would be counterproductive. There is no training budget—the hourly number is known only because they had to find it for their Baldrige application work.
- Remmele will pay for any education that the company can use, regardless of a person's current position. Thus, an accountant's interest in machining courses or a janitor's engineering education are not questioned and are paid for 100% up-front—not qualified on grade performance. "Here's the money, now what's your excuse. We have to knock down barriers that stand in the way of anybody becoming whatever they want to become."
- Knowledge maintenance is valued: With an employee base of 475 people, they send 50-60 to the IMTS Exhibition and Conference.
- Custom-tailored training is typical. Across the corporation, psychological testing is done down to second- level managers, with skill/leadership development done down to third level. A structured program was put in place for the Production Machining Division's "focused-factory" people that did individual needs assessment and then taught the skills that were needed.

Workforce diversity; management succession
- Remmele values the breadth of innovation and approach that comes from diversity in human resources but is having difficulty attaining the breadth it desires from the Minnesota area, which has a dominant ethnic consistency. This is becoming a challenge as the company grows and its annual recruitment volume increases. Rather than compromise its core values on new-recruit qualifications, it has broadened its recruitment activity into surrounding states and beyond.
- Senior management at Remmele is approaching retirement age, and succession is once again an issue for consideration. Previous transition practice has basically employed a multi-year gradual phase over to a designated successor. With growth, the company has recognized the need for a broad-based program of management-skill preparation and has instituted an individualized development program aimed at strengthening the entire management team and growing internal skill sets needed for Remmele's future growth and succession.

Gaining new skills; guarding against insularity
- Most of Remmele's senior management team have been recruited from outside rather than promoted from within. This has added to the diversity of thought without polluting the core values and without creating a "dead-end" feeling among long-term employees—who value competency over title in both their own performance and that of their management. Remmele has had to reach outside as it has not had a natural training environment for developing new management—which is now realized and addressed with a new and individualized "leadership development" program specifically aimed at growing internal management skills.

- Recruitment efforts target top talent and gifted personnel with a mind of their own; screening machinist apprentice candidates for breadth of interest and world consciousness, as well as for values and value

systems—rather then for a specific dogma. Recently older apprentices are entering the program, bringing with them their experiences in other companies. Occupations other than machinist are not subjected to the same screening template, which adds further to the diversity of thought.

Correcting mismatches between people and their tasks

- The specific nature of Remmele's ideology and its consistency among employees has resulted in a self-organizing system. When three shop employees were asked: "What if somebody gets past the screening process and turns out to be on the lazy or less prideful side?" the individual answers were a progression of practice—1) "It wouldn't happen," 2) "We'd talk to them and help them get up to speed, and 3) "Eventually they'd see that they didn't fit and leave voluntarily; but if all else failed the supervisor would invite them to leave." These sentiments were echoed closely in another division, where the focused-factory cell teams decide who they will team with and then work with each other to develop the necessary complement of skills and responsibility: "Nobody really hasn't fit in, but if all else fails, the pressure is raised on that person and eventually the supervisor will help if they don't move on voluntarily."
- *Open-Book Management* expresses the management-employee situation when it is incorrectly addressed—something that doesn't occur in the open communication environment at Remmele: "Work is a lot like bowling, except there's a guy called a supervisor who stands in front of the pins with a curtain. He can see the pins but the bowler can't. The bowler throws the ball, hears something, and says, 'How'd I do?' The supervisor says, 'Change your grip.' The bowler says, 'But how did I do?' The supervisor says, 'Move your foot.' The bowler changes his grip and moves his foot and throws another ball. He hears the pins fall and asks, 'How am I doing?' 'Don't worry about it. We've got a review coming up in six months. We'll let you know then.'"[1]

Filling critical slots when a key employee is absent

- There is a lot of cross-trained job rotation at Remmele on both a formal and informal basis that provides critical backup insurance. In broad terms, apprentices are rotated through each of the five plants for six months at a time, people are moved from job to job within plants as projects come and go, and people are moved from plant to plant as business waxes and wanes in different sectors.
- Project Managers have moved successfully between plants, but Plant 50's project engineers require unique skill sets. Within the plants there are generally multiple project managers capable of handling each other's responsibilities.
- Focused-factory teams in the Production Machining Division are cross-trained on all cell production stations as well as the broader set of support functions like purchasing and maintenance.

Finding more high-quality machinists; handling surge requirements

- With Remmele growing at 10–12% and a base of 475 employees, the current staffing chore is about 50 people per year to cover both growth and attrition—with constant growth in productivity mitigating these numbers. These requirements put a large recruitment load on the plant's human resource people, and machinist apprentices are a particular issue. Though Remmele has always worked closely with the vocational schools, bringing teachers out each year for tours and discussions about changing needs, they are now reaching into the high schools to show that a machinist's life is clean, high paying, and high technology–oriented.
- For surge requirements in the traditional machining businesses Remmele relies on overtime and borrowing machinists among the plants. Hiring temporary machinists is not an option, as they are simply not available. There is also a strong bias to grow their own as they generally don't even hire journeyperson machinists from elsewhere.
- The Production Machining Division (Plant 30) does not generally require journeyperson machinists and can utilize outside contractors to fill surge requirements.
- The Automation Division (Plant 50) generally needs engineers in times of surge and is able to bring in highly skilled people on contracts.

Reassigning tasks and responsibilities to meet special needs

- Remmele has an excellent and active internal interaction network where everybody knows each other well enough. Within plants the family/team culture provides this visibility. Across plants the common-function forums convened for purchasing, accounting, technology, and marketing provide the interaction and communication channels. When particular needs arise they can be readily matched with the right people who have the right capabilities.

Change Proficiency Maturity—Employee Relationships
Mastered Stage (4) for Both Proactive and Reactive Change Proficiency

Principles Knowledge Base: The corporate Human Resources Department has the principal responsibility for employee relationship management and has an appropriate employee handbook spelling out the details, definitions, and expectations of company employment. This handbook begins with the corporate Guiding Principles statement (see Appendix) that in fact establishes the employee relationship framework with its emphasis on employee satisfaction through economic security, trust and open communications, continuous learning, concern for individual needs, involvement in decisions, and a clean, safe working environment. The Guiding Principles are governing, with the remainder of the handbook interpreting their application and providing background and detail for such things as tuition reimbursement and regulatory compliance.

Scope Metric Focus: Though time and cost to find and recruit the qualities and diversity desired in good machinist apprentices are rising, neither are incommensurate with the values attributed to methodical screening and selection. Annual employee surveys and the practices that reflect the ideological core ensure a robust, stable, predictable environment. The company's current emphasis is on broadening its skill development with the new management and leadership training, widening its recruitment pool with its outreach to high schools, and increasing diversity by broadening its recruitment efforts.

Modification Competency—Proactively Formidable: Remmele has had to reach outside for most of its senior management as it has not had a natural training environment for developing new management. This influx of management trained elsewhere has been successfully added to the corporation without losing or changing the corporate ideology and without creating a "dead-end" feeling among long-term employees. Recruitment efforts for both management and operational people target top talent and gifted personnel with a mind of their own; screening candidates for breadth of interest and world consciousness, as well as for values and value systems—rather than for a specific dogma. That such people can be added to the mix without disruption is a testament to a practice that is well founded and compatibly consistent.	**Reconfiguration Competency—Reactively Automatic:** Remmele's strong ideological core makes it relatively easy to move people from one part of the company to another, as they share a common and practiced sense of company, working framework, and appreciation for professional competency. This same set of principles values constant learning and continuous change, facilitating quick deployment of resources into areas where they may have little prior experience. The extensive internal networking facilitated by an open communication environment and frequent cross-divisional functional forums provides an ability to identify the right people for urgent needs within the company whenever they arise.

[1] Case, p. 63.

3.3 Partner Relationships: The inter-relationship that exists among a group of businesses or individuals sharing the liabilities, risks, and rewards of a common business venture. Within an industry, the relationship that exists between an enterprise, its business partners, and its competitors. Generic Agility issues include creating an operating agreement quickly that satisfies all partners, establishing effective operating procedures unimpeded by corporate cultural differences, and dissolving the partnership easily when it's no longer useful.

At Remmele, partner relationships at all levels are governed by the Guiding Principles that promote good corporate citizenship, support of the community, ethical business conduct, and support of the industry as a whole. Within this framework, Remmele, in conjunction with its business partners and competitors, strives to be part of a vital, growing industry.

Proactive Change Proficiency Issues	
Creation	• Identifying synergistic business partners
	• Creating an operating agreement quickly that satisfies all partners
	• Dissolving the partnership easily when it's no longer useful
Augmentation	
Migration	
Modification	
Reactive Change Proficiency Issues	
Correction	• Rectifying dysfunctional resources
Variation	
Expansion	
Reconfiguration	

Identifying synergistic business partners
- In the literal sense, Remmele could be viewed as avoiding partner relationships, believing that dependence on others increases the risk while providing minimal value to the company as a whole. Historically, Remmele has opted to develop internal capabilities as they relate to new technologies, increased capacity, and improved performance versus acquiring capabilities through a business partnership. Very recently, the company has been beta testing a cross-referral relationship with a highly regarded engineering firm in Boston, Foster Miller. By co-leveraging the strengths of both companies (the concept and product design expertise of Foster Miller and the machine design, fabricating, machining, and assembly capability of Remmele), Remmele hopes to increase customer satisfaction even further. "Leadership in the marketplace can only be sustained by constantly meeting or exceeding the expectations of our customers and anticipating their future needs through continuous improvement (augmentation) of our products and services."
- Acquisition opportunities for Remmele have been viewed in a somewhat similar manner as business partnerships—they have historically been avoided. After assessing the investment requirements plus the complexity of assimilating a "foreign" environment into the Remmele culture, these factors have far outweighed the perceived benefits of acquiring a synergistic organization. Subsequently, the company continues to look internally when the need exists for new skill sets, incremental machining capabilities, increased capacity, etc.
- At the industry level, Remmele consistently "partners" with many diverse companies within the machining industry, including suppliers, customers, synergistic enterprises, and even competitors. The company strives to be a good corporate citizen realizing that it is critical to their long-range survival to be part of a vital, growing industry. Remmele has not only supported trade associations and both local and national professional organizations, but has consistently assumed a leadership position, helping to address, for the industry as a whole, those parameters that have been instrumental to Remmele's own success. The company strongly promotes continuous training and learning at all levels and thus has assisted other companies in establishing machinist training programs and has assisted the industry in establishing management training programs for the overall improvement of management standards. Remmele believes it is critical to be a good supplier, a good customer, and a good competitor by following the ethical standards of business conduct.

Creating an operating agreement quickly that satisfies all partners
- By focusing on the more traditional customer and supplier relationships and the associated contracts and terms of delivery, Remmele has had minimal need for operating agreements associated with partnering

relationships. Their somewhat informal relationship with Foster Miller was consummated by a very "loose" operating agreement that enables tremendous flexibility for both parties to pursue synergistic opportunities actively. The risk and exposure to Remmele of such a relationship are minimal but so are the associated rewards.

Dissolving the partnerships easily when it's no longer useful
- There is no formal procedure in place to establish business partnerships and no formal procedure to dissolve such partnerships. Once again, Remmele relies on the guiding principle, its belief in the ethical standards of business conduct, to determine not only *what* business relationships to pursue but also *how* to develop, manage, and eventually dissolve these relationships. Partnering relationships, in the truest sense, have not been encouraged at Remmele, and therefore the need to dissolve such relationships has been minimal.

Rectifying dysfunctional resources
- Minimal business partnering has resulted at Remmele, thus precluding the need to address dysfunctional partners or resources. The routine partnering that does occur at a supplier, customer, or competitor level is based upon the establishment of clear expectations, timelines, and deliverables. If shortfalls in performance do occur, Remmele's approach is to be supportive, to mentor, to share technical or business information, and to communicate constantly until the problem is solved.

Change Proficiency Maturity—Partner Relationships **Accidental Stage (0) for Both Proactive and Reactive Change Proficiency**	
Examples Knowledge Base: The present knowledge base, as it relates to business partnering, consists of a handful of examples that have or have not worked. Future partnering opportunities are assessed on an individual basis but rely heavily on the preconceived notion that business partnerships are based upon risk avoidance and thus will not drive the greatest value for Remmele.	
Pass/Fail Metric Focus: Partner relationships at Remmele comprise a limited body of knowledge. Existing models are judged to be successful or unsuccessful, examples of opportunities that should either be pursued or avoided.	
No Competency—Proactively Lucky: The identification of partnering opportunities is casual and somewhat arbitrary. Routinely, such opportunities are not sought out but arise as part of the day-to-day task of doing business. Partnering opportunities that are identified, such as the relationship with Foster Miller, are assessed based upon their ability to provide value for Remmele and fill an existing need or gap.	**No Competency—Reactively Lucky:** The success or failure of such a relationship is somewhat random and routinely involves minimal prior positioning or preparation to ensure effectiveness. At Remmele, based upon historical performance and a culture that is unforgiving of mediocrity, successful partnering at a business level is the exception rather than the norm.

3.4 Supplier Relationships: The inter-relationships that exist among a group of resources engaged by an organization to deliver specific goods or services, typically as independent businesses or contractors, as well as the relationship each of these resources has with the organization directly. Generic Agility issues include imparting real customer requirements quickly and accurately, reaching contract agreements quickly, forming and operating integrated product/process teams, multi-tier concurrent information exchange, quick response to changing schedules and quantities, migration of value-added responsibilities upstream in the supply chain, and late discovery of critical supplier failures.

At Remmele, the foundation of the relationship with suppliers is built upon their Guiding Principles and clearly delineated purchasing guidelines. Within this framework, Remmele and its suppliers interact to drive mutual business benefit and ultimate customer satisfaction.

Proactive Change Proficiency Issues	
Creation	• Identifying long-term, viable suppliers • Imparting real customer requirements quickly and accurately • Reaching contract agreements quickly
Augmentation	• Investing in key suppliers to drive improved performance
Migration	
Modification	
Reactive Change Proficiency Issues	
Correction	• Discovering and resolving critical supplier failures
Variation	
Expansion	• Responding quickly to changing schedules and quantities
Reconfiguration	

Identifying long-term, viable suppliers

- The creation and maintenance of an effective supplier base for raw materials, components, or technically advanced machining centers is paramount to the continuous business success of a machining contractor such as Remmele. In today's dynamic business and technical environment, suppliers must be positioned to meet the customer's current and future needs as they relate to technical capability, product quality, equipment reliability, cost, cycle time, and delivery performance. As stated by Roy Otto, Machine Tool Supply, a Remmele supplier since the 1960s, "Remmele is a typical customer three to five years from now. They have high expectations of their suppliers, clearly moving their suppliers towards excellence." A second supplier supported this statement, "Remmele challenges us to build them the next generation of machine tools, to develop machining centers that push the envelope of technology. Remmele is not afraid to take well calculated risks to improve machining technologies."
- Remmele chooses its supplier base carefully based upon a number of critical parameters, including current capability, willingness and ability to invest in future capability, technical expertise, responsiveness, reputation, and business viability. Suppliers realize that they will be expected to meet the needs of the current project plus the as of yet undefined needs of future projects. Remmele sets clear expectations for cost, lead-time, and inventory levels and will partner with suppliers to meet these goals. Frequent, excellent interaction between Remmele and its supplier base has helped to establish the basic theme of "do more for less."
- Not only does Remmele carefully select its supplier base, but the company as a whole makes a substantial investment in maintaining its key suppliers. A constantly updated supplier history database tracks supplier performance including on-time deliveries, supplier responsiveness, quality audit results, a buyer satisfaction metric, etc. The supplier base is selected, maintained, and constantly optimized, on both a plant and corporate level, by supplier relationship teams that include representatives from purchasing, quality control, engineering, and manufacturing. Though some items are single sourced (i.e., customized automation components), most items are dual-sourced to manage uncertainties in supply and demand more effectively.

Imparting real customer requirements quickly and accurately

- At project inception, Remmele sets clear expectations with their critical suppliers and provides a monthly supplier report tracking actual performance vs. expectations. Per Ron Rolfes, Ryerson Steel, a supplier of aluminum, stainless steel, and carbon steel raw stock in bars, sheets, and plates, "Remmele is very customer specification–oriented and passes this orientation on to suppliers. Ryerson is expected to meet the demands

of both Remmele and Remmele's customer base." To insure that raw material and component specifications are met, Remmele audits supplier capabilities on a continual basis but minimizes in-house inspection and test. Quality and/or delivery problems are addressed quickly and effectively.

- Communications between Remmele and their supplier base occur via many media—electronic, fax, telephone, face-to-face meetings—dependent upon the capabilities of the individual suppliers. Direct electronic order entry links, database query capability, and direct CAD and CNC data file transfer capability are in place with many key suppliers. Information exchange between suppliers and Remmele, at all levels, is deemed to be highly effective because "everyone at Remmele is highly focused and knowledgeable about the business."

- In Remmele's Plant 30, a focused-factory environment, day-to-day interactions with all suppliers occur on a shop floor level. After certification and contract negotiations with the purchasing organization, subsequent supplier interactions related to demand variability, quality issues, or supplier delivery performance are managed directly by the operators in a specific work-cell. Suppliers have fully embraced this concept believing it improves communication, efficiency, and effectiveness. In the future, operators in Plant 30 will be utilizing more sophisticated QC, SPC, planning, and scheduling tools and will assume even more responsibility as it relates to supplier interactions and management.

Reaching contractual agreements quickly

- Effective customer/supplier relationships are predicated on clear definition of roles and responsibilities, agreement upon realistic expectations, and constant, open communication. If these parameters are supported by a strong, underlying, value-based ideology with associated functional guidelines, then the need for complex, formalized contractual agreements is minimized. At Remmele, supplier contracts are primarily based upon relationships and are often specific to a particular supplier or project. Audits are routinely executed by the purchasing organization to insure that discounts are being applied and that purchasing guidelines are being followed.

- Competitive businesses with demanding and informed customers must rely on employee initiative to seek out opportunities and respond to customers' needs. By employing an effective control system that utilizes belief systems, boundary systems, and interactive control systems, Remmele has been able to empower its employees, at all levels, to interact with suppliers in an effective and ethical manner.

- Many of Remmele's future purchasing strategies, including expansion of electronic commerce, pay upon receipt, automatic stock replenishment and direct purchasing, will further minimize the need for formal contracts while enabling more timely and efficient interactions.

Investing in key suppliers to drive improved performance

- Remmele continually sets high expectations for their supplier base as it relates to technical knowledge and expertise, equipment capability, cost reduction, decreased lead-time, cycle time reduction, and inventory management. To meet these ever-increasing expectations, Remmele provides both business and technical support to their suppliers. Machine Tool Supply, a Remmele supplier, was challenged to remove both cost and lead-time from their supply chain to meet Remmele's expectations. To accomplish this, changes were required to the internal Machine Tool Supply information system. Through the joint efforts of both Remmele and this supplier, major inventory reductions were accomplished and maintained, plus the cost and lead-time goals were met. A key Remmele supplier comments, "Suppliers learn from Remmele. They are open about their business. They will show anyone their plants. They do this with the belief that sharing the knowledge will make everyone better."

- Remmele's relationship with its supplier base is based upon trust—"They don't play games with their supplier base. They are very open and up-front. We go the extra mile for them." Remmele in return invests in their suppliers to improve their technical capability and their business viability. Remmele uses its corporate purchasing power to improve service, lower cost, and optimize the supplier base.

Discovering and resolving critical supplier failures

- Real-time operating surprises, related to the timely availability of equipment, raw materials, and components that meet specifications, can be minimized by performance auditing and constant communication between customers and suppliers. When problems do occur, timely interaction, effective teamwork and the availability of meaningful data can minimize the impact and prevent catastrophic failure. At Remmele, clear expectations are established with critical suppliers at project inception; these expectations include supplier responsiveness, technical capability, and effective communication. All of these capabilities are fully leveraged when a supply problem is identified.

- In addition, Remmele facilitates rapid recovery from individual supplier failures by dual sourcing most raw materials and components. The suppliers for critical raw stock such as aluminum, stainless steel, and carbon steel bars, sheets, and plates are redundant—allowing incremental demand to a primary supplier to be met by a secondary supplier, enabling an alternate primary supplier to provide contingency material if the original primary supplier encounters quality problems, and providing Remmele the opportunity to assess a new supplier while already having a certified primary supplier in place. All of these factors minimize risk and enable Remmele to meet customer expectations in spite of supplier performance failures.
- In all cases, actions by both Remmele and suppliers to identify and resolve problems are consistent with the Remmele Customer Satisfaction Philosophy: "We will accomplish this customer satisfaction) through teamwork and employee involvement; by regularly investing in the best equipment, tools and systems available, and by investing in the ongoing training and development of our people to enable each of us to perform in a manner that meets or exceeds the expectations of our customers."

Responding quickly to changing schedules and quantities
- Through the implementation of a flexible and somewhat redundant supplier base, through the ability to interface with its own suppliers or the customer's suppliers, by establishing clear expectations with suppliers prior to project inception, and by establishing clear communication linkages between Remmele and critical suppliers, the company is well positioned to respond to demand changes, both positive and negative. As cited by a key Remmele supplier, "Remmele is organized to manage changes requested by the customer quickly and effectively. Their project managers work closely with purchasing to maintain a high level of communication with key suppliers. Everyone is on the same page when it comes to change." Remmele and key suppliers work as partners to maintain minimum inventory levels while simultaneously enabling and accommodating demand variability.
- Remmele provides weekly delivery schedules to all suppliers with one to two months future visibility. These schedules enable some level of responsiveness to upside or downside demand by both Remmele and key suppliers. In addition, through continued emphasis on cross-functional training, equipment flexibility, and resource utilization, Remmele as a whole is configured to respond in a timely and effective manner to variable customer demand.

Change Proficiency MaturitySupplier Relationships
Repeatable Stage (1) for Both Proactive and Reactive Change Proficiency

Concepts Knowledge Base: The most relevant concepts in place relating to supplier relationships are 1) those that ensure an uninterrupted stream of raw materials and components that meet all specifications, 2) the ability to decrease raw material contribution as a component of cost, 3) the ability to respond to both Remmele's and the customer's ever-changing demands and expectations.	
Time Metric Focus: From a supplier relationship perspective, the time metric is critical. The focus is on raw material and component availability, the ability to minimize lead-time, the ability to reduce cycle time, the opportunity to increase Remmele shop floor utilization and minimize downtime, plus the ability to identify and resolve supplier failures in a timely manner.	
Creation Competency—Proactively Occasional: With a focus on time, the ability to 1) create relationships, 2) impart customer requirements quickly, 3) reach contractual agreements, and 4) execute effectively become critical drivers. In Plant 10, a fifth raw material supplier was identified and contracted to meet the needs of a specific project—timing and the ability to execute were critical. At the end of the project, the supplier will once again become a contingency supplier.	**Correction Competency—Reactively Safe:** Suppliers are chosen based upon their technical expertise, responsiveness, business stability, reputation, and willingness to invest in future capabilities. Suppliers with these attributes can most readily recover from catastrophic failures or respond to rea- time operating surprises. Dual sourcing of critical raw materials and components also minimizes the impact to Remmele if a supplier failure occurs.

3.5 Customer Relationships: The inter-relationships that exist between an organization and those who receive goods or services and determine value through compensating reward and continued relationship; usually also the user of goods and services. Generic Agility issues include developing and sustaining loyal relationships across product technology cycles; ascertaining unarticulated needs, developing new relationships in new markets, exploiting emerging electronic commerce effectively, integrating intra-enterprise information systems, developing and employing a customer knowledge base, and developing more responsive and more robust logistic and distribution systems.

At Remmele, customer relationships are governed by the Customer Satisfaction Philosophy and the corporate Guiding Principles which lay the following foundation: "Customer satisfaction goes far beyond the products we manufacture and encompasses the total business relationship between our customers and all our people and activities within our company." This foundation provides the guideline for customer and organizational interactions and inter-relationships at both a plant and corporate level.

Proactive Change Proficiency Issues	
Creation	• Developing new relationships in new markets
	• Developing and employing a customer knowledge base
Augmentation	• Committing to continuous improvement in every service or product
Migration	• Developing and sustaining loyal relationships across process-technology cycles
Modification	• Ascertaining unarticulated needs.
Reactive Change Proficiency Issues	
Correction	
Variation	• Responding to customer's changing production needs
Expansion	• Responding quickly to changing schedules and quantities
Reconfiguration	• Changing resource (i.e., Remmele/customer) relationships

Developing new relationships in new markets
- For many companies, business success has been determined by the ability to target a specific industry and then continually expand the breadth of products and services within that industry. For Remmele, the converse has been true—business success has been determined by the ability to target specific products and services and then expand across markets and industries. The Remmele Mission Statement states the following: "Because we strive to be the best, we focus our efforts. We specialize in high quality, technologically advanced services in the areas of: (1) contract fabricating, machining and assembly; (2) designing and building custom equipment for automating or mechanizing a variety of manufacturing processes; and (3) fabricating and building machinery designed by customers where it fits our manufacturing capabilities. Customers for Remmele services consist primarily of manufacturing industries." Illustrative of the Remmele Mission Statement, the company presently provides products and services to a wide variety of industries— aircraft, automotive, computer, defense, medical, electronic, etc. Remmele's machining and fabricating capability is industry independent. This business diversification strategy not only allows Remmele to drive double-digit revenue growth on an annual basis but enables them to understand and respond to downturns within an industry segment while minimizing exposure to Remmele as a whole.
- Remmele's recent marketing thrust into international markets is also representative of their ability to target and develop new opportunities. The norm of the contract machining industry is to target local customers and markets and fully leverage geographic proximity. By finely tuning their strengths (i.e., responsiveness, technical capabilities, reputation, customer focus), providing a competitive product offering, and demonstrating a global presence, Remmele hopes to drive both top line growth and increased market and industry diversity.
- Whether the markets are new or existing, domestic or international, Remmele's ability to develop and maintain customer relationships is paramount to their continued success. Recognizing this reality principle, the company is highly focused on building stronger customer relationships, with both new and existing customers, and on selling value. The Remmele "iceberg" concept emphasizes competitive evaluation vs. competitive bidding—selling the full value from a customer perspective of doing business with Remmele.

Developing and employing a customer knowledge base
- The ability of any company to predict their customers needs and then match these needs to their internal capabilities provides a true competitive advantage. In order to accomplish this alignment of needs and capabilities, intimate knowledge of the customer's products, services, operations, and markets is required.

Remmele addresses this need for customer intimacy by focusing on both the customer (i.e., products, markets, reputation, business growth rate, industries served, stability) and his need (i.e., parts, automation equipment, technical expertise required, machining value added). Remmele uses this information to qualify all customers and projects and to ensure alignment with the company's capabilities. The relationship with the customer drives the decision to quote on a project and determines the risk level that Remmele is willing to assume.

- In the Plant 30 focused-factory environment, Remmele often looks to the customer for training in process, quality, manufacturing, etc. Remmele is searching for those items that are "beyond the print," requirements that may not be part of the formal specification, but will ensure consistent, high quality parts. In the same facility, Remmele machines parts for the automotive industry, the computer industry, and the medical industry. Each of these components has substantially different process and quality requirements—from extremely close tolerances to clean room assembly requirements to FDA Good Manufacturing Practices compliance. In each case, Remmele looked to the customer to provide the knowledge base that was required, actually participating in on-site training in many cases. Through this mechanism, Remmele learns more about the industry, the customer, and his needs, while the customer ensures that his process and quality needs will be met.

Committing to continuous improvement in every service or product
- Continuous improvement and learning are integral components of the Remmele corporate culture and are apparent throughout every aspect of the corporation. The Remmele Guiding Principles ensure customer satisfaction:
  1) "By aspiring to excellence in quality, delivery and productivity, which will assure competitive process,
  2) By committing to continuous improvement in every service or product we provide a customer,
  3) By treating everyone with courtesy, integrity and friendliness."
- For Remmele, long-term customer relationships are the norm, particularly in Plant 30. Cost, quality, and delivery commitments made at program inception may be applicable throughout a four to seven year product life cycle. To meet aggressive commitments over the long-term, continuous process improvements are required to address learning curves, dramatic volume fluctuations, customer-driven engineering changes, material price increases, etc. In many cases, process improvements are identified, implemented, and maintained by the operators in the work-cells and on the shop floor who are most knowledgeable of the customer, the product, and the process.
- Diane Rose, Argo-Tech Corporation, stated the following, "Remmele is committed to excellence. They are always trying to improve the products they are producing. Every employee and manager at Remmele is committed to consistent, high quality customer satisfaction. They are the leaders in technology. We benchmark our supplier base against Remmele."

Developing and sustaining loyal relationships across process-technology cycles
- In today's dynamic environment, where rapidly changing markets, technology, and expectations are the norm, companies struggle with the ability to develop and maintain loyal customer relationships. The satisfied customer of today may become the disgruntled customer of tomorrow. Remmele's solution to this challenge was to implement a project management process throughout the corporation. Project management is the process that:
  4) Converts a customer's request for quotation into a sale
  5) Manages the customer's project through the entire manufacturing process
  6) Provides continuous support to the customer throughout the customer relationship life cycle.
- The project manager is the customer's single focal point ensuring that "all the pieces come together" and that the customer's expectations are continually met. Customer-, process-, or technology-initiated changes to parts and assemblies are easily incorporated because the project manager is intimately familiar with the customer, the project, and the process. Changes are introduced in a timely and efficient manner avoiding the "hand-offs" that commonly cause errors in implementation.
- In Plant 50, a manufacturer of automation equipment, the project managers work with strategic customers to understand their strategic business direction so that Remmele can meet their future needs for automation equipment. Remmele participates in a technology development mode with many customers—developing processes to develop future products.
- But Remmele doesn't take it for granted that the loyal and satisfied customer of today will be just as satisfied tomorrow. Every two years Remmele conducts a customer satisfaction survey to assist the company in its commitment to provide high quality products and services to its customers. Customers identify the following as

Remmele's key attributes: total quality, technical solutions, reliability, on-time delivery, technical and innovative leadership, teamwork, responsiveness, ethical standards and, above all, project management. A loyal Remmele customer quoted, "Project management is the key Remmele differentiator. It enables Remmele to understand customer needs, to solve problems and to be responsive."

Ascertaining unarticulated needs

- Highly successful customer relationships are dynamic and include much more than the exchange of goods and services for a compensating reward. Remmele's Customer Satisfaction Philosophy captures this concept as follows: "Customer satisfaction goes far beyond the products we manufacture…leadership in the marketplace can only be sustained by constantly meeting or exceeding the expectations of our customers and anticipating their future needs…." The ability to achieve and maintain this type of relationship with the customer is one of those parameters that sets Remmele apart from their competition; it provides a "giant step" towards Remmele's goal of "being the best in the high quality, technologically advanced portion of the contract manufacturing and factory automation industries."
- Remmele supplies highly complex machined castings to Rockwell International. Mike Barron, Purchasing Manager at Rockwell, states the following, "Remmele is always striving to find higher quality, less expensive ways to make our parts. They do this of their own initiative. They do whatever I ask of them and more. They just do it. It's the only company I have like that—I wish I had ten more!" Remmele applies this philosophy of exceeding customer's expectations and ascertaining their unarticulated needs not only to the parts they manufacture but also to the overall customer relationship. Mike Barron goes on to state, "When Rockwell purchased their own flexible machining system for in-house use, Remmele came in and showed us how to use it. They helped us to manufacture high quality parts on our own equipment."
- Remmele does extensive co-development with their customers; this not only ensures customer satisfaction but enables Remmele to expand their product and process capabilities continually. Boeing, a long-term Remmele customer for tooling, needed to produce complex, machined parts more quickly, efficiently, and at a substantially reduced cost. Boeing looked to Remmele to work with them to solve this problem. The solution became the introduction of high velocity machining capability at Remmele. The process that was used to ascertain Boeing's needs and to identify high velocity machining as the solution was not haphazard but rather the implementation of a formalized process to understand customer's expectations and together identify the appropriate process and/or technology solutions.

Responding to customer's changing production needs

- The ability to respond effectively to ever-changing needs is the cornerstone of the Agility concept. As a customer's demand, quality, and cost requirements for parts change, the agile supplier of the future will be able to meet those needs in a timely, cost effective, and robust way. Remmele is the agile supplier of the future available today.
- Remmele machines short-run, complex housings for Argo-Tech Corporation. A variety of different configurations are manufactured, and the customer makes frequent engineering changes to the parts machined. Schedules from Argo-Tech are updated and modified frequently. Diane Rose, purchasing manager at Argo-Tech states the following, "Remmele's attitude is 'we can do anything you need us to do.' This attitude is pervasive through the entire company. They respond better than anyone I've ever seen. We make outrageous requests and Remmele *always* satisfies us."

Changing resource relationships

- Remmele monitors their customer base to try to ensure controlled and sustainable growth for the company and continuous satisfaction for all customers. Remmele employs highly effective marketing and sales management techniques to target and qualify customer prospects, to position the value-added aspects of their products and services, to ascertain what the customer "really wants," and to ensure a good fit between customer needs and Remmele capabilities. But Remmele executes the target marketing strategy within the confines of long-term corporate guidelines related to customer and industry dependency.

| **Change Proficiency Maturity—Customer Relationships** |
| **Managed Stage (3) for Both Proactive and Reactive Change Proficiency** |

Rules and Responsibilities Knowledge Base: Through the clear articulation of the Guiding Principles, the corporate Mission, and the Customer Satisfaction Philosophy, a "rule book" focus is definitely in place. All employees have well defined roles and responsibilities relating to customers' interactions and are held accountable for acting accordingly.
Robustness Metric Focus: Remmele can rapidly respond to customer changing needs, changing markets, modified relationships, process modifications, and technology drivers. Commitment has been made at the corporate level to develop and sustain excellent customer relationships. Remmele falls short only as it applies to the scope of their relationship with their customers. To date, the company has not implemented electronic commerce or integrated intra-enterprise information systems with their customer base. This may become an area to leverage for future competitive advantage.

Migration Competency—Proactively Aggressive: Loyal customer relationships are maintained as product, technology, and process migration occurs. This is indicative of Remmele's ability to ascertain customers' unarticulated needs, both current and future, and proactively position to meet those needs. This is enabled by the company's commitment to process and technology leadership and their willingness to invest in the continuous education and training of their people.	**Expansion Competency—Reactively Sure:** Within the appropriate guidelines related to customer and industry exposure, customer satisfaction, and company growth, Remmele has expanded, with a high level of confidence, into new markets, new industries, new processes, and new technologies. They have achieved double-digit revenue growth on an annual basis while continually improving the quality of their customer relationships.

3.6 Information System Unit Relationships: The stimulation of the environment and the embodiment in the corporation for acquiring and using information technology components that solve unique business needs yet fit into an overall corporate structure. This creates the dichotomy that on one hand you want to provide a great degree of freedom and autonomy for the business units to operate, while on the other you want solutions to fit into a corporate structure in order to share data, knowledge, and solutions across the business units.

The template by which a company can provide this degree of flexibility is predicated on some strong standards which are part of a structure or an architecture that deems a component or system function to be of no value added to the business or of no strategic or competitive value—or conversely a function that creates an unfair advantage against the competition. With a template/architecture of this nature, there are areas defined as places for "plug and play," deployment and retirement, and local optimization based upon the specific needs of a business unit (e.g., a plant) or function (e.g., finance). Conversely there are a set of functions which themselves may be changed by the corporate goals and needs, yet cannot be violated by the business unit or function.

Proactive Change Proficiency Issues	
Creation	• Designing an infrastructure of global interaction standards that permits unique local solutions
Augmentation	• Improving the standards without impacting operational applications
Migration	• Anticipating future electronic interactions with customers and suppliers
Modification	• Adding new standards to the infrastructure without wreaking havoc on existing unique implementations
Reactive Change Proficiency Issues	
Correction	• Fixing an infrastructure that is overly restrictive
Variation	• Accommodating variations to the infrastructure standards for unique requirements
Expansion	• Expanding the internal user community and number of supported business units
Reconfiguration	• Moving unique solutions from one business unit to another

Designing an infrastructure of global interaction standards that permits unique local solutions
- In the past, information systems have been closed environments, allowing only minimal amounts of autonomy, usually in the form of sorts and reports. Today an information technology organization has the ability to provide a template and an environment that promotes customized solutions based on unique business needs, yet does not require a complete invention or development of all the components of the solution. Thus, a company can create an information system base that enables independent business units or departmental functions to implement custom point solutions that provide them with a competitive edge. Technical advances available to the information technology organization enable this new freedom, while providing an infrastructure for sharing information among the user community within the company, as well as the external customer and supplier communities. Intranet and client/server environments with object-oriented architectures, applications, databases, and message buses are all part of today's solution.
- Too often the motivating force for new information technology systems is the lure of the latest technology itself, rather than the need to solve specific business problems. Inserting new technology without an understanding of how the tools and applications must deliver business benefit only creates confusion. Management of the information system unit relationships means knowing why the units are needed as well as how they must relate. Tom Panzerella, president of Cook Specialty, another progressive machining company, sheds light:
"…technology enables them to feel and act like owners of their piece of the production process…Around here CIM might just as well stand for 'communication in manufacturing'….The idea was to bring the voice of the customer right onto the floor, where the people running jobs could hear it directly."[1] Brian McWilliams adds: "What saved Cook from the pitfalls that many larger companies encounter when they automate to the hilt is the company's insistence that its technology serve its people, not the other way around."[1] Managing change proficient information system relationships starts with a design based on basic business requirements that then dictate the core set of interactions between the business units, be it vertical integration of manufacturing or horizontal integration among finance, production, and engineering, or external integration with customers and suppliers. At Remmele, this business focus is reflected in their early development of a finite scheduler to address the high priority business-need of predictable and on-time delivery.
- Currently, Remmele is in the process of designing its next generation information technology infrastructure and has put this priority in its strategic plan. Design criteria recognize the need to accommodate optimal and unique local solutions at the divisions while maintaining an overall inter-divisional and corporate interaction standard. Remmele's culture and management's stated desire is to empower the user community to solve

their problems and create advantages as they know best. For instance, three divisions now use tools to help machinists develop CNC programs on 3-D images in order to drive the milling machines, one division has built an interface to a coordinate measuring machine that provides direct on-line customer access, and one division is building a reconfigurable quality standards database. These are excellent point solutions at the time of this writing, implemented before the company began its design of a new corporate-wide system architecture; but they are indicative of the need for local individualism as well as the potential for global usefulness. Remmele's guiding principles support local autonomy, and their emerging infrastructure strategy is expected to support this concept as well. Internet/intranet concepts with message-based interactions provide one obvious way to accommodate platform independence.

Improving the standards without impacting operational applications
- The goal of the infrastructure is to ensure continued viability of the whole system as components are improved, added, or removed. At any point in time, the rules and standards of the information technology architecture need to be stable. Also, implementations need time to mature and become fully functional in the business. However, locking the architecture down and never revisiting it would defeat the whole purpose of putting an architecture in place. Standards that specifically address revision control with an eye to ongoing change can help here. One good recent example with high visibility is the Internet browser category serviced by Netscape, Microsoft, and others. In order for Internet browsers to work they have got to adhere to a set of standards that multiple vendors can employ. At the same time each of these vendors is trying to advance their capabilities and offer new competitive features. Thus, revisions for Netscape and Microsoft Internet Explorer follow each other with leapfrog capabilities. Backward compatibility might be expected; but notably these browsers can also process material that was generated for a newer version from either the same vendor or the competitor. That doesn't mean they handle the new features as they were intended to be handled, but they don't crash or refuse to work, and they generally display the information in some other usable form.

Anticipating future electronic interactions with customers and suppliers
- A company needs to provide a watchful eye on what is happening and being developed in information technology in their industry and benchmark against that of other industries. Almost every industry is in some stage of inter-enterprise electronic integration, and it is virtually impossible to predict the details of tomorrow's data interaction and requirements today. An extensible architecture allows for unanticipated application and data requirements and is more likely to satisfy when a company collaborates on system design and data constructs with customers and suppliers. This philosophy in the information systems area is one that is often counter to past perspectives. Yet many companies are discovering that collaboration in engineering design and manufacturing execution are providing better quality and quicker response to change. This same degree of collaboration in the information technology arena can reap many similar benefits. It can also provide the openness for future expansion. By sharing system design considerations and designing-in an accommodation for unanticipated data and information interaction, companies can easily migrate into newer forms of internal and external interaction.

Adding new standards to the infrastructure without wreaking havoc on existing unique implementations
- With an environment and management philosophy that promotes autonomy, yet tries to support a standard integration infrastructure, there is an obvious area for conflict. There is the potential that one or more site-specific or business-specific solutions would require the standards to be modified. Alternatively a corporate requirement could warrant a revision or major modification to the standards. As implementation barriers, cultural inhibitions to changes in standards can be even stronger. As Remmele or any company defines its information architecture it needs to promote the expectation that standards will be modified and changed over time—setting in place the concept that there cannot be sacred systems or applications.
- As business needs change or industries embrace new standards or practices, layers of standards must be able to expand and contract (e.g., remove a standard from the corporate set and move it to the industry set). There may be for example a set of basic information technology standards that come from the overall information technology community (e.g., TCP/IP for networking). There may then be a set of standards developed by the corporation that are not embraced globally but are accepted within the industry group (e.g., EDI). On top of that there will be a set of standards that are corporate wide (e.g., EXCEL) and so on as you decompose the functions and businesses. The architecture provides a template for decisions about where to best invest in information systems over time. For example, a decision to develop or use a unique solution which is innovative and supplies a competitive advantage at one point in time may need to be changed once

there is an accepted industry solution that is readily available to all. This releases funds to invest in newer competitive components that were tied up in maintaining unique or "homegrown" solutions at a high cost. Remmele found it necessary to develop their own finite scheduling package long before anything appropriate was available. Now it is increasingly common to expect off-the-shelf manufacturing execution systems to feature finite scheduling.

Fixing an infrastructure that is overly restrictive

- As an information system environment evolves, there are inevitable requirements that cannot be serviced by the existing infrastructure standards. Most organizations respond in terms of months or sometimes even years to make the necessary changes. More often these opportunities are either ignored or handled by a workaround that is hardly robust or requires major human intervention in order to function. Change proficiency, on the other hand, is facilitated by an operating culture that adheres to the infrastructure standards. That is to say, if in the initial implementation the architecture is compromised (e.g., a financial application expediently bypasses the requirement to go through a transaction router) barriers to making changes in the infrastructure are created and institutionalized. The propagation of these generally undocumented compromises cause painful or catastrophic failures later when changes to the infrastructure are attempted. By strong adherence to the standards, and careful documentation of the exceptions, the ramifications of change can be understood in advance. Another form of restriction is evident in Remmele's older de facto infrastructure, where the existing system is just too difficult to change in some needed directions. Rather than live with these restrictions or design elaborate workarounds, Remmele has opted to design a new infrastructure that is more accommodating.

Accommodating variations to the infrastructure standards for unique requirements

- Often applications and system functions are desired which cannot meet the "letter of the law" of the infrastructure standards. This is often the case for purchased packages which have been created independently of the architecture. Change proficient architectures and standards will account for the exceptions as well as the rule. Messages and interactions within the overall systems, for instance, can be defined with an "open" area for variant commands and responses. As well, responses to data requests or commands for action should allow for a negative response. This allows both a variation in the actual content of expected responses and variation in the way a set or series of interactions may be implemented by a new or modified sub-system or component. By pre-designing the architecture and thinking through alternative scenarios, when exceptions occur decisions can be made quickly on the effect of the variation and how to best accommodate and document it.

Expanding the internal user community and number of supported business units

- Commonly, corporate system architectures are an "after the fact" reality. Systems get built or purchased piecemeal, and a map grows in order to explain the interactions, which is then described as the "architecture." In today's environment many companies are starting to define their infrastructure and the interaction of applications in advance of implementation. But the tendency is to either create a structure that will act like the past when implemented or to chose various off-the-shelf applications and draw a picture to show how they will interact after implementation. Unfortunately the architecture rarely takes into account the design needed for proactive and reactive change. If a company has one business unit, it will generally define a solution that handles one unit. If a company has three units, it will design for three. In growth environments this will guarantee inadequate support. New organization structures that feature many small autonomous units in a state of continuous collective flux stress architectures that have built-in support expectations. Remmele is a paragon of this new organizational thinking and is set up to spawn new divisions with different operating profiles regularly.

- There is a growing recognition that ubiquitous electronic communications capabilities can enhance the productivity of all employees and result in a highly responsive and self-coordinating business unit. With this recognition comes the need for greatly expanded employee access. Cook Specialty, a small machining company with only 120 employees, already has 30 computer terminals in the plant. "Operators rely on them to tap into Cook's shop-floor control-and-scheduling package….The software enables operators to trade notes on the status of production jobs and to key in relevant information from their communications with customers. Many operators start their day by logging on to the system to look for 'hot' jobs—those that need immediate attention."[1]

Moving unique solutions from one business unit to another

- Multiple divisions at Remmele employ job estimation software built around Microsoft Excel spreadsheets. None of them are identical in detail but share a lot in concept, especially where corporate activity based–like costing is employed. A similar cross-divisional application built around Excel can be found in the project management job-status reports. None of these were built with the intention of being exported across the divisions either—yet a good idea invented in one division was easily duplicated in another. In these example cases the defacto infrastructure of Microsoft applications software is what enabled the concept portability. One important advantage that Excel offers in this case is the portability across PC and Mac platforms. Another interesting benefit of Excel is its inherent ease of modification for the user. These examples are not meant to promote Excel, but rather the concepts of platform portability and easy user adoption and adaptation, eliminating the need for scarce-resource specialized expertise and the constraints of single-platform mandates. Though there are boundary constraints on any set of infrastructure standards (must use Microsoft in this example case), the reconfigurable freedom comes from careful balancing of local freedom with global utilization.

Change Proficiency Maturity—Information System Unit Relationships Repeatable Stage (0.5) for both Proactive and Reactive Change Proficiency
Concepts Knowledge Base: At Remmele there is an underlying operating philosophy that encourages experimentation and drives the development of innovative point solutions to business opportunities. The user community is not penalized or discouraged from developing or acquiring unique software applications that enhance the meeting of objectives. There are numerous innovative examples that provide the conceptual base for fast acquisition and employment: of productive software applications: Remmele led its industry in the early development of its own finite scheduler and was driven in this effort by the business needs for on-time delivery rather than the lure of high technology; they see the value of electronic intimacy gained from their on-line interface of a coordinate measuring machine with one of their customers; they've learned the power of unique tools in the hands of creative employees when a machinist used CNC modeling software to show a prospect how their job might be handled; and they recognize that making a corporate choice between PCs or Macs flies in the face of their corporate guiding principles for accountable autonomy. These concepts are both about creating deployable solutions quickly and about needs that should be fulfilled by a supporting infrastructure. This take-the-bull-by-the-horns point-solution approach has kept them in the forefront of their industry in the past. Now they recognize the need for an infrastructure that supports this activity on a larger scale and helps the spread of good solutions across the company. To this end a corporate infrastructure that promotes local solutions and global interaction is in the design phase.
Time Metric Focus: Remmele's principle focus until recently has been on the successful implementation of beneficial point solutions. This focus is now turning to the time it will take to finalize the new information infrastructure architectural approach and the time to subsequently propagate a full corporate-wide installation. Cost of implementation is a big consideration factor in evaluating the acceptability of a new infrastructure design but is used principally as a go/no-go gating factor rather than as a focused competency metric. Robustness and scope have not received noticeable attention as yet and cannot yield real results until an enabling infrastructure is in place. Remmele appears well poised to respond to these issues when the time is right, however, as they recognize both the value of information systems and an architecture that supports autonomy within a set of boundary standards.

Creation Competency—Proactively Occasional: Remmele has a remarkable capability to create innovative information system solutions for specific business problems and opportunities, both at the divisional and corporate levels. These appear to have sprung from the cultural environment that supports innovation and autonomy rather than from an overt information systems strategy. Driven by the inherent cultural environment, they are developing a strategy and architecture that is compatible with the corporate principles and can leverage these point solutions across the corporation.	Correction Competency—Reactively Safe: Where Remmele stays on top of the latest technology for machining and fabrication processes with a deep knowledge base, the same attention to broad-based expertise has not been developed in the information systems area—their business environment simply has not required this in the past. As a result, correction competencies are more evident in the newer freestanding divisional systems than in the integrated cross-divisional systems that are older and more complex. Inability to fix some problems reasonably, as well as a desire for new capabilities, have led to the decision to build the next-generation infrastructure for the company.

[1] B. McWilliams, Inc. "Re-engineering the Small Factory," *Technology*, No. 1, 1996.

3.7 Production Unit Relationships: The interactive relationships among individual production resources that collectively comprise a complex production process or a production business unit, such as cells, machines, workstations, batch kettles, material handling systems, assembly lines, etc.—regardless of manual or automated content. Generic Agility issues include accommodating surge capacity needs and product demand fluctuations, accommodating individual part or product customizations, inserting production technology upgrades and innovations, gaining longer productive lifetimes from capital investments, coping with maintenance and operator training for new technology, and integrating and reconfiguring new systems predictably.

At Remmele, all production unit components operate within the existing plant infrastructure which may vary on a plant-to-plant basis. The effective interaction of equipment, processes, systems, and people occurs within this framework.

Proactive Change Proficiency Issues	
Creation	• Accommodating individual part or product customization
Augmentation	• Implementing continuous improvement throughout all aspects of the production unit
Migration	• Inserting production technology upgrades and innovations
Modification	
Reactive Change Proficiency Issues	
Correction	• Responding to critical equipment, system, or process failures
Variation	• Recognizing when it is appropriate to modify a process to improve performance
Expansion	• Accommodating surge capacity needs and product demand fluctuations
Reconfiguration	

Accommodating individual part or product customization
- In the Plant 30 focused-factory environment, Remmele emphasizes a total quality, long-term relationship with the customer. Work-cells, comprised of equipment, people, processes, and systems, are designed and implemented around a specific customer part or subassembly. Unique process capabilities (i.e., clean room environment) may also be developed and incorporated.
- All aspects of the work-cell, including parts procurement, supplier interactions, quality control, process development, performance monitoring, and actual parts production, are managed by empowered work teams that are responsible and accountable for the cell's performance. Cross-functional training and multi-tasking capability ensure the effective utilization of resources. All production unit components are dedicated throughout the life cycle of the program.
- A strong program management focus ensures clear definition of customer's needs and expectations, compatibility with Remmele's capabilities, and accurate/competitive quote management prior to program inception.
- Intimacy with the customer, his market, his product, his and needs enables Remmele to implement timely and effective process and/or product changes while continually expanding the Remmele knowledge base.

Implementing continuous improvement throughout all aspects of the production unit
- Remmele's commitment to continuous improvement as it relates to their production units is evident in their Guiding Principles:
  1) Achieve customer satisfaction by committing to continuous improvement in every product or service we provide a customer.
  2) Achieve employee satisfaction by involving everyone to ensure we accomplish our goals.
  3) Achieve growth by attracting and further training outstanding people who are intelligent, honest, hard working, skilled, and self-motivated to excel and by regularly investing in the best tools, systems, and equipment available to be effective and competitive.
- As evidenced by the following quotes from Remmele customers, the Guiding Principles are not only communicated and understood, but demonstrated throughout the organization:
  - "Remmele's best asset is their excellent people with great attitudes and a willingness to adapt to their customers' changing needs."
  - "Remmele is always trying to improve the product they are producing."
  - "We have our own in-house complex machining cell. Remmele has been instrumental in providing its own technical expertise to help us improve our operation."

- – "(At Remmele) every person working on our job is totally knowledgeable about the process and situation. Our drawings are thoroughly reviewed and comments for cost reduction and quality improvement are always provided."
  - – "Their process control knowledge is superb. They always seem to be aware of the latest process technologies."
- At Remmele, the effective integration of knowledgeable employees, state-of-the-art facilities, highly flexible machining systems, extensive process capability, and a corporate goal of being the best in the industry ensures continuous improvement throughout all aspects of the manufacturing environment.

Inserting production technology upgrades and innovations
- Remmele's commitment to technology leadership and their endeavor to be the best in the industry drive the need for 1) continuous assessment of process capability, 2) a commitment to technology benchmarking on a worldwide basis, and 3) the financial capability to invest continuously in equipment, training, and process upgrades. Implementation of this strategy in a timely and effective manner also requires the ability to insert technology upgrades into existing facility, organizational, system, and production infrastructures.
- In Plant 20, Remmele's repetitive batch production facility, the effective implementation of this strategy has been demonstrated via the integration of flexible machining systems (FMS) into this medium-volume production environment. The FMS encompasses a five-axis machining center, with automatic part and tool loading and unloading, that enables unmanned operation. These systems can be reconfigured to handle a wide variety of part configuration requirements. Remmele purchased the FMS technology, trained existing machinists and operators, developed procedures and process/quality documentation, interfaced FMS into existing information systems, and *then* found customer demand that could benefit from this capability. This proactive approach to technology upgrade and insertion not only helps Remmele maintain its technology leadership position but provides real competitive advantage in terms of productivity, cost reduction, and machine utilization.

Responding to critical equipment, system, or process failures
- Remmele has built redundancy into critical components of their supplier base, their human resources, and their machining cells. Primary and contingency suppliers are in place for most critical raw materials and components, extensive cross-functional training enables operators and machinists to move within and across plants, and the implementation of multi-machining center work-cells provides equipment redundancy in the event of machine failure. This inherent redundancy enables rapid recovery from real-time operating surprises.

Recognizing when it is appropriate to modify a process to improve performance
- In the high value-added machining of complex, close tolerance parts, process control and consistency are critical to ensure repeatable, high-quality parts. But such processes are not static. Productivity improvements, cost reductions, and equipment replacement may drive the need for process modification and re-optimization.
- In one work-cell in Plant 30, a long-term price commitment precluded Remmele from passing on all cost increases when production volumes decreased dramatically. To address this issue, significant process modifications were required both by Remmele and its suppliers. Through the collaborative efforts of the work team, suppliers, and the customer 1) raw material quality was improved, and inspection at Remmele was reduced by increasing process steps at the mill, 2) the work-cell was reconfigured to reduce labor by 50%, 3) process steps at Remmele were eliminated without impacting product quality, and 4) machining equipment was removed from the work-cell and utilized for other projects. The end result was that profitability was maintained throughout the program life cycle, and the customer charted 29 straight months of zero-parts-per-million defects.

Accommodating surge capacity needs and product demand fluctuations
- In many ways, Remmele is a typical job shop environment continually dealing with surge capacity requirements and product demand fluctuations. What differentiates Remmele from most of its competitors is the inherent capability and flexibility that has been "built-in" to its people, equipment, processes, and systems. Most capacity fluctuations can be effectively addressed by leveraging an extensive knowledge base, highly trained personnel, interactive systems, flexible machining capability, robust processes, the focus provided by the project management process, plus the pervasive Remmele "we can do anything you need us to do" attitude,.

Change Proficiency Maturity—Production Unit Relationships

Defined Stage (2) for Both Proactive and Reactive Change Proficiency
Metrics Knowledge Base: Production unit components and resources are aligned and focused on achieving customer commitments. When change occurs (i.e., market-, industry-, or technology-driven), components and resources can be realigned to accommodate these changes. Success or failure is determined by the ability to meet specific metrics associated with the cost and timeliness of these changes. At Remmele, changes in production unit relationships are the norm. Performance metrics are in place to ensure the viability of change for both the customer and the company.
Cost Metric Focus: As illustrated by the Plant 30 example presented above, the cost metric is the one most frequently used by Remmele to determine success or failure. The configuration of components and resources within a production unit may be reconfigured on a periodic basis to achieve a specific metric associated with the cost of change.

Augmentation Competency—Proactively Competitive: Continuous improvement, as it relates to all aspects of the production unit and the components thereof, is an integral part of the Remmele business strategy and the basis for increased competitiveness and continual growth. The Guiding Principles provide the framework within which augmentation of people, processes, equipment, and systems will occur.	Variation Competency—Reactively Confident: Real-time operating surprises are an integral part of a job shop environment. At Remmele, through the flexibility of their production unit components and resources, the ability to respond to these surprises in a timely and cost effective way is a given.

4.1 Product Innovation Management: Innovation management practices that routinely create and leverage new product concepts are distinguished by their impact on existing markets or their creation of new markets. Generic Agility issues include supporting the pursuit of innovative rather than incremental products, harnessing increased cross-discipline opportunity and complexity, adding research activity into the current concepts of integrated product and process development, increasing the economic lifetime of products that too quickly become obsolete, designing with reusable building blocks, and eliminating 'not invented here' impediments to useful idea acceptance.

At Remmele, the foundation of the product innovation management practice is the corporate ideological infrastructure and its emphasis on technological advancement as it relates to both products and processes. By committing to technology leadership, the continued investment in the 'best' tools, systems, and equipment becomes a given. This foundation facilitates the identification of customer needs and available technology and aligns them with Remmele's technical capabilities.

Proactive Change Proficiency Issues	
Creation	• Defining and commercializing an innovative product concept
Augmentation	• Including a product planning phase in the annual operating plan
Migration	• Leveraging technology platforms to commercialize future products
Modification	• Adding research activity into the concept of integrated product and process development
Reactive Change Proficiency Issues	
Correction	• Knowing when to terminate product innovation in a particular technology area
Variation	• Recognizing when it is appropriate to deviate from a process to pursue innovative opportunities
Expansion	
Reconfiguration	• Designing with reusable building blocks

Defining and commercializing an innovative product concept
- Effective technology and product concept definition and commercialization are critical to any company where technology leadership is a major component of their corporate mission statement. But technology availability and technical capability do not ensure product commercialization success. A third component, market and customer need, must be part of a successful business formula for new product concept commercialization.
- At Remmele, as part of the annual strategic business planning process, technology and product road maps are developed. Through this process, those product concepts that most effectively integrate technology availability, technical capability, and market need are identified and prioritized.
- Through such a process, high velocity machining was identified as an innovative product concept with the potential for long-term growth and profitability. Simultaneously, a customer was identified who had a need to produce complex, machined parts more quickly, efficiently, and at a substantially reduced cost. Integration of this product concept with the customer's need led to the introduction of high velocity machining capability at Remmele—the ability to machine rapidly and cost effectively out of a solid rather than fabricating the part out of sheet metal. Over a period of 18 months, Remmele:
  - Formed a company-wide, high velocity machining team to identify and benchmark worldwide capabilities
  - Worked closely with prospects to ascertain their needs
  - Purchased, installed, and validated equipment
  - Trained operators and engineers
  - Developed in-house process capabilities
  High velocity machining capability has now become an integral part of Remmele's product offering and is being leveraged across new markets and industries.

Including a product planning phase in the annual operating plan
- From Remmele's inception, employees at all levels of the organization have been both encouraged and challenged to be innovative, to look to the future, and to take risk. This philosophy remains as an integral part of the Remmele culture. But, at the same time, innovation cannot occur in a haphazard way; it must be focused and managed if it is to drive growth and continued business success.
- As part of Remmele's strategic planning process, they have developed and incorporated the technology and product planning phase that identifies both emerging market needs and evolving technologies. This formal process occurs on an annual basis and is initially driven by cross-functional subcommittees representing each

Remmele plant and support staff. The outcome of each subcommittee is a future-driven technology and product road map. Input is consolidated at a corporate level, concepts are added and eliminated, and decisions are made. Those product concepts deemed to be most viable from a business perspective are prioritized, and funding is established to support investigation and/or commercialization. The planning process is revisited on a quarterly basis to make updates and modification.

- This highly interactive process drives ownership throughout the corporation and ensures focus for product innovation. It also ensures overall linkage of product innovation and the long-term business strategy.

Leveraging technology platforms to commercialize future products

- Historically, Remmele has developed and commercialized products and services that incorporate leading-edge technologies as a mechanism to differentiate themselves from their competitors. Their ability to leverage these technology platforms into other markets and applications has been frequently demonstrated.
- Remmele's entry into the medical industry with miniature precision machined parts is illustrative of this capability. As part of their product planning process, Remmele had identified miniature machining as a technical capability, but preliminary investigation indicated a questionable business opportunity (i.e., the market need was not clear). Months later a fortuitous contact between Remmele and a large medical component manufacturer with an urgent need (their current supplier was having difficulty supplying the high quality, high precision, miniature parts required for an invasive medical application) matched a market need with a technical capability (developed under Remmele's earlier product planning investigation). Remmele was able to respond quickly to this customer's need by leveraging: 1) its existing technical capability related to high-precision machining, 2) its robust internal quality system, 3) its willingness to work with the customer to ascertain his needs and the needs of the marketplace, and 4) its 'we can do it' attitude.

Adding research activity into the concept of integrated product and process development

- For many companies, implementation of integrated product and process development (IPPD) is a "giant step" forward enabling improved competitiveness and continued business growth. For Remmele, IPPD has been the norm—product and process development are so intertwined that it is impossible to separate them. Historically, one has often evolved into the other. By incorporating research into the IPPD methodology, Remmele has taken the next step forward.
- Remmele's technology, product planning, and commercialization process have extensive breadth and depth. It begins with research related to: 1) market dynamics, 2) market opportunities, 3) technology definition and identification, 4) technology availability, and 5) the actual discovery and interpretation of new technical knowledge. It includes all aspects of integrated product and process development: 1) requirements definition, 2) detail design, 3) integration, test, and validation, and 4) production readiness. It culminates in the commercialization of new product concepts, including all aspects of 1) marketing, 2) sales, 3) service and support, 4) manufacturing (i.e., contract machining, fabricating, and assembly), and 5) logistics and distribution.
- Remmele's ability to integrate effectively and consistently all aspects of research, IPPD, and commercialization to drive the implementation of new, innovative product concepts will be instrumental to their continued success.

Knowing when to terminate product innovation in a particular technology area

- For most companies, not *all* new product concepts lead to eventual product commercialization. Those companies that are highly skilled at defining and commercializing a continuous stream of new and innovative products are also quite skilled at determining when to terminate product development activities. Termination as early as possible in the commercialization process decreases non–value-added development expenditures and enables reassignment of valuable resources to more viable projects.
- A potential customer of Plant 30 presented a new product concept opportunity to Remmele based on screw machine technology. The concept was totally consistent with Remmele's Mission Statement and Guiding Principles and would have allowed Remmele to target and develop new domestic markets. Remmele incorporated this new product concept into their technology and product planning process and began investigative activities. By using internally developed assessment and risk analysis tools the following parameters were evaluated:
  1) Customer—relationship, business viability, business drivers
  2) Market opportunity
  3) Innovativeness of the technology

  4) New process technology required at Remmele to commercialize the product concept
  5) Anticipated product life cycle.

The customer was new and unknown to Remmele, the market opportunity was large, the technology was 'new' to Remmele but not technically advanced (i.e., no competitive leadership capability), extensive new process technology development would be required at Remmele, and the product life cycle was questionable. Through this process, Remmele decided the risk was too high to proceed and terminated this project in the concept phase prior to extensive resource expenditure.

Recognizing when it is appropriate to deviate from a process to pursue innovative opportunities

- New product innovation management practices are put in place to provide focus and direction but must be agile enough to address unanticipated opportunities. Because of Remmele's ideology that encourages innovation and risk taking, an opportunity-driven culture has developed. New technologies and product concepts are routinely identified by Marketing, Sales, R&D and Manufacturing. At Remmele, these new concepts and opportunities are readily assimilated into the existing technology and product plans—opportunity insertion is the norm. The rigor of the process does not preclude taking advantage of the opportunity.

Designing with reusable building blocks

- Remmele's Automation Division, in Plant 50, designs and builds custom systems for automating nonstandard applications of assembly and testing, web handling, metal removal, and fabrication. The focus of Plant 50 on customization and, in most cases, one-off designs, makes use of well-tuned processes in the following areas: 1) customer qualification, 2) product qualification, 3) customer interaction and communication, 4) program management, 5) knowledge management, and 6) data transfer. The Automation Division has a significant inventory of engineering experience, gained from projects in a wide range of customer applications and markets. Very long employee tenure enables them to offer this inventory of knowledge to new clients who are often in totally dissimilar industries from those in which the experience was originally gained.
- The ability to leverage design solutions across customers, applications, and markets often determines business success or failure in the customized equipment industry. The effective use of simulation tools and CAD capabilities in Plant 50 has resulted in reusable designs and design components. The implementation of a software simulation package on the shop floor allows direct linkage to CAD and download to the CNC controller of the machine tool. Designs are robust, high quality, transferable, and reusable.

Change Proficiency Maturity—Product Innovation Management Mastered Stage (4) for Both Proactive and Reactive Change Proficiency	
Principles Knowledge Base: The strongest principle in play is the one that promotes technology innovation and leadership. Decisions are guided by the belief that technology leadership will drive competitive advantage and continued business success.	
Scope Metric Focus: Product innovation practices are applied universally, independent of product, market, or application. Innovative product solutions are the lifeblood of the corporation. The processes in place to generate these solutions must be timely, cost effective, and robust.	
Modification Competency—Proactively Formidable: Product innovation is supported by active "databases" associated with market knowledge, core competencies, and technology solutions. Within an environment of continuous learning and challenge and a corporate commitment to technology leadership, these off-the-shelf "databases" and capabilities can be continually reconfigured and utilized to drive product innovation. Effectively managing this product innovation process is dependent upon the ability to envision the future and to assemble the associated pieces accordingly. Remmele's ability to *anticipate* customer/market need and to respond to this need in a proactive way with innovative products and solutions is representative of their mastery stage in this business practice.	**Reconfiguration Competency—Reactively Automatic:** Remmele's ability to utilize existing processes and tools related to product innovation management independent of product, market, or application demonstrates reconfigurability. A cross-divisional engineering synergy group with engineers from all plants meets regularly to transfer technology and share ideas.

4.2 Process Innovation Management: Innovation management practices that routinely create and leverage new production process concepts which either exert major impact on existing operating metrics or create new product/line-of-business opportunities. Generic Agility issues include breaking entrenched thought patterns and beliefs about production, establishing a culture that leads instead of follows advancing production concepts, developing process characterization models, employing virtual process-design verification tools, and involving all people responsibly.

At Remmele, the foundation of the process innovation management practice is the corporate ideological infrastructure and its emphasis on technology leadership; continuous improvement; continuous investment in superior tools, systems and equipment; and further training and development for all employees. This framework facilitates the identification of available technology and aligns it with Remmele's technical capabilities.

Proactive Change Proficiency Issues	
Creation	• Developing a core competency of process innovation that supports market leadership
Augmentation	• Maintaining a culture that leads instead of follows advancing production concepts
Migration	• Transitioning process innovation responsibility to the shop floor
Modification	• Substantially modifying existing process innovation practices and communicating the changes
Reactive Change Proficiency Issues	
Correction	• Breaking entrenched thought patterns and beliefs about production
Variation	• Recognizing when it is appropriate to deviate from a process to pursue innovative opportunities
Expansion	• Making process implementation decisions based upon both opportunity and risk analysis
Reconfiguration	• Reusing generic process concepts to satisfy new applications

Developing a core competency of process innovation that supports market leadership
- Remmele has made a firm commitment to technology leadership as it relates to process innovation. As part of the annual strategic planning process, new process technologies and manufacturing capabilities are identified. Over an agreed upon time period, these technologies are investigated and prioritized based upon alignment with Remmele's technical capabilities and potential impact on operations.
- Remmele has dedicated highly regarded technical experts to identify and investigate new production process concepts, worldwide, that will help maintain Remmele's market and technical leadership position. These resources also assist with integration and verification of these new process concepts into the existing plant infrastructures.

Maintaining a culture that leads instead of follows advancing production concepts
- The introduction of new production concepts into an operating environment is often disruptive and threatening and adversely impacts performance metrics (i.e., cycle time, cost, delivery performance). At Remmele, the reverse is true. From company inception, Remmele's owners and management have emphasized the value of risk taking, the importance of technology leadership and continuous change, and the value of employee empowerment. Remmele's employees are continuously looking for the next technology, an improved production process, or the next business venture. They are not threatened by change—they thrive on change.
- Remmele maintains this culture as follows: 1) by emphasizing technology leadership and continuous improvement, and the value thereof, in the Corporate Vision, the Guiding Principles and the Customer Satisfaction Philosophy, 2) the company president articulates the Remmele philosophy personally to all new employees, 3) the company newspaper discusses company performance (i.e., actual operating *and* financial metrics are openly shared), performance shortfalls, new products and processes, customers, 4) managers and employees are encouraged to take informed risk and make decisions, 5) continual vertical, horizontal, and cross-functional forums are held at all levels to keep employees informed and to answer their probing questions, 6) employees are encouraged to own their processes and to continually improve upon them and finally, 7) Remmele employees share in the success or failure of the company which encourages a high level of pride and ownership.

Transitioning process innovation responsibility to the shop floor
- Historically, at many manufacturing firms, process innovation in production process concepts was the responsibility of the process engineering staff. Process implementation was often relegated to operators via a "throw it over the wall" mentality. At Remmele, the machinists and operators on the shop floor contribute

heavily to process innovation in addition to manufacturing engineers and project managers. This philosophy relates to both processes associated with new product and customers as well as to process innovation and improvement associated with mature products or projects. Appropriate controls and mechanisms are in place to ensure communications and buy-in by program managers, engineering, the customer, and management as well as to ensure up-front process characterization and predictability.

- The introduction of a new program in Plant 30 required new process innovation in the areas of grinding, fixturing and clean room assembly. Remmele operators and engineers worked closely with the customer, suppliers, and academia to develop the appropriate processes and implement them into the work-cell. When, after several years, component demand decreased dramatically, the cell work team was responsible for developing processes that reconfigured the cell to reduce direct labor and reduce costs.

Substantially modifying existing process innovation practices and communicating the changes

- The ideological expectation of technology leadership, continuous improvement, and continuous employee training and development facilitates the modification of existing process innovation practices and resultant production process concepts. As new technology and manufacturing practices are identified and assimilated into the existing plant infrastructure or as process innovation occurs internally, these practices are not rejected as "foreign" but are readily accepted and adapted into the existing framework. Employee involvement in new process identification and development drives ownership prior to implementation.
- Historically, project qualification at Remmele focused on business drivers—the customer relationship, market opportunity, innovativeness of technology, project life cycle, etc. The focus was almost exclusively on opportunity, not on risk. Recently, up-front process risk assessment has been added to this qualification process. Informed risk management is a basic building block of the Remmele ideology.
- Changes to existing process innovation practices and the resulting production process concepts are communicated through numerous horizontal and vertical slice teams and interplant and intraplant meetings which are the backbone of the Remmele communication network.

Breaking entrenched thought patterns and beliefs about production

- Throughout Remmele, knowledge is a goal, not a result. Knowledge generation, capture, and mobilization are deemed to be critical to the continued business success of the company. In particular, technical capability and expertise are regarded as one of the highest forms of knowledge, and prestige is assigned accordingly. Shop floor machinists and operators are well trained and highly skilled—many having gone through an extensive apprenticeship program. Remmele's customers also understand the value that shop floor employees provide:
  1. "Remmele management is committed to ensuring that employees have the best up-to-date training. You can see it in the product they provide."
  2. "Every person associated with a project is totally knowledgeable about the process and situation."
  3. "The people at Remmele are extremely knowledgeable and experienced. Their process control knowledge is superb."
- As stated by a Remmele manager, "The goal is to solve tough manufacturing problems in the minds of the people we employ and implement the solutions through hardware." At Remmele, production is the lifeblood of the company—and everyone knows it!

Recognizing when it is appropriate to deviate from a process to pursue innovative opportunities

- Mission Statements, compatible with the Corporate Mission Statement, have been developed for all Remmele plants. The guidelines presented in these Mission Statements govern the types of products and customers that each individual plant will support.

Making process implementation decisions based upon both opportunity and risk analysis

- Assessment of market opportunity is the barometer that many companies use to make business decisions. But opportunity analysis alone is not self-sufficient; risk analysis must also be factored into the equation.
- At Remmele, risk analysis is a critical component of each customer/project qualification process. Routinely, this risk analysis assesses business risk versus opportunity. In Plant 30, a production process risk analysis tool has been developed and incorporated into the up-front risk analysis process. This tool helps to develop both opportunity and risk factors for the critical parameters of the production process associated with a particular component (i.e., equipment, tooling/supplies, cycle time, scrap, process steps, etc.). From a Remmele perspective, this requires a high degree of process characterization knowledge but should enable improved "informed risk" management and decision making.

Reusing generic process concepts to satisfy new applications

- The Remmele culture and ideology support the continued investment in the best tools, systems, and equipment plus the generation of incremental knowledge for all employees. It's also a culture that supports informed risk taking and decision making. In this environment, the analytical thought process, the scientific method, is applied to all problems, and solutions are derived accordingly. At Remmele, innovative management practices, based upon the scientific method, are robust and reusable. They are applicable to production process, to planning process, or to marketing. The same steps apply: 1) problem/need definition, 2) hypothesis generation, 3) data gathering, 4) verification, and 5) implementation. At Remmele, process innovation and management are intuitive and evidenced throughout the organization.

Change Proficiency Maturity—Process Innovation Management Mastered Stage (4) for Both Proactive and Reactive Change Proficiency	
Principles Knowledge Base: Technology leadership, knowledge management, continuous improvement, and continuous change are the underlying principles impacting this process innovation management concept. No rule book or road map is required—the principles are intuitive.	
Scope Metric Focus: Process innovation and management thereof are apparent across all functions within the organization. The process has been applied 1) to creating and implementing new production processes, 2) to developing a technology and product planning process, and 3) to creating a process for identifying and targeting new market opportunities.	
Modification Competency—Proactively Formidable: Respect for the process, but awareness of the need for continuous improvement and change, is demonstrated. Process innovation practices that are flexible with reusable modules and concepts are in place. New production process concepts are readily adapted, accepted, and assimilated into the existing plant infrastructure without impact on operation performance metrics.	**Reconfiguration Competency—Reactively Automatic:** The ideology drives high regard for knowledge, technical capability, and analytical thinking. Process innovation practices build upon these principles; they are robust and reusable. Similar processes can be found throughout all functions of the organization. They can be readily configured to meet the need.

4.3 Practice/Procedure Innovation Management: Innovation management practices that routinely create and leverage new business practice concepts and procedures, which exert major impact on existing operating metrics or create new business opportunities. Generic Agility issues include the development of an infrastructure of tools, techniques, and culture for identifying and acting upon radical process improvement opportunities, gaining commitment and buy-in to make radical unprecedented change in traditional procedures and practices, and viewing reengineering as an ongoing core competency requirement.

At Remmele, the foundation of the procedure innovation-management practice is the corporate ideological infrastructure and its emphasis on learning, continuous change, empowerment, accountability, and collective success. This foundation facilitates the development and reconfiguration of individual practices and procedures to meet real and specific needs.

Proactive Change Proficiency Issues	
Creation	• Defining and adopting a new practice; recognizing value in defining and communicating a new procedure
Augmentation	• Minimizing and eliminating non–value-added impact of procedure application
Migration	• Objectively evaluating new industry practices for real benefits
Modification	• Substantially modifying existing practices and procedures, and communicating the changes
Reactive Change Proficiency Issue	
Correction	• Recognizing a problem and then fixing, removing, or replacing procedures and practices that impede operation
Variation	• Recognizing when it is appropriate to deviate from a procedure in order to fulfill an opportunity
Expansion	• Broadening the pool of people qualified to interpret critical procedures correctly
Reconfiguration	• Reusing generic procedural concepts to satisfy new applications

Defining and adopting a new practice; recognizing value in defining and communicating a new procedure

- This company could be incorrectly characterized as one with few procedures, as they do not have a company procedures manual for other than ISO compliance; 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 order-status report, and the quality procedures database 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. Q: So what exactly is the innovation management practice for procedures and practices? A: 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 practice employs top management, providing a single "project manager" customer interface responsible for both profit and revenue rather then 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.

- "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*."[1] These words from *Built to Last* express Remmele's procedural framework perfectly. Words from Simons illuminate further: "Telling people what to do by establishing standard operating procedures and rule books discourages the initiative and creativity unleashed by empowered, entrepreneurial employees. Telling them what *not* to do allows innovation, but within clearly defined limits."[2]

Minimizing and eliminating non–value-added impact of procedure application
- There is no formal procedure for continuous improvement, as is typical in many places with codified rules modeled after classical Kaizen techniques; but rather a much more powerful visceral understanding driven by the strong learning culture. It is the quest for knowledge that produces continuous improvement as a side effect, much as it is the capturing and sharing of this knowledge that provides procedure and practice as a side effect. A pervasive environment of open communication, active involved feedback, and the expectation that any decision should be justified with a knowledge-base of reason and information drives the continuous improvement of practices and procedures by users. For example, a video tape on "Workforce Skills for Modern Manufacturing" features a Remmele machinist apprentice saying that her group felt the program had some weak spots, and with management encouragement they helped design improvements in these areas.

Objectively evaluating new industry practices for real benefits
- Remmele views procedures as tools to improve the likelihood of achieving an objective and is wary of having them become a substitute for the objective. Thus, for instance, applying for a Baldrige award was pursued as a learning experience, but the procedures were not deemed valuable enough to become a part of the business once the application activity was finished.

Substantially modifying existing practices and procedures, and communicating the changes
- The ideological expectation of continuous change and continuous learning facilitates the acceptance of beneficial modifications to practices and procedures. Communicating new practice and procedure concepts occurs on a continuous basis in the various cross-functional and cross-divisional meetings that serve as the knowledge-sharing networks in the company. Sometimes procedures are embodied in automated tools. One such innovative tool captures and structures quality procedures in a centralized database framework and was built specifically to facilitate the addition of new quality procedures at one of Remmele's divisions; allowing customized programs for individual customers that are constructed from a standard set of reusable procedural concepts—all in a framework that satisfies Remmele standards and facilitates modular construction of individualized procedures. The automated tool is principally a user interface to an on-line structured database that is centralized for communicating current procedures accurately and instantly.

Recognizing a problem and then fixing, replacing, or removing procedures that impede operation
- Typical organizational structures provide a functional alignment, with specialized customer and inter-function interfaces. For instance, it is common for a quoting group to estimate a job and respond to a request for quote (RFQ)—which is later thrown to the job-execution people if an order arrives—who may or may not approach the order in the manner in which it was bid. In the early days of the company, Fred Remmele recognized this as a dysfunctional process: the customer was not satisfied in the manner that the quotation suggested, the company was not satisfied with expected profits, and confusion ensued in the variety of interfaces a single customer might have over the course of a business relationship. This realization gave birth to a replacement practice that created project managers (in one plant they are called program managers) that are single-point responsible for all interfaces with a customer, starting with the quotation/estimation activity and continuing with the profitability of the relationship. In some cases a project manager may have a team dedicated to a specific customer relationship; in others the project manager may simply coordinate the application of shared resources.

Recognizing when it is appropriate to deviate from a procedure in order to fulfill an opportunity
- The ideological infrastructure at Remmele establishes general boundaries and guidelines, and empowers people to choose the methods they will employ to achieve objectives. Deviating from standard practice can often pave the way to new practice when successful. For example, one Remmele division misplaced a quotation request for a very substantial international program and was reminded by the expectant rep very close to the deadline. Remmele's bid preparation is much more detailed than the industry norm, takes time to develop, and is readily shared with the prospect as accompanying supporting data for the bid response. In contrast, industry norm is often a single-page price quotation with little or no cost detail. To buy time on this late start, the project manager, rather than short-cutting the detail development, provided weekly status reports on the increasing knowledge base they were accumulating in order to make an accurate bid. The prospect was extremely impressed with the pertinence and depth of the knowledge base as well as with the questions that were asked in the weekly status reports, and kept the bid open as a direct result. Not only did this innovative approach keep the bid open, it also resulted in a productive dialog with the prospect that

  enabled a superior winning response. This is now a recognized procedure that is considered any time a substantial or complex quotation effort is undertaken.

Broadening the pool of people qualified to interpret critical procedures correctly

- Critical procedures are generally those that are involved with customer interface or those that are requirements imposed by law or regulation. In Remmele's case the interesting ones are customer oriented and facilitated with computer assistance. For instance, each division has an evolving estimating procedure that attempts to capture in great depth the process approach and cost detail. Spread sheet templates are the typical implementation framework and constantly evolve with improvement and knowledge. Though these procedures differ from division to division, the use of common spreadsheet tools is easily learned and lends itself well to incremental correction and modification as novices are introduced to the estimation process for the first time.

Reusing generic procedural concepts to satisfy new applications

- The ideology at Remmele creates a true sense of family/team, and eschews individualistic grandstanding. One result is that people are quick to recognize and borrow good ideas for application elsewhere. For instance: Communication council meetings occur monthly in each plant with a variety of people in attendance. At one plant the council consists of six shop people, a supervisor, and the plant manager. Employees prompt the council members in advance to speak and ask questions for them. This practice has been so successful internally that its basic concepts were adapted to the external sales rep organization, which has a council meeting once a year with five sales reps expected to represent and get input from all reps for the meetings. Recently a program manager was added to the council to see first hand how seemingly innocuous, uncommunicated events can create misunderstandings.

Change Proficiency Maturity—Practice/Procedure Innovation Management Mastered Stage (4) for Both Proactive and Reactive Change Proficiency
Principles Knowledge Base: The strongest principle in force here is the one that eschews micro-managed operations, whether by top management or by blindly-followed procedure, thereby making people responsible for how they choose to meet an objective. The role of a corporate procedures manual is satisfied primarily by the corporate Guiding Principles (see Appendix). Additional principles playing strong roles are the beliefs in continuous change, continuous learning, accountable empowerment, knowledge-base development and communication, and customer satisfaction.
Scope Metric Focus: Innovative solutions are required of all business functions, not just in the corporation's core competency areas of machining and production process. For instance, both the current search for an information technology strategy and the search for a way to gain increased employee diversity are likely to generate innovative practices as neither are yielding to standard straightforward approaches and the process continues. Robustness in this practice comes from the readiness of Remmele people to borrow and adapt ideas that they see working elsewhere, as well as the inherent understanding that all decisions are open to criticism if they cannot demonstrate a thoughtful and knowledgeable foundation. Cost and time to develop and evolve innovative procedures and practices are not impacted by layers of approval—accountable empowerment makes each user responsible for the applicability of procedures and practices employed.

Modification Competency—Proactively Formidable:	Reconfiguration Competency—Reactively Automatic:
Modification Competency—Proactively Formidable: Respect for procedures without blind obedience fuels constant modification and improvement. In one of its highest forms, Remmele is experimenting with scalable structures that facilitate development and modification with reusable procedure concepts. Their development of an on-line procedures framework for customizing quality programs from reusable procedure modules is without known precedent—and provides a preemptive competitive capability to manage a large number of different quality programs without the typical confusion and expense.	**Reconfiguration Competency—Reactively Automatic:** Though there are divisional/plant-based identities and prides, the ideology at Remmele creates an operative sense of family/team across the entire corporation, eschewing individualistic grandstanding. One result is that people are quick to recognize and borrow good ideas for application elsewhere. Plant 50 pioneered a credit card ordering process for MRO items (supplies, seminars, etc.), giving specific people credit cards for specific suppliers. Problems with the Visa billing are resolved by the user. This was subsequently adopted in all plants.

[1] Collins and Porras, p. 139.
[2] Simons, *Harvard Business Review*.

4.4 Strategy Innovation Management: Innovation management practices that create and nurture objectives and strategies which are distinguished by their effective impact on fulfilling the longer term enterprise vision. Generic Agility issues include the development of breakthrough planning competencies and follow-through implementation competencies, sustaining coherency and consistency with the past while introducing new vitality and better understandings into visions and strategies, and creating a culture that seeks innovative strategies and is willing to support and implement them.

At Remmele the strategy innovation management practice works within the framework of the evolving vision—expressed in the corporate statements for mission, guiding principles, and customer satisfaction (see Appendix) and is strongly influenced by the culture of continuous learning, the goal to "Be the Best," and the expectations for informed risk taking. This framework provides a set of goals, metrics, and principles which facilitate the development and reconfiguration of corporate and divisional objectives, strategic issues, and strategies on both an annual and as-needed basis.

Proactive Change Proficiency Issues	
Creation	• Encouraging risk; eliminating lockstep "institutional imperative" thinking
Augmentation	• Improving a strategy during implementation without losing its purpose to whimsical or transient ideas
Migration	• Preparing the business to capitalize upon the attainment of an objective
Modification	• Incorporating new and different expertise (people) and knowledge in the planning process
Reactive Change Proficiency Issues	
Correction	• Discovering invalid objectives and poor strategies quickly and taking appropriate action immediately
Variation	• Deviating appropriately from a strategy when opportunities present themselves
Expansion	• Increasing the depth of knowledge involved in strategic planning and implementation
Reconfiguration	• Adopting and adapting strategies from other industries

Encouraging risk; eliminating lockstep "institutional imperative" thinking
- In the words of one divisional manager: "I think informed risk is very related to empowerment. I think that one of the cultures we have at Remmele, and one that we work very hard to create, is that if you take an informed risk and it doesn't work out, that's OK. The management style at Remmele strives on purpose to have a management team that doesn't beat people up. We can be assertive, but not aggressive in our management style. So, as I look at risk taking, I know that the president will support me. I absolutely know that. I feel it is my responsibility to keep him informed about what's going on. Something I've learned is if you have a team of people working on a project, the best thing you can do is make sure everyone knows who is responsible for what, and that you're not taking that responsibility away from them. An example of that would be the recent situation where we had to increase our price, and as we were working through that whole situation the president was not willing to tell us, the team and myself in particular, what to do. I was half on this side of the fence and half on that side of the fence, and I was all ready to have him make the decision for me, because this was a huge, big problem, with a big impact on Corporate. I kind of laid it all out and he got a smile on his face and said 'what are you going to do?' I worked real hard to give him that bomb and he wouldn't take it. He wouldn't even volunteer his thoughts and opinions until I finally made a decision. That was a real good lesson for me, in recognizing myself that I was willing to let him make that decision. The point there is that he wasn't in the best position to make that decision. I was a lot closer to all the things going on, and our team was a lot closer to all the things going on. We were going to have to live with all the results. So as I laid out my decision to him, interesting enough, he didn't agree with it. He told me why. At that point he got me to really dig deep into a good understanding of what I really felt we had to do. We spent time talking with the team, and we were convinced that we were right. He said, 'Look, you need to make the decision; you need to go forward with that. I'll support you.' So we really went ahead knowing that he disagreed. The funny part is that it turned out he was right. We found out a couple of months later and did some backpedaling to change our approach."

Improving a strategy during implementation without losing its purpose to whimsical or transient ideas
- The danger here is from seductive strategy changes that obscure and even replace objectives, becoming an end unto themselves. Firm mission and strategic policy statements, augmented annually with detailed divisional strategies and objectives, establish a clearly articulated focus and direction. The strategy improvement activity is then driven by the "Be the Best" corporate goal coupled with cultural beliefs in continuous learning and constant

change; while open communications, 360 degrees of accountability, and respect for knowledge-based plans provide the stay-on-track mechanism.

Preparing the business to capitalize upon the attainment of an objective
- The natural sense of family/team and the active and wide open communication practices at Remmele mean that people not only know what is happening and why, but have also been involved at least in the debate on and questioning of the values and expectations of the current strategies. This eliminates the surprises. At the same time, though the company is a paragon of autonomous empowerment, it does not abdicate hierarchical responsibility, reviewing objectives, strategies, and progress in frequent management team meetings and cross-divisional forums. This provides the inter-strategy coordination.

Incorporating new and different expertise (people) and knowledge in the planning process
- Remmele's board of directors consists of eight members, five of whom are outside members with management or professional experience in other industries: automated testing equipment, military munitions, consumer and industrial products, and an attorney. Outside board members bring new thinking from different industries. For instance, when Remmele was an $8 million, 150-person company, it had an outside board member who proposed that Remmele develop a professional sales organization—an alien thought in the machining industry where owner/managers typically do the selling. The company created a new management position and went outside the company as well as their industry to fill it with professional marketing expertise. The new manager in the new position promptly recommended a nation-wide sales representatives approach—more foreign concepts—and was told: "We're not comfortable with the idea of having '5%ers' selling technical services, but if you want to do that, give it a shot. That's what we hired you for". In 1979 six initial reps were brought on in New England, Chicago, Tennessee, Colorado, St. Louis, and Philadelphia. Now there are approximately 75 reps, and the success of this strategy is reflected in the growth that the company has achieved.

Discovering invalid objectives and poor strategies quickly and taking appropriate action immediately
- Discovering and shutting down a poor objective or strategy can be as valuable as achieving one—as it diverts resources away from marginal or losing activities and makes them available for higher productivity work. Marvin Patterson, as corporate director of engineering for Hewlett Packard, delivers many useful insights in his book, *Accelerating Innovation*. Among them: "There is a particular uncertainty at the beginning of each new product activity, and the process itself is a method for eliminating the uncertainties in a product implementation. For example, sometimes by eliminating the uncertainties, project teams find that the product simply is not feasible as conceived. Another possible outcome of the product development activity is the discovery that, while the product was initially conceived as being highly valuable in the marketplace, new information or circumstances have reduced that value to an unacceptably low level. In spite of the fact that such discoveries can lead to product cancellation, both of these considerations must be considered extremely productive discoveries….It's extremely productive for project teams to recognize and quickly conclude, for example, that they have been outdone by the competition and that project cancellation is the only rational option. The alternative certainly is counterproductive in the extreme—to try to keep the project alive, to invest perhaps another $5–$10 million in developing the product and to have it canceled by the marketplace. In fact. to have the customer cancel a project is the worst of all possible fates. It means a company has committed its investment but will reap no return from it."[1]
- You can't hide at Remmele—not that you'd want to if you worked there. There is a constant questioning and debate over what is going on by virtually all employees. This tends to identify strategies that aren't working quickly and drives the urgency for corrective action. Also, the supportive management style that allows people to run with their reasoned decisions without penalty for being wrong promotes decisive action: it encourages someone who realizes that they are on the wrong path to do an about face, and it makes it easy because they can do this without losing face.

Deviating appropriately from planned strategies when opportunities present themselves
- Remmele generates and banks knowledge from its relentless market and process research and its constant pursuit of potential new lines of business. This has allowed it to weigh unexpected opportunities in real time and begin implementing new strategies quickly. They also maintain a mix of strategies: some that support current business and some that develop new business. When opportunities for current business exceed expectations, the corporate Strategic Policies naturally channel resources away from the development strategies and into the goal-meeting and customer-satisfying opportunities. Remmele's entry into the medical small parts business, triggered by an unexpected phone call from a large medical concern, tells both sides of

this story. The company wanted to know if Remmele did small parts. "We said 'No' but indicated that we had a desire to enter that area. They were having vendor problems, so they came over and took a look at Plant 30, where we use the focused-factory concept, and figured that we could get into the medical business if we wanted to be. It turns out that about six months earlier we had considered an attempt to enter this market, so the management team had already thought through the process. We had talked to potential customers and to people who were in the business and decided that miniaturization was a real movement. We also wanted to diversify into the medical business and saw small parts as the entree there. We even bid on a small acquisition locally but couldn't reach price agreement, and realized that we would have to start it from scratch. We were all ready to do that when we got so busy that we just let it drop—six months later this call comes. We had a management 'champion' who had been through the early market research who really wanted to do it. We knew small parts would require us to develop a whole new capability very far from the experience base, but we were able to jump on the opportunity when it came because we had done the homework."

Increasing the depth of knowledge involved in strategic planning and implementation

- At Remmele, marketing and technology personnel throughout the company conduct frequent and periodic cross-divisional meetings to look for potential innovations and new market opportunities. Both groups engage in continuous and deep knowledge development: the director of advanced manufacturing-engineering spearheads a dedicated world-search for technologies, engaging other personnel when promising process or equipment is discovered; the director of marketing spearheads classic research activities into markets targeted for investigation by the cross-divisional team and the management team. These knowledge development activities are continuous, structured, scheduled activities. Additionally, management takes active leadership roles in trade association work calculated to keep them at the forefront of developing industry knowledge.

Adopting and adapting strategies from other industries

- It is said that there are few new ideas for people to work with, and that most of what we do that we call new is really borrowed or inspired by something we have seen elsewhere. This is true of almost all business strategy development at any company—it adopts or builds upon strategies taught in business schools, published as case history, or seen first-hand elsewhere. Generally, however, there is a strong "institutional imperative" filter that makes some ideas acceptable candidates and others beyond consideration. Though Remmele is not totally immune to hidden bias, its ability to embrace foreign concepts and its propensity to expose itself to foreign ideas create a broader pool of candidate strategies. Remmele bets first on people and their passions to pursue reasoned strategies—rather than first choosing the strategy and then finding a person willing to follow it. Examples of strategies uncommon in Remmele's industry include the use of manufacturers representatives, a predominately outside board of directors, significant growth as a goal, a major commitment to knowledge and skill development, autonomous empowerment, finite shop scheduling, and activity-based costing. An excellent example of a strategic principle adopted and then adapted from another industry is the concept of "informed risk," which Remmele credits to Intel's mission statement from the early '90s.

Change Proficiency Maturity—Strategy Innovation Management **Mastered Stage (4) for Both Proactive and Reactive Change Proficiency**	
Principles Knowledge Base: Innovation management practices at Remmele, regardless of focus, stem directly from the corporate Mission to "Be the Best," the companion implementation principles set forth in the corporate Strategic Policies (see Appendix), and the fact that these corporate statements actually describe the way the company operates. These principles provide a consistent framework that generates and channels natural innovative behavior among all employee groups. Key roles for strategy innovation management are played by the principles of open communications, accountable empowerment, continuous learning, informed risk, and constant change.	
Scope Metric Focus: It is evident that Remmele does not have an overt practice that it recognizes as strategy innovation management, yet a highly effective and robust de facto practice emerges from the system of corporate principles. By the same token, the company is naturally emphasizing scope with its broad-based knowledge development support, active industry association activity, promotion of open and involved employee discourse, and support for people who want to pursue different but reasoned ideas.	
Modification Competency—Proactively Formidable: Respect for people and knowledge and "pride in quality," encourages Remmele to seek and integrate new and different expertise and knowledge when planning activities go beyond the experience base.	**Reconfiguration Competency—Reactively Automatic:** A comfort and belief in informed risk and continuous change, protected by a strong framework of guiding principles, have produced a planning practice that is generally unafraid to entertain, support, and eventually integrate previously foreign concepts.

[1] M. Patterson, *Accelerating Innovation* (New York: Van Nostrand Reinhold, 1993), pp. 42–43.

5.1 Knowledge Portfolio Strategy: Identifying knowledge critical to the business and managing the mix of knowledge assets. Generic Agility issues include identifying the nature and location of core competency knowledge, identifying knowledge to drive market positioning and differentiation strategies, identifying knowledge to drive market entry and penetration strategies, developing a core competency management strategy, reevaluating values and leveraging techniques of intellectual property rights, and obtaining value from increasingly complex knowledge with decreasingly applicable lifetimes.

At Remmele, the foundation of the Knowledge Portfolio Strategy is the corporate ideological infrastructure and its emphasis on "being the best," as clearly articulated in the Remmele Corporate Mission Statement. Within this framework, knowledge assets are identified and managed.

Proactive Change Proficiency Issues	
Creation	• Identifying knowledge to drive market entry and penetration strategies
Augmentation	• Emphasizing and growing the total body of knowledge versus functional knowledge only
Migration	• Investing in knowledge generation prior to a perceived need
Modification	• Developing a core competency management strategy
Reactive Change Proficiency Issues	
Correction	• Utilizing the available knowledge base to improve performance
Variation	• Recognizing the need to realign knowledge assets
Expansion	• Committing to internal development of assets to address external shortfalls
Reconfiguration	• Changing the mix of knowledge assets in response to business drivers

Identifying knowledge to drive market entry and penetration strategies
- In highly technical manufacturing companies, the emphasis on technology and technological advancement often overshadows the importance of effective marketing and sales strategies. Acknowledgment that customer pull has replaced technology push as the key driver of business success is not yet in place.
- At Remmele, the converse is true. Remmele has long recognized the need for effective marketing and sales strategies plus the ability to implement these strategies on a broad, industry-independent basis. The identification and prioritization of market growth opportunities is a critical part of the annual planning process. Input on new market potential (provided by sales, marketing, customers, manufacturing, etc.) is leveraged against existing Remmele capabilities to identify barriers to entry, competitive positioning, and business opportunity for each potential new market. For those markets with the highest potential for success, exhaustive investigation and analysis are conducted by a cross-functional team of Remmele resources. Information is gathered from business research firms, academia, professional industry organizations (i.e., SEMI, AMT), networks, competitors and, of course, Remmele's own internal resources. From the resultant body of knowledge, a business case is generated for each high potential market opportunity and a decision to proceed, terminate, or gather incremental data is made.
- Remmele's "hit rate" on successful new market entry is substantially higher than the industry average. The company believes this is because they don't justify market potential exclusively on financial return data, but instead rely heavily on the "deep studies" knowledge base.

Emphasizing and growing the total body of knowledge versus functional knowledge only
- Remmele's endeavor is to be the best, "to be the recognized leader in the U.S. in the high quality, technologically advanced portion of the contract manufacturing and factory automation industries." To achieve this goal, they have long recognized the importance of training, education and the overall pursuit of knowledge. But Remmele also recognized that it is total knowledge, not just functionally-specific knowledge, that provides the greatest value.
- Remmele invests heavily in education for all employees. They reimburse the employee for tuition and books *prior* to beginning a course, in order to remove the perceived barriers. In addition, they will fund the employee to take courses on any or all disciplines that the company can use (i.e., accountants may take engineering courses; operators may take finance courses). As stated by a Remmele manager, "Here's the money, now what's your excuse. My job is to knock down barriers that stand in the way of anybody becoming whatever they want to become."

- Remmele requires a high degree of versatility and capability in their workforce. Consistent with their Guiding Principles, "by attracting and further training outstanding people who are intelligent, honest, hard-working, skilled, and self-motivated to excel" the company will continue to grow and prosper.

Investing in knowledge generation prior to a perceived need

- Remmele, as a somewhat typical job shop, is opportunity driven. Because opportunities and the timing thereof are highly unpredictable, Remmele has implemented a strategy to develop capabilities in advance of a need and then leverage that capability when the timing is right. This innovation banking, "hiding in the bushes and waiting to pounce as soon as an opportunity passes by," enables Remmele to be highly competitive upon entry into new markets and industries.
- As part of their annual planning process, Remmele had identified miniature machining as a technical capability and had targeted several potential market applications. Unable to find real market opportunity, they "banked" the capability for future use. A fortuitous encounter between Remmele and a medical component manufacturer with an urgent need for micro-machined precision parts led to Remmele's entry into the miniature machined parts medical industry.

Developing a core competency management strategy

- Remmele's commitment to employee excellence exists at all levels of the organization, including management. The company realizes that it currently does not have the depth in management and key personnel to meet future growth demands. This has driven a renewed emphasis on the development of core competencies at the top management level. Remmele's focus is now on leadership skills, preparing for the next generation of Remmele leaders. The company has employed an external organizational development consultant to assess the skills of all top management personnel and to assist in the generation of development plans for each. The annual performance review process will be modified to include the evaluation of leadership capabilities.
- The realignment of core competencies for top management to focus on leadership skills is one more example of Remmele's "banking" of capabilities for future use. As Remmele completes their development and implementation of a structured succession plan for key employees, they have ensured that a pool of highly talented, competent leaders of the future will be available to choose from.

Utilizing the available knowledge base to improve performance

- "Leadership in the marketplace can only be sustained by constantly meeting or exceeding the expectations of our customers and anticipating their future needs through continuous improvement of our products and services."—Remmele Customer Satisfaction Philosophy. In the early 1980s, Remmele's on-time delivery performance was a mere 50%—customer commitments were not being met due to the inadequacy of Remmele's planning and scheduling system. Immediate correction was required and finite scheduling, as yet not commercially available, was identified as the proposed solution. Initial efforts with the University of Minnesota to develop such an application proved feasible, but the solution was not readily implementable into a small, manufacturing environment. Remmele turned to Manufacturing Management Systems, a software firm in Texas, to develop and implement a system with them. The project was successful, the Remmele Manufacturing Management System (REMMS) was born, finite scheduling capability was introduced, and on-time delivery performance rapidly increased from 50% to greater than 90%.
- Remmele's ability to identify the appropriate knowledge base and leverage it in a timely manner to resolve performance issues demonstrates excellent recovery capability.

Recognizing the need to realign knowledge assets

- Program management is recognized as one of the key elements of Remmele's business success. The role of the program manager is broad and highly diverse—he is the customer's key interface into Remmele, and thus it is critical that the "message" he sends is one of competence and value.
- In Remmele's Plant 30, a focused-factory environment, work-cells and associated resources are configured around a customer's part or project. Each cell is managed as a small business—operators assume procurement, quality control, preventive maintenance, production, and financial responsibilities. The program manager, as the key interface between the work-cell and the customer, needs strong business knowledge and focus to be effective. To address this need, Remmele deviated from its standard definition of a project manager and assigned highly skilled business managers, with minimal technical capabilities, to manage the customer interfaces. The experiment was a failure; the customer valued business knowledge, but valued technical knowledge even more. Highly technical program managers were reassigned to Plant 30 as a result.

Committing to the internal development of assets to address external shortfalls

- To maintain its technology leadership position, Remmele is continually challenged to attract, develop, and retain a human resources capability sufficient to meet their current and future needs. In highly technical functional areas, machinists as an example, Remmele has historically not been able to recruit capable external resources and, thus, has made a commitment to develop these capabilities internally.
- Remmele has developed a highly regarded, award-winning apprenticeship program to train future machinists and counts on the fact that these highly skilled craftsmen will remain Remmele employees after their apprenticeship is complete. The training process begins with the careful selection of student apprentices who have graduated from a two-year vocational training program—Remmele selects the best and the brightest while ensuring that they have a value system consistent with the Remmele ideology. The program includes extensive classroom and on-the-job training and lasts for 3½ to 5 years. It includes experiences in all facets of Remmele's operations in all five plant locations. After graduation from the program, machinists continue to refresh and improve their skills throughout their careers.
- The Remmele apprenticeship program involves a phenomenal commitment by the company to develop the best, to "grow its own," in order to ensure continued company growth and technology leadership.

Changing the mix of knowledge assets in response to business drivers

- The development of a human resource strategy is a critical component of the annual planning process at Remmele. The current mix of knowledge assets is compared to their perceived future needs, and the gaps are identified. This process enables Remmele to augment their skill sets, to reprioritize training needs, and to address pending shortfalls on an ongoing basis. Responses may include the hiring of new employees, reassignment of existing employees, reemphasis on developing specific skill sets (i.e., leadership skills for top management), or the expansion of specific training programs.
- In the latest annual planning process, Remmele identified the need for the implementation of a succession planning process, for a project manager development program, to expand their apprenticeship program and to add human resource capacity. These needs were developed in response to critical business drivers presently impacting Remmele and the industry in general. Remmele's ability to manage and reconfigure their knowledge assets is a highly agile management practice.

Change Proficiency Maturity—Knowledge Portfolio Strategy Mastered Stage (4) for Both Proactive and Reactive Change Proficiency	
Principles Knowledge Base: The principle involved in developing a portfolio strategy for Remmele's knowledge assets is clearly articulated in the Corporate Mission Statement—Remmele endeavors to be the best. The realization is clearly in place that the management and generation of knowledge assets is critical to achieving this goal.	
Scope Metric Focus: The portfolio of knowledge assets at Remmele is broad, traversing all functions and all employees. Total knowledge assets are highly valued versus a focus on functional assets only. Remmele is a true learning organization.	
Modification Competency—Proactively Formidable: The commitment to learning and continuous employee development enables Remmele to add incremental knowledge assets or de-emphasize existing assets dependent upon the perceived need. In many cases, knowledge assets are proactively "banked" waiting for an appropriate opportunity for use. Remmele is presently developing incremental leadership skills for top management in anticipation of business growth and eventual top management attrition.	**Reconfiguration Competency—Reactively Automatic:** Knowledge assets at Remmele are broad and deep across the organization, and they are continually growing. In addition, Remmele has developed an expansive network of external knowledge assets including customers, suppliers, industry organizations, and external consultants. When a need arises, these assets can be configured and leveraged in a timely and effective manner.

5.2 Knowledge Generation: The creation of knowledge assets in product technology, production process, procedures, markets, and other areas not previously possessed by the organization through techniques such as acquisition, discovery and development. Generic Agility issues include overcoming not-invented-here barriers, efficacious and predictable time and cost, applicability to current and future needs, and synergy with other knowledge.

At Remmele, the Knowledge Portfolio Strategy provides the framework which will be populated with knowledge assets as they are generated. Assets will be aligned with knowledge sources and internal needs.

Proactive Change Proficiency Issues	
Creation	• Creating a knowledge base to enable the pursuit of an incremental market opportunity
Augmentation	• Continuous improvement and updating of the existing knowledge base
Migration	• Applicability of knowledge to both current and future need
Modification	
Reactive Change Proficiency Issues	
Correction	• Modifying a decision to reflect incremental knowledge
Variation	• Overcoming not-invented-here barriers
Expansion	• Increasing the existing knowledge base through the addition of synergistic knowledge assets
Reconfiguration	

Creating a knowledge base to enable the pursuit of an incremental market opportunity
- As part of the annual planning process, market entry opportunities are routinely identified and prioritized. Those opportunities with the highest potential for success are exhaustively investigated to determine value and "fit" with Remmele's technical capabilities. The investigation results in a comprehensive body of knowledge that includes market dynamics, market requirements, customers, competitors, channels, competitive pricing, technical capabilities required, and overall value drivers.
- A need was identified by Remmele's advanced manufacturing engineering manager for a U.S.-based, high quality gear manufacturer. Initial assessment indicated a potential fit with Remmele's capabilities, and an investigative "gear team" was established. The team includes program managers, a plant manager, financial support, and a process expert. Extensive data gathering is underway to confirm initial findings and to verify the up-front investment required. Whether this opportunity is actually pursued or not, the body of knowledge that was generated will be archived for future reference.

Continuous improvement and updating of the existing knowledge base
- As a learning organization, Remmele is continuously assessing and augmenting its existing knowledge base to ensure that it is current, relevant and comprehensive. When gaps are identified, remedial steps are taken to make the necessary modifications.
- In Plant 30, operators essentially manage all aspects of the work-cell; thus, a broad portfolio of skills and knowledge is required. A structured program was developed and implemented to assess the needs of the operators and support personnel, to identify skill set gaps and to identify the remedial action required. With additional training, employees develop broader skill sets and can assume incremental responsibilities.

Applicability of knowledge to both current and future needs
- The thrust of a learning organization is not only to generate knowledge on a continuous basis but to ensure that it is available to all employees for future application. At Remmele, the investment in knowledge generation is quite large and perceived as an investment in the future, not a cost. On the shop floor, the utilization of knowledge within and across functions, from plant to plant and, particularly, from job to job is readily apparent. When a new project is quoted and eventually implemented, reusable knowledge is leveraged to improve the quality of the process implementation. As clearly stated by a Remmele machinist, "We don't re-invent the wheel every time we get a new part in. We have experience, good communication, and a database of previous projects we can refer to. There always seems to be someone around who has dealt with a type of part or program before and can point you in the right direction." Remmele does not sell just parts fabrication, engineering, or design support; they sell solutions.

Modifying a decision to reflect incremental knowledge

- In Remmele's highly empowered workforce, decision making, at all levels of the organization, is constantly required. This is not decision making that occurs in a vacuum but rather decision making that is based upon informed risk. Employees are strongly encouraged to invest time and resources in gathering the information required to make good decisions. At Remmele, it is the thought process that goes into a decision that comes under intense scrutiny, not the decision that results from it. The culture at Remmele is forgiving of mistakes that are made if the individual or team that made the decision can demonstrate the comprehensive "homework" process that led them to a conclusion.

Overcoming not-invented-here barriers

- In many companies, particularly those that are highly technically competent, a mind set develops that values internally generated knowledge far more than knowledge acquired elsewhere. This mind set often leads to internal development and manufacturing activities to regenerate a body of knowledge that is already available elsewhere.
- At Remmele, knowledge is valued based upon its quality, its merit, and its applicability. The source of the knowledge itself is relatively unimportant. The company builds its extensive knowledge base from data and information gleaned from customers, suppliers, competitors, industry groups, secondary research sources, internal sources, etc. Remmele invests routinely in domestic and international "fact finding" trips, the purpose of which is to add to the existing knowledge base. As stated by one of Remmele's customers, "Remmele will show anyone their plants. They do this with the belief that sharing knowledge will make everyone better."

Increasing the existing knowledge base through the addition of synergistic knowledge assets

- On an individual basis, Remmele's focus is on the total body of knowledge and not just on technical skills. For each employee in one division, a detailed skills and knowledge assessment is developed and updated on an annual basis. This tool not only highlights areas of strength and expertise but also identifies areas for growth and incremental development. Continuous improvement and change are critical components of the Remmele corporate ideology and, thus, employees view learning in a very positive light. Continuous learning enables them to handle more change and responsibility on the job, it enables them to pursue incremental opportunities and, most importantly, it enables them to grow and become more valuable to the company.
- Through 1) the skills and knowledge assessment, 2) the cross-functional training matrices that are developed to provide maximum employee flexibility, and 3) an individual's own needs and desires, an informal training road map is developed on an individual basis. This tool focuses on both hard skills and soft skills that may be required. To address these needs and to generate the appropriate level of knowledge:
  1. A wide variety of in-plant courses are available covering a broad spectrum of skill and knowledge areas.
  2. External courses are identified in hard skills such as engineering, finance, manufacturing technology, etc.
  3. Cross-functional training and on-the-job training are emphasized (i.e., learning from in-house experts).
  4. Courses are offered internally and externally to improve the ability of employees to learn and to help them deal with day-to-day interactions (i.e., teamwork, negotiation skills, people management).
  5. Mentoring is readily available and strongly encouraged.

  The focus at Remmele is not only on knowledge generation, but also on knowledge sharing.

Change Proficiency Maturity—Knowledge Generation Managed Stage (3) for Both Proactive and Reactive Change Proficiency
Rules and Responsibilities Knowledge Base: Knowledge generation is governed by the Knowledge Portfolio Strategy which provides objectives for identifying the mix of knowledge assets required to achieve Remmele's business strategy. Knowledge generation is not haphazard or arbitrary but closely aligned with the Mission and Guiding Principles.
Robustness Metric Focus: Knowledge generation activities are focused on developing a total body of knowledge, not just on honing highly technical skills. The processes used to generate knowledge—development, discovery, acquisition—are predictable and universal applying to all knowledge. Initially, the scope metric also appears to be applicable in this business practice, but a gap is apparent in the information technology domain. To date, Remmele's efforts in this area have fallen short of their knowledge generation capabilities demonstrated in all other functional areas.

| **Migration Competency—Proactively Aggressive:** Remmele routinely anticipates and prepares for future knowledge requirements in several ways. Knowledge is frequently generated prior to an actual need and "banked" for future applications. Additionally, knowledge is generated and then retained in a reusable format (i.e., database, project files) to avoid "re-inventing the wheel" every time a new part or project comes to the shop floor. | **Expansion Competency—Reactively Sure:** The Remmele focus on continuous change, continuous improvement, continuous learning, and continuous growth requires a knowledge base that expands to meet ever-changing needs. As it relates to knowledge generation, this implies development, discover, and acquisition across the total knowledge base and on an ongoing basis. Remmele emphasizes not only the hard skills associated with technical competency but also the soft skills that are paramount to effective inter-relationships with customer, suppliers, and other employees. |

5.3 Knowledge Capture: The collection and systematizing of procedures, processes, experiences, lessons learned, techniques, and other knowledge contained in people's heads, and placing it in an accessible repository. Generic Agility issues include creating an accessible institutional repository for core competency knowledge as the workforce becomes more mobile, identifying what knowledge is not captured and therefore must be discovered, keeping the knowledge repository current, and creating non-intrusive capture techniques.

As articulated in its Mission Statement and Guiding Principles, Remmele is a learning organization committed to growth in knowledge, skill, and responsibility for all of its employees. It's within this framework that the company identifies critical knowledge assets, collects them in an organized, retrievable and reusable manner, or commits to develop and capture such assets in the future.

Proactive Change Proficiency Issues	
Creation	• Developing a database of problems and solutions for future reference and application
Augmentation	• Building upon an existing body of knowledge to ensure breadth, depth, and retention
Migration	
Modification	
Reactive Change Proficiency Issues	
Correction	• Keeping the knowledge repository current
Variation	• Identifying the need for incremental knowledge assets and securing them
Expansion	
Reconfiguration	

Developing a database of problems and solutions for future reference and application
- The head of planning for Royal Dutch/Shell is quoted in *Accelerating Innovation* as suggesting that: "The ability to learn faster than your competitors may be the only sustainable competitive advantage."[1] Because product and process development are repetitive, there is ample opportunity to learn and improve, but much of what might be learned is lost if product and process cycle times drag on indefinitely or if critical findings are not stored for future reference.
- At Remmele, new product and process knowledge spreads throughout the plants. The technology group meets every other month to: 1) discuss potential products, processes, and capabilities, 2) present problems and proposed solutions, 3) solicit input from a diverse set of backgrounds, and 4) glean wisdom from industry experts. Information gathered at these meetings is collected, categorized, and inputted into a technical database available to all of the plants for future retrieval and utilization.
- Other "databases" at Remmele are less formal and structured but just as valuable. In Remmele's focused-factory environment in Plant 30, a new project required in-depth knowledge of cast iron processing—knowledge that was not currently available at that site. A technical expert was identified at Plant 20 and reassigned to Plant 30 for several months—to transfer his knowledge base in a learning and mentoring mode.
- Databases are also maintained on a project-specific basis to document technical innovation, process learning, and solutions to reoccurring technical problems. As quoted by a Remmele machinist, "We don't re-invent the wheel every time we get a new part in. We have experience, good communication, and a database of previous projects we can refer to."

Building upon an existing body of knowledge to ensure breadth, depth, and retention
- Remmele has developed a highly regarded, award-winning apprenticeship program to train future machinists. Most apprentices are young graduates of a two-year vocational training program. There are exceptions: one, for instance, entered Remmele's apprenticeship program at age 46, following 17 years of industry experience in assembly and inspection and two years in a Vo-tech training program. She was seeking challenge, opportunity, growth, and a career change. Remmele was looking for commitment, breadth of interest, openness to new ideas and technologies, and a knowledge base that could be leveraged. The apprentice and Remmele both achieved their goals in December 1995 when she completed a 2½ year apprenticeship program and became a machinist in Plant 50.
- Remmele captures, transfers, and manages its knowledge assets through the identification and training of employees like the apprentice example above. Remmele is able to retain such employees by offering continuous challenge and learning and access to state-of-the-art equipment and technology, by providing an

atmosphere of trust and open communication, and by ensuring that Remmele is an economically and personally rewarding place to work.

Keeping the knowledge repository current

- Technology leadership is a critical component of Remmele's ideological infrastructure. As stated in their Mission Statement: "Endeavoring to be the best, our goal is to be the recognized leader in the high quality, technologically advanced portion of the contract manufacturing and factory automation industries." To achieve this goal, continual assessment and updating of the corporate technological knowledge base is critical.
- Remmele uses many vehicles and sources to "feed" their technical knowledge base: 1) each year 50–60 Remmele employees visit the international machine tool show to observe the latest technology in action and to capture glimpses of the future; 2) teams of Remmele operators, machinists, and engineers visit machine tool manufacturers to discuss requirements, needs and capabilities; 3) Remmele routinely benchmarks other contract machining job shops to gather process and technology insights; 4) external technical experts are invited to Remmele-sponsored seminars and "technology sharing" sessions; 5) sales reps and project managers participate in "intelligence gathering" excursions, both domestic and worldwide, to assess customers' current and future needs.
- Channeling this plethora of information back to Remmele, knowing that the culture will enable its utilization to the fullest, is what creates real value. Whether the repository is in a technical or manufacturing database or in the minds of Remmele's employees, the information is timely, current, and readily assessable.

Identifying the need for incremental knowledge assets and securing them

- Remmele perceives itself as a capital-intensive and intelligence-intensive business. Just as incremental capital assets are required to augment or expand existing capabilities (i.e., the transition from three-axis to five-axis machining centers), incremental knowledge assets are also required on a routine basis to ensure continuous growth and business viability. In both cases, Remmele responds to the need with commitment, rigorous data gathering, and focused investment.
- At Remmele, the need for in-depth technical knowledge has been assumed and funded from the company's inception. But in today's competitive environment, technical knowledge and expertise is not sufficient. From the plant manager to the project manager to the operator on the shop floor, the need for financial knowledge and understanding has become overwhelmingly apparent (i.e., operators in Plant 30 have assumed responsibility for component cost, process investment, and work-cell profitability). Remmele responded to this need, not with the addition of incremental cost accountants, but by appointing the CFO and the plant accounting managers as the company's financial educators and mentors.
- Accounting managers at Remmele have diverse roles and responsibilities: 1) to provide management accounting support, 2) to promote an understanding of job profitability at all levels, 3) to educate *all* employees on the impact of performance and profitability, 4) to function as a key member of the management team, and 5) to brief employees on cost systems and the components of cost. Remmele has recently begun detailed financial training in all plants for *all* employees, championed by the CFO but supported by the Remmele management team.

Change Proficiency Maturity—Knowledge Capture **Defined Stage (2) for Both Proactive and Reactive Change Proficiency**
Metrics Knowledge Base: The capture of knowledge assets is governed by the Knowledge Portfolio Strategy and is a critical component of all learning organizations. The focus is on the timeliness and currency of the knowledge assets—on the rate that the knowledge base changes, requires updating, and can be augmented with incremental knowledge assets. But the focus is also on the cost of change—the investment required to keep the knowledge base current and accessible. At Remmele, the costs associated with knowledge collection and management are viewed as a long-term investment versus a short-term expense. Remmele is well positioned to move into the next stage of maturity as it relates to knowledge capture.
Cost Metric Focus: Remmele has clearly refined its ability to collect knowledge in a timely and efficient manner and to keep its knowledge repositories current. The focus on cost demonstrates Remmele's acute awareness of the investment that is being made in developing and maintaining this knowledge base. This investment is founded and justified on the belief that "something intelligent will be done with all of the information that is collected and systematized in our formal and informal databases."

Augmentation Competency—Proactively Competitive: Remmele's Knowledge Portfolio Strategy emphasizes the value of growing the total body of knowledge versus functional knowledge only. Knowledge capture supports this strategy by collecting and systematizing technical knowledge assets as well as incremental knowledge assets that deal with cost management, project management, market knowledge, etc. According to Nevens, "High performing companies emphasize a set of skills notably different from their less successful counterparts. They value cross-functional skills and knowledge assets, while other companies pride themselves on their functional strengths. High performers boast, 'We've got the best project managers in the world.' Low performers say, 'We've got the best circuit designers.'"[2] Remmele clearly falls in the high performer category.	**Variation Competency—Reactively Confident:** Industry and market dynamics require rapid and cost-effective responses to real-time competitive actions, technology innovations, or environmental requirements. The ability to retrieve applicable knowledge from existing databases or repositories in an efficient manner or to secure incremental knowledge through appropriate sources in a real-time mode will separate competitive from non-competitive companies. Remmele has clearly demonstrated its ability to deal with the "Who? What? When? Where? and Why?" of knowledge capture.

[1] Patterson, p. 12.
[2] T. M. Nevens, et.al, "Commercializing Technology: What the Best Companies Do," *Harvard Business Review*, May–June 1990.

5.4 Knowledge Mobilization: Expeditiously deploying beneficial knowledge that was developed elsewhere. Generic Agility issues include eradicating not-invented-here attitudes, exposing "lessons learned" within the organization and encouraging adaptation, packaging and processing captured knowledge to facilitate reusability, and linking knowledge users with knowledge sources in the face of rampant knowledge proliferation.

Remmele is a learning organization and as such has committed to the rapid generation, capture, management, and mobilization of knowledge. Within this framework, Remmele employees are the mobilizers that ensure that these knowledge assets are "put into movement or circulation" throughout the organization.

Proactive Change Proficiency Issues	
Creation	• Developing cross-functional teams to gather and disseminate knowledge assets
Augmentation	• Asking threatening or potentially embarrassing questions to motivate learning and drive real change
Migration	• Applying existing solutions to new problems in order to facilitate reusability
Modification	• Efficiently deploying existing knowledge to new employees within an organization
Reactive Change Proficiency Issues	
Correction	• Eradicating not-invented-here attitudes
Variation	• Accommodating different learning styles through the packaging and presentation of knowledge
Expansion	• Sharing knowledge across a broader base of employees to facilitate better decision making
Reconfiguration	• Enabling the bi-directional flow of knowledge throughout the organization (i.e., from anyone to anyone)

Developing cross-functional teams to gather and disseminate knowledge assets
- Remmele is an intelligence intensive business, one in which identifying, obtaining, and deploying critical knowledge assets provide a true competitive advantage. According to Quinn, "Once a company gains a knowledge-based competitive edge, it becomes even easier for it to maintain its lead and even harder for its competitors to catch up."[1] Once a month, one division's R&D committee meets to discuss new technologies and new opportunities—to explore incremental market and/or business ventures that are consistent with their mission statements and their capabilities. These meetings are attended by representatives from Design Engineering, Manufacturing Engineering, and Marketing to share and disseminate cumulative knowledge. Independently, monthly meetings are held to discuss new potential markets, to prioritize opportunities, and to target those that deserve in-depth, investigative research. Once gathered and systematized, this in-depth market knowledge feeds back to the R&D committees—to address capability—and to the sales force—to approach prospective customers to address needs and expectations. This continuous, bi-directional flow of information and knowledge touches not only all functional organizations within Remmele but also transcends externally to touch potential customers and suppliers. Per Quinn, "Companies that learn from outsiders— especially from customers, suppliers, and specialists can reap even greater (competitive) benefits."[1]

Asking threatening or potentially embarrassing questions to motivate learning and drive real change
- Chris Argyris helps set the stage: "Genuine learning in organizations is inhibited by a universal phenomenon called organizational defensive routines. These consist of all the policies, practices, and actions that prevent human beings from having to experience embarrassment or threat and, at the same time, prevent them from examining the nature and causes of that embarrassment or threat….Being considerate and positive can contribute to the solution of single-loop (simple, one-dimensional) problems, but it will never help people figure out why they lived with problems for years on end, why they covered up those problems, why they covered up the cover up, why they were so good at pointing to the responsibility of others and so slow to focus on their own."[2] Learning and driving change involve asking the "hard" questions and then mobilizing the knowledge derived from those 'hard' questions.
- At Remmele, informed risk is a critical component of the culture and is strongly linked to empowerment. But informed risk commands that decisions be made without having access to all the information required in the time allocated—informed risk can and does lead to mistakes. When mistakes are made, pressure—the "hard" questions—comes from everywhere, not just from management and peers but from the shop floor, from support organizations, and from cross-functional divisions. People at Remmele openly question decisions, not to focus on the answer, but to focus and learn from the decision-making process.
- In Plant 30, an informed decision was made to purchase equipment for a work-cell without securing input from the operators on the shop floor. The equipment was installed and made production ready but did not have the process capabilities required to meet productivity and cost commitments. A serious mistake had been made.

The focus then turned not to the decision that was made but to the decision-making process itself. Hard questions were asked by the operators, and incremental knowledge was secured. The entire work-cell then focused on the options:
1) Living with the "wrong" equipment, sub-optimizing the process capability and "saving-face" for the original decision makers
2) Admitting to the mistake, taking a one-time financial loss, and replacing the equipment
The latter option was chosen. Everyone learned from the experience and shared the resulting knowledge throughout the Remmele organization.

Applying existing solutions to new problems in order to facilitate reusability
- Remmele's commitment to product and process innovation is just one component of the company's continued business success. One of Remmele's real competitive advantages is derived from the ability to reuse the existing knowledge assets to apply existing solutions to new problems or projects. As stated by one of Remmele's project managers, "We don't reinvent the wheel every time we get a new part in. We have experience, good communication, and our technical manufacturing database. Manufacturing engineering can help point people in the right direction."
- Technology groups meet monthly, across plants, to transfer process knowledge, to discuss problems, to share potential solutions and to identify sources of applicable knowledge assets. The focus is on applying "lessons learned"—to reuse existing knowledge to improve the quality of the solution, to decrease cycle time, and to reduce cost.

Efficiently deploying existing knowledge to new employees within an organization
- Within a learning organization, the Knowledge Portfolio Strategy has been developed, providing the framework to be populated with the appropriate mix of knowledge assets. Knowledge generation and knowledge capture mechanisms are understood, in place, and being utilized. Mobilizing knowledge assets becomes the norm, the expectation, the standard way of doing business. The learning organization becomes a well oiled machine, becoming ever more efficient and productive. What's the impact of bringing new employees into such an organization? How do you ensure that these employees become an integral part of the organization, making it stronger because of their presence? The answer lies in both the employee selection process and in the ability to transition knowledge assets to these employees in a timely and effective manner.
- To ensure business success, Remmele "attracts and further trains outstanding people who are intelligent, honest, hard-working, skilled, and self-motivated to excel." Secondly, Remmele provides a culture where "psychological ownership is powerful. People are so much in charge of what they are doing, they can't help but feel ownership. People are employed with the expectation that they will be here forever if things work out. That requires that Remmele provide these people with tools that will help them to be more valuable to the organization. This is the Remmele mind set—investment oriented vs. expense oriented." And finally, Remmele employs a comprehensive orientation and training program for all new employees. From an initial meeting with Remmele's president to discuss corporate ideology and business strategy to a comprehensive, on-the-job mentoring program to a skills assessment and personalized training plan, new employees soon become part of the Remmele community and recipients of Remmele's extensive knowledge assets.

Eradicating not-invented-here attitudes
- At Remmele, knowledge is a goal, not a result. By focusing on the continuous generation and capture of knowledge consistent with the Knowledge Portfolio Strategy, Remmele enhances its ability to be the best in the high quality, technologically advanced portion of the contract manufacturing industry. The source of these knowledge assets is not critical—the inherent value of the asset is what counts.
- As stated by a Remmele operator, "Pride in quality, education, training, teamwork make Remmele different—people hear you when you make suggestions."
- Two of Remmele's plant managers recently traveled to Japan to investigate new technologies, to visit potential customers, to visit machine tool manufacturers, and to visit competitors. This is representative of a general knowledge banking activity—gathering knowledge assets for future application regardless of source.

Accommodating different learning styles through the packaging and presentation of knowledge
- Knowledge assets are continually generated and captured for current or future application but may not be in a format that can be immediately used. Customization of the knowledge asset may be required based upon the audience, the application, or the process prior to actual utilization.

- Remmele uses external instructors to prepare and deliver many of its training programs. To ensure success, Remmele works with these instructors up-front to "Remmele-ize" the program—to customize the program for a specific application at Remmele. The training is delivered in a way that is consistent with the company's Guiding Principles, and the content aligns perfectly with the need.

Sharing knowledge across a broader base of employees to facilitate better decision making

- In many organizations, knowledge is perceived as power—the more you have, the more powerful you are. Sharing knowledge is perceived as decreasing your level of power and authority, undermining your hierarchical position in the organization.
- At Remmele, knowledge is also highly valued but not for the powerful positioning it enables. Knowledge is seen as the mechanism that enables continuous improvement, that drives technological leadership, that assures growth and continued business success, and that makes Remmele a personally rewarding place to work. By sharing knowledge internally and externally, the company as a whole grows stronger.
- In Plant 30's focused-factory environment, the operating philosophy drives 1) ownership by everyone, 2) distribution of responsibility and accountability within the work-cell, 3) integrated maintenance, purchasing, process engineering, and job costing responsibilities on a work-cell–specific basis, and 4) enriched job satisfaction. Weekly cell meetings are mandatory to encourage information sharing and the transfer of cross-functional knowledge assets. Business management at a work-cell level drives informed decision making and enables employees to leverage cross-functional knowledge assets. The focused factory is Remmele's response to the age-old question, "How do you take highly skilled people and keep them motivated in a repetitive production environment?"

Enabling the bi-directional flow of knowledge throughout the organization (i.e., from anyone to anyone)

- According to Quinn, "Information sharing is critical because intellectual assets, unlike physical assets, increase in value with use. Properly stimulated, knowledge and intellect grow exponentially when shared."[1] In many organizations, the challenge is to overcome the reluctance of professionals and technical experts to share information.
- In 1949, Fred Remmele and Thomas Zastrow started a tool and die business—the Fred L. Remmele Co. The firm was based on certain Guiding Principles, one of these being a respect for employees. Remmele believed that employees should be heard rather than ignored because they have things to say that are of value. Remmele also believed that a close working relationship with customers was critical—that the customer wanted a focal point of the company.
- Fred Remmele's beliefs live on in the Remmele Engineering of today. Employees at all levels within the organization have the opportunity to share their ideas and their concerns; to challenge decisions; to access knowledge assets and databases; to grow in knowledge, skill, responsibility, and compensation—all within an atmosphere of trust and open communication. Knowledge flow is:
  1) Bi-directional throughout the organizational hierarchy
  2) Bi-directional across functions,
  3) Bi-directional with customers and suppliers and, interestingly enough,
  4) Bi-directional, to some degree, with competitors
  As clearly demonstrated, Remmele has truly overcome any and all reluctance to share knowledge.

Change Proficiency Maturity—Knowledge Mobilization Mastered Stage (4) for Both Proactive and Reactive Change Proficiency
Principles Knowledge Base: Remmele's own Guiding Principles, the principles of a learning organization, establish the charter for knowledge generation, capture, and mobilization. By aspiring to excellence…, by committing to continuous improvement…, by providing an atmosphere of trust and open communication…, by involving everyone in the organization…, by attracting and further training outstanding people… and by regularly investing in tools, systems and equipment, Remmele strives "to be the best." Within this framework, knowledge is deployed internally and externally and at all levels of the organization.
Scope Metric Focus: Competency has been achieved for all metrics—mechanisms are in place to ensure that knowledge is mobilized in a timely and cost-effective way—employees have access to the knowledge assets they need to make decisions when they need them. Dollars are expended to distribute the information required but in a way that effectively leverages all formal and informal means of communication. The knowledge that is deployed is applicable to the need and accessible to all individuals that need it.

Modification Competency—Proactively Formidable : Knowledge assets can be viewed as discrete "bits and bytes" of information to be transported from any location to any location within an organization. Knowing which increments to transport when, plus knowing that the right increments are available in the first place, demonstrates a highly advanced capability. At Remmele, mobilizing knowledge assets has become the norm—the process has become intuitive. Existing knowledge is deployed to new employees within the organization. Just as readily, new knowledge is deployed to existing employees within the organization. The right knowledge assets are deployed at the right time and at the right cost and to the right people.	**Reconfiguration Competency—Reactively Automatic:** The ability to take different pieces of knowledge and reassemble them in different configurations to meet different needs is intuitive. This capability is demonstrated 1) by including technical R&D knowledge in a discussion on targeting new markets or by considering new market potential in technical group meetings, 2) by incorporating cost accounting, procurement, preventative maintenance, engineering, and QC skills into the day-to-day operation of a Plant 30 work-cell, or 3) by enabling open and honest communication when a shop floor operator challenges a decision made by his manager or his manager's manager. At Remmele, the belief is that *all* employees have something important to say and that they should be given the opportunity (i.e., tools, systems, training, cultural environment) to say it.

[1] Quinn, Anderson, and Finkelstein, *Harvard Business Review*.
[2] C. Argyris, "Good Communication That Blocks Learning," *Harvard Business Review*, July–August 1994.

6.1 Leading Indicator Metrics: Metrics that indicate pending change in the business environment which will require reactive response or create benefit from proactive response. These metrics are often qualitative, as quantitative signals are generally too late. We are more interested in the Agility that is enabled *by* the practice than in the Agility *of* the practice itself. Agility issues are biased today by the immaturity of this practice in industry in general and include the development of indicators that provide early warning of changing customer needs and emerging market opportunities and signify advances in change proficiency at competitors and in both served and unrelated markets.

The business practice is the collection of activities that define, gather, present, review (for effectiveness), and evolve the indicator metrics. The framework for this practice consists of the perceptions and needs of shareholders, customers, prospects, employees, and potential investors that will monitor these metrics and use them as decision criteria, as well as the culture of continuous learning and knowledge development. The potential user base is broad because customers, prospects, and investors will seek their own indicator metrics in the absence of any supplied by the company.

Proactive Change Proficiency Issues	
Creation	• Early warning of competitor's advances, customer's needs, and new market opportunities
Augmentation	• Improving indicators for earlier warnings
Migration	• Monitoring other industries and markets that pre-sage important trends
Modification	
Reactive Change Proficiency Issues	
Correction	• Diagnosing and fixing metrics that fail to predict as expected
Variation	• Overreacting, reacting too soon, and reacting to transient oscillations or "noisy" indicators
Expansion	• Monitoring more competitors, markets, industries, and technologies
Reconfiguration	

Early warning of competitor's advances, customer's needs, and new market opportunities
- "If a top management team cannot clearly articulate the five or six fundamental industry trends that most threaten its firm's continued success, it is not in control of the firm's destiny."[1] This comment from Hammel and Prahalad places the subject of leading indicator metrics in perspective. Another from Robert Simons is also instructive: "Senior managers need sensing systems more like the ones used by the National Weather Service. Ground stations all over the country monitor temperature, barometric pressure, relative humidity, cloud cover, wind direction and velocity, and precipitation. Balloons and satellites provide additional data. These data are monitored continuously from a central location in an effort to identify patterns of change."[2]
- Remmele engages an independent outside professional group to conduct customer satisfaction studies every two years. The group makes recommendations when numbers fall below their database norms.
- Competition is closely tracked for every plant against top ten and against specific industry leaders. Numbers are assembled internally each year and reviewed with a running year-by-year analysis of trends in sales-per-employee, ROA, ROE, revenues, and profits.
- In their search for economic trends, emerging growth, and new customer needs Remmele regularly consults a variety of industry forecasting reports and newsletters such as *The Economy and You, AMT Market Intelligence, NTMA Forecast Reports, Economic Planning Associates, Aviation Forecasting*, and many others that provide both industry-specific and broad economic predictions.
- Remmele also conducts a very candid and comprehensive employee satisfaction survey each year in order to monitor changing attitudes and other trends internally. One very indicative metric can be seen in the safety record: the fact that zero minutes were lost to safety problems over the last three years at one plant says something strong about employee attitude as well as safety training, process design, and plant layout.

Improving indicators for earlier warnings
- The focused-factory cells at Plant 30 typically make sizable commitments for multiple years to individual customers and build dedicated production cells to satisfy those commitments. Contracts that run their course and don't result in renewal or next-generation succession can remove a sizable amount of monthly revenue and surplus an equally sizable amount of valued human resources. Accurately predicting a non-renewal or termination situation well in advance of the situation is of major import to Remmele. Recently one such

occurrence caught the company unprepared when the existing indicators went unheeded. The effectiveness-review process then resulted in a new priority being put on the measurement and presentation procedures.

Monitoring other industries and markets that may pre-sage important trends

- Remmele's informal following of trends in other industries and formal research into trends in potential markets has led them to expect significantly more outsourcing, significantly more design responsibility, and a demand for sophisticated inter-enterprise electronic interaction. These insights are influencing the internal debates and have already focused a major strategic planning effort on the information technology area, which has a direct impact on change proficiency through its affect on the speed and breadth of information transfer.

Diagnosing and fixing metrics that fail to predict as expected

- Leading indicators that can effectively predict coming changes before they are commonly accepted can be hard to find and unreliable in their initial design. There is a rich history and body of generally available methodology for analyzing and predicting corporate financial performance and industry and economic trends, but the interest here is in change proficiency—a subject with little history and methodology to draw from. As served markets become more volatile, and customers more demanding of faster responses, competitive positioning will rely on more competency at change proficiency. Taking or maintaining a leadership position here relies on an ability to monitor and predict the progress of served markets as well as the progress of competitors. Metrics that work for one rate of market volatility are not likely to work as well when the rate of change increases or general change proficiency in the industry increases—with time, leading indicators must be re-calibrated or replaced. Recognizing when this is required is the first requirement. Remmele is a front runner in an industry that is not yet competing as a matter of course on change proficiency—and as a result has not yet been faced with industry pressure to seek new indicators. It has, however, developed a respect for indicators that can predict market downturns as a result of past downturns in both aerospace and computer machined-parts—which they feel they could have foreseen with the proper indicators in place. These lessons have resulted in periodic and formal economic and industry-sector analyses.

Overreacting, reacting too soon, and reacting to transient oscillations or "noisy" indicators

- Generally when new operating practices are introduced to solve problems in older approaches, new failure modes are discovered. As companies develop change-demanding indicators and abilities to change faster, they will run the risk of responding to false signals. No specific countermeasures were found at Remmele that relate to these issues, but the cultural forces that require thoughtful knowledge before making decisions are unlikely to be satisfied with simple trigger conditions.

Monitoring more competitors, markets, industries, and technologies

- The 75+ members of Remmele's sales rep organization turn out to be a major asset when information about market and technology trends are needed. Corporate marketing is able to mobilize and coordinate this knowledge resource when specific information or suspicions need to be confirmed and benefits from the wide diversity of markets and industries served by the individuals in the organization—who all service other principals in addition to Remmele. Independently, this organization is also a source of unsolicited information about changes and trends, attuned as they are to Remmele's thirst for knowledge and ability to act.

Change Proficiency Maturity—Leading Indicator Metrics
Managed Stage (3) for Both Proactive and Reactive Change Proficiency

Rules & Responsibilities Knowledge Base: The periodic "measurement," presentation, review for effectiveness, and evolution of the indicators for customer satisfaction, economic and served-market outlooks, competitive analysis, technology developments, and employee satisfaction have specific process owners and procedures. Process owners for measurement, presentation, and evolution are specific individuals on the corporate management team; while the team takes collective responsibility for effectiveness reviews and initiating the development of new indicators. Though the current Remmele indicator metric practice is judged fairly mature within its industry now, it is important to understand that change proficiency and related indicator metrics in this industry and most of the markets it serves are still at an early stage of competitive utilization, and it is likely that the change issues in this practice will graduate in sophistication or difficulty in the near future. In a social structure of high-school teenagers, a 17-year-old senior has unchallenged maturity.

Robustness Metric Focus: The cost and time involved in the development and evolution of its competitive analysis, market research, satisfaction surveys, and technology outlook are integrated into the operating expenses as activities with broad values beyond their application as pending-change indicators. The underlying ideology of continuous learning and knowledge development values the time involved in learning, and the application of experienced insightful resources to the technology-watch and market-research activities optimizes both the time and cost in reaching informed decisions. The respect and requirement for knowledgeable and open justification of decisions at Remmele has resulted in information-rich indicators that take the form of tables and reports as opposed to simple single-numeric indices. Informed risk is the operating principle at work here, and the "informed" part is what makes the practice robust.

Migration Competency—Proactively Aggressive: Market research into new markets is done on a regular and continuing basis, even when business is growing in currently served markets. Initial inquiries that look promising result in deeper analysis, often with the assistance of professional research firms. These deeper searches look specifically for trends and forces in industries that are creating new needs for difficult machining tasks not yet addressed adequately by an established service base. Simultaneously, and with cross-functional team coordination, technology outlook resources search for new equipment capabilities and process technology that can offer new advantages, sometimes driving the search for appropriate markets in turn. This constantly active, broad-based world-search is exposed to trends in other industries as a matter of directed course.	**Expansion Competency—Reactively Sure:** When the company must seriously adopt a new technology or investigate a new market, it mobilizes a broad-base of internal resources; employing the expertise of operators, machinists, managers, sales reps, and divisional marketing people wherever useful. Coordinated and targeted market and competitive research often utilize the extensive 75+ sales rep organization for reality input and confirmation of suspicions. The sales rep organization is a unique and powerful resource as they all represent other and differing principals—and are exposed to a wide variety of industries, markets, and technologies as a result.

[1] G. Hamel and C. K. Prahalad, *Competing for the Future* (Cambridge, MA: Harvard Business School Press, 1994), p. 68.
[2] Simons, *Harvard Business Review*.

6.2 Operating Metrics: Metrics that indicate and gauge change proficiency and its maturity and progress in both current and future competitive critical practices; recognizing and monitoring the development of this necessary class of core competencies. Agility issues are biased today by the immaturity of this practice in industry in general. They include the definition of metrics that measure innovation activity, capture the incidence of lost opportunities, and reflect change proficiency in critical operating activities—and the elevation of these dynamic metrics to the same importance as static operating metrics which measure output and its various traditional causal relationships.

The business practice is the collection of activities that define, gather, present, review (for effectiveness), and evolve the operating metrics. The framework for this practice consists of the annual divisional strategic plans and the corporate performance reporting and monitoring systems, as well as the perceptions and needs of employees (especially managers) and board members that will monitor these metrics and use them as operating and planning decision criteria.

Proactive Change Proficiency Issues	
Creation	• Identifying critical practices to monitor; defining competency-monitoring metrics
Augmentation	• Improving accuracy of meeting metric objectives
Migration	• Developing metrics targeted precisely at change proficiency
Modification	
Reactive Change Proficiency Issues	
Correction	• Eliminating or fixing metrics that distort or replace the attainment of the true objective
Variation	• Allowing different metrics at different plants
Expansion	• Expanding the user base
Reconfiguration	

Identifying critical practices to monitor; defining competency-monitoring metrics
- It is common today for manufacturers who are trying to reduce costs in order to become more competitive to monitor process times for such things as change-over, set-up times, and die-change and to set goals for improvement. In general, it is even more common for companies to focus on cycle-time reduction in what they consider to be their current critical competitive practices and to set specific improvement objectives, especially in product development and product realization. Our interest in this reference model is specifically focused on change proficiency and related critical business practices. Outside of standard production process operating variables neither Remmele nor the machining industry yet focus overtly on change proficiency as a critical competitive practice across the board. Nevertheless, Remmele has laid some valuable groundwork with its early ABC implementation for costing and its informal monitoring of training and knowledge development (to ensure they maintain enough), quotation times, time taken to re-employ surplused capacity, and on-time deliveries. Though these activities are considered critical and are the subject of management review and discussion, their measurement remains informal for fear that hard display and monitoring will distort the actual practice.
- When the metrics for on-time delivery performance indicated room for improvement many years ago, Remmele took the initiative and developed finite production scheduling capabilities. They continue to monitor on-time delivery for each plant.
- Quotation time is watched principally because the Remmele quotation process is a highly detailed and consequently time-consuming activity. Cognizance of this metric through informal monitoring has supported the development of semi-automatic quotation assistance tools. It takes about six weeks to make a Plant 30 firm–fixed-price quotation for a focused-factory project that will make a commitment for years. Generally they will begin researching process possibilities well in advance of the RFQ in order to develop a working knowledge base.
- Recently Remmele mounted a full-court press to find new business that could absorb personnel idled by an outsourcing contract that moved offshore. This division had grown principally in response to unsolicited opportunities and without the need for an aggressive business development capability. Though the experience resulted in five new contracts, the protracted time and uncertainty involved in the period of prospecting and negotiation for additional outsourcing contracts sensitized them to this process. An informal metric is now in place to gauge response time improvement when the next reaction event is required.
- ABC-like practice at Remmele is used both as an improvement yardstick and as a foundation for automating quotation assistance. In general, ABC practices are a strong and necessary enabler for change proficiency as

robustness requires predictable costs. At the same time, ABC-like measurements are the only direct way to actually measure the cost of change. "We don't have a full ABC implemented, but Peat Marwick estimates that we are about 75% there. Years ago when customers wanted to analyze the costs of their products, Remmele had to justify allocations of square feet, machine, lights, etc., and Remmele plants needed to know how to make real money so they could buy some more equipment." That's the motivation Remmele cites for their implementation of costing concepts years before ABC gave credence to the practice. The company has always kept the "value" on equipment that was established during the depreciation period, even after full depreciation has occurred. They allocate factory burden and SG&A costs according to machine hours and people hours. Standard rates are calculated for 80% of full plant capacity and updated annually. Machine hours are in the allocation scheme to eliminate artificial pressure to remove people and automate fully. If work disappears from the shop or plant capacity is underutilized, the rates are not changed; rates are based on "standard plant capacity" and not on actual plant usage. They strive to do as much "direct" costing as possible, for example:

- The Repetitive Batch Division charges costs of quality people directly. "We did more wrap-rate roll-ups until technology became a major factor. Pulling people out with burdened labor only really caused a problem."
- Job quotations from Plant 30 show direct costs for: engineers (including quality), engineering technicians, tooling, and square footage allocation for occupancy. All are direct charges and not buried in the allocated overhead rate.
- At the Automation Division: "We want 90% direct engineering charge-off and 80% direct technician charge-off from a 40-hour week. But we actually average a much higher work week in order to accomplish training."

Improving accuracy of meeting metric objectives

- As a general metric improvement policy, Remmele focuses on attainment accuracy. Thus, actuals vs. committed objectives are monitored for the usual operating metrics, with awards given for accuracy and generally not for doing better than the objective. This operating philosophy is not yet predominant in the change proficiency operating metric practice only because most are still in the informal stage.

Developing new metrics targeted precisely at change proficiency

- Successful quotation development, engineering change incorporation, process development and installation, production-rate doubling, single part quotation-delivery cycle, corporate-wide change of divisional performance-reporting system, and other such change proficiency issues will become critical with time. Remmele has just decided to try to monitor the amount of knowledge development conducted each year by the company, knowing that this change proficiency cornerstone practice feeds its competitive leadership ability to enter new markets and apply new technologies effectively.

Eliminating or fixing metrics that distort or replace the attainment of the true objective

- Management theorists have long told us that we generally won't get performance by simply setting objectives, but that we must measure and display the progress and attainment as well. However, that old warning "be careful what you wish for" is highly applicable when it comes to operating metrics and well regarded at Remmele. Just as counting strokes per day as a figure of merit for a stamping plant increases the stroke count without increasing the finished parts count, so will measuring the hours or dollars invested in training divert the focus away from valuable and high quality knowledge development. Remmele management understands this phenomenon and has chosen explicitly to exclude training and knowledge-development measurements from operating reports and management incentive programs—though they *have* started an off-book metric to insure that this critical knowledge-development practice isn't short changed in boom cycles.
- At a meeting with divisional controllers: "Accountants here just keep score; we don't run the place. That's different here, and we like it that way."

Allowing different metrics for different plants

- Change-proficient processing for repetitive batch operations have different key factors than those for production machining or even general machining divisions, not to mention custom automation development and fabrication. One division may be especially concerned about set-up times and short-lead-time orders, another with constant cost reduction and production rate changes, a third with team learning curves and quotation development time, while a fourth frets over some of the same as well as some others. All need the

ability to custom design and fit their operating metrics, and all benefit from seeing the achievements possible with different approaches. Though Remmele has some universal performance metrics in the financial arena, even there they understand that different markets and operating realities will have differing optimal performance levels.

Expanding the user base
- At this early informal stage of change proficiency operating metrics, the management team is responsible for definition, review, and evolution. When the competency and progress of change proficiency at Remmele requires explicit and broader involvement, the open-communication, dissemination, and buy-in practices and vehicles within the company will facilitate the introduction and utilization of metrics.

Change Proficiency Maturity—Operating Metrics **Repeatable/Defined Stage (1.5) for Both Proactive and Reactive Change Proficiency**
Examples Knowledge Base: Remmele abounds with common knowledge and widely known anecdotes about Herculean and successful response efforts when customers requested something difficult, out of the ordinary, or with very little notice—and they are borne out by customer testimonial. An equally rich and active verbal history describes the efforts and time involved in fixing business problems caused by unexpected market changes or downturns. And there are just as many stories in circulation about proactive innovations that changed a business profile or opened whole new markets quickly. The open information and family/team culture appears to be responsible for maintaining this active verbal history. **Metrics Knowledge Base:** Though not broadly based as yet, the employment of change proficiency operating metrics at Remmele is beginning to branch beyond a simple focus on time: investments (costs) are being monitored for knowledge development and renewal, and accuracy (robustness) is the principal score card for meeting objectives. The pioneering implementation of ABC-like costing at Remmele underscores the respect they hold for metrics that reflect reality and provide meaningful improvement direction. The disciplines developed in ABC cost-capture methodology, as well as the costs themselves, provide a foundation of knowledge for solid change proficiency metrics.
Time Metric Focus: Time is still the principle metric concern for many of the change events Remmele watches: replacing lost business, developing a quotation, responding to a customer production volume increase, delivering a short-notice order, obtaining sufficient new apprentice candidates, etc. **Cost Metric Focus:** Cost of making and supporting change has some attention already at Remmele, even beyond their ABC-like costing methodology. Knowledge development costs are one of the newer metrics being monitored, for instance. It is instructive to understand that these costs are not being monitored with an eye toward containment, but rather to ensure that these non-directed investments are not diverted or curtailed over prolonged boom times. Also, Remmele does not formally report or stress these numbers for fear of adversely influencing the responsible processes.

Creation Competency—Proactively Occasional: Remmele took leadership initiative in the development and implementation of ABC-like costing practices and finite scheduling technology. Both are major metric cornerstones for change proficiency, and both were highly proactive moves for any industry. Other areas are starting to get some attention as well: knowledge development is being monitored informally, and their next-generation information technology strategy is addressing the need to accommodate multiple platform types and a high rate of technological change. **Augmentation Competency—Proactively Competitive:** The general operating disciplines at Remmele are based on principles that embrace continuous learning, constant change, and "pride in quality." In general-use operating metrics this has translated into an improvement focus on predictable accuracy.	**Correction Competency—Reactively Safe:** Remmele is culturally attuned to question established knowledge and replace or update it when it is found lacking. When using the quotation estimation spreadsheet models, for instance, it is standard practice to test extreme process-variable cases to verify that both the model and the ABC is reasonable—and if not, the problem is immediately diagnosed and fixed. There is also an innate respect for the power that indirect performance metrics may have to replace the intended objectives, prompting metrics for important knowledge investment to be kept "off-book." **Variation Competency—Reactively Confident:** With four operating divisions all in the machining industry, Remmele accommodates differences in definition and achievement of operating metrics. This is in recognition that optimal performance is a function of the individual markets, customers, and work specialties that differentiate the divisions.

6.3 Valuation Metrics: Metrics appropriate for an annual report that indicate future potential for both robust viability in the face of adversity and leadership in the face of possibility. Agility issues are biased today by the immaturity of this practice in industry in general and include: Identifying and measuring applicable knowledge assets, innovation competencies, and change proficiencies relevant to the volatility of the business environment; simplifying the measurement and display mechanisms; conveying the efficacy of the metrics to users.

The business practice is the collection of activities that define, gather, present, review (for effectiveness), and evolve the valuation metrics. The framework for this practice consists of the perceptions and needs of board members, shareholders, customers, prospects, employees, and the investment community that will monitor these metrics and use them as planning and decision criteria.

Proactive Change Proficiency Issues	
Creation	• Defining effective metrics for corporate knowledge assets and innovation potential
Augmentation	• Strengthening the linkage between, and the appreciation for, valuation metrics and value
Migration	• Developing metrics that capture preparedness progress for future requirements
Modification	
Reactive Change Proficiency Issues	
Correction	• Eliminating or fixing metrics that distort or replace the attainment of the true objective
Variation	• Monitoring and reporting metrics for individual lines of business
Expansion	• Expanding the user base
Reconfiguration	

Defining effective metrics for corporate knowledge assets and innovation potential

- "Where a company is going is more important than where it is coming from."[1] This comment attributed to the president of Sony of America places the subject of valuation metrics in perspective. America's most successful business investor, Warren Buffett, known for picking companies for long-term performance as opposed to short-term potential, includes the following tenets in his selection criteria: no requirement for reengineering or turnaround-type change to be successful, initiative shown in strategy (not bound by industry institutional thinking), objectivity and candor in performance reporting (no puffery and frank discussion of mistakes and failures), priority placed on reasoned capital investment strategy, general consistency in performance history, franchise-type as opposed to commodity-type lines of business, and an understandable business potential.[2] These elements appear to be reasonably good indicators of knowledge assets and innovation competency, and they indicate the results of successful application, not just the measurement of a potential that may remain unemployed. In our estimation, Buffett would find the valuation metrics he looks for in Remmele's annual report and place a high valuation on them in the process.

- Though not always succinct or formally reported, Remmele's valuation metrics are the subject of constant discussion and common knowledge and provide the foundation employed in decision making. They cite the diversification in their lines of business, striving for insurance against specific market downturns. They invest in knowledge and skill development heavily and continuously. They see workforce commitment in good results, high morale, and low turnover. They respect capital investment as a decisive factor in their future success. They monitor advances in materials and fabrication technologies like composites and near-net shape processes that have the potential to alter their markets significantly. They cite regional and national apprenticeship competition scores and awards as measures of training program value. They monitor the percentage of business that any one customer or any one market contributes to the total, looking for low numbers. They know the percentage of business coming from unique-capability/under-served markets in relation to common-capability/over-capacity markets. They encourage and note innovative response to opportunities and adversity, and they take pride in a steady growth history and a low-to-no debt position.

Strengthening the linkage between, and the appreciation for, valuation metrics and value

- Q: "How do you feel when a disproportionate amount of the capital budget is allocated to another plant, like the high velocity machining program, for instance?" A: "We all know what's behind the investment in HVM and what we expect to gain from it. It has a good capability to generate cash that the rest of us can use later. I think that's the general attitude. It makes you think about the leverage you get on your own plans." Open communications, the sense of family/team, and a concerted effort to educate everybody on how to read and

analyze the financial performance and investment decisions of the company is responsible for this knowledgeable attitude.

Developing metrics that capture preparedness progress for future requirements
- "We are a capital-intensive and intelligence-intensive business." This recognition is reflected in Remmele's analysis and forward planning for recruitment and training, as well as in their focused attention on capital investment. Staffing requirements, especially in the highly skilled machinist categories, are projected five years forward for a variety of different potential operating scenarios. These requirements are factored with productivity trends and attrition rates and reflected into the present recruitment and apprenticeship program planning. Actual enrollment in the apprenticeship program is a good forward indicator of the company's growth potential.
- The value of gauging knowledge assets and ongoing knowledge development as an indicator of true corporate value is widely touted in business press and books these days, but firm and manageable metrics and measurement techniques have not been offered with the same assurances.[3, 4] Though Remmele has chosen explicitly to exclude training and knowledge development measurements from operating reports and management incentive programs, they *have* started to keep an off-book metric to monitor the ongoing investment.

Eliminating or fixing metrics that distort or replace the attainment of the true objective
- Remmele has purposely refused to overtly capture and report knowledge investment, and even the more easily captured training investment, because of their concern that the emphasis could cause managed numbers at the expense of quality training. They are starting to track the investment off-book, however, for new technology and market exploration to make sure that they continue to maintain this current asset.

Monitoring and reporting metrics for individual lines of business
- Valuation metrics for knowledge renewal and innovation competency are generally qualitative and anecdotal at this stage of general business understanding and need candid presentation in order to be useful. Averaging peaks and valleys of divisional performance into a corporate roll-up fails to capture the true state of the company and fails to recognize that different divisions may have different optimal operating points. The performance and assessment portion of Remmele's annual strategic plan is broken down into specific divisional detail and is presented and available to all employees. This same divisional candor is preserved in marketing literature as well as annual reports for shareholders.

Expanding the user base
- The management team and the board of directors are responsible for definition, review, and evolution of valuation metrics, with active user classes including board members, share holders, sales representatives, prospects, customers, and employees. When it becomes necessary to broaden the usage and understanding of valuation metrics among employees, the employee newsletters and frequent open communication meetings within the company provide an effective and proven mechanism. Additionally, the company is introducing specific financial training into the workforce through mechanisms similar to the exercises and techniques discussed in *Open-Book Management*. To expand appreciation among customer and prospect user classes, Remmele has only to exercise its demonstrated prowess for obtaining descriptive and complimentary reporting in trade publications. Remmele's shareholders are relatively small in number and appreciative of the valuation metrics employed by Remmele. Expansion in this class of user is gradual and facilitated through candid and personal contact with management and board members.

Change Proficiency Maturity—Valuation Metrics
Managed Stage (3) for Both Proactive and Reactive Change Proficiency

Rules & Responsibilities Knowledge Base: The management team and the board of directors are responsible for definition, review, and evolution of valuation metrics—with specific responsibilities for gathering and presenting formal data assigned along functional lines to finance, human resource, advanced manufacturing, marketing directors, and divisional general managers. The gathering and presentation of both formal and informal metrics follow established procedures and include the degree of business diversification, the investment in knowledge and skill development, workforce attitude and turnover, capital investment, advances in materials and fabrication technologies, apprenticeship competition scores, percentage of business devoted to single-point customers and markets, percentage of unique-capability business to common-capability business, innovative responses to opportunities and problems, growth and growth rate, continued ROA and ROE excellence, and debt position. Formal metrics appear in reports and strategic plans as numbers in some cases and observations in others. Informal metrics appear in the pool of common knowledge and management discussion and occasionally appear in observational comments of planning and reporting documents.

Robustness Metric Focus: Remmele exhibits a strong knowledge-based operating philosophy, expecting to take risks but requiring that they be well reasoned and calculated. To this end the valuation metrics it utilizes and displays are designed to provide solid decision-making and score-keeping information. The recent addition of knowledge-renewal investment monitoring is an example that shows appreciation for measuring this asset maintenance activity as a valuation indicator; but more importantly, the fact that it is explicitly kept off-book is a result of their focus on accuracy—and their concern that treating it in a more formal way would result in a "managed" soft number.

Migration Competency—Proactively Aggressive: A cornerstone of the Remmele approach to change proficiency is to minimize the potential of being surprised, to foresee and prepare for change requirements before they cause problems. The knowledge-based approach they take to planning is not limited to skills and competencies but applied to forecasting and preparedness with equal fervor. Growth potential in their business is dependent upon both capital investment and the availability of skilled machinists. As both capital and apprentices require time before they produce growth returns, they provide good preparedness metrics in the valuation pool.	**Expansion Competency—Reactively Sure:** Disseminating information, gaining commitment to a learning process, and achieving buy-in on corporate objectives are high competencies at Remmele rooted in the standard operating procedures and cultural environment. Recently Remmele began rolling out a widespread employee education program aimed at making everyone competent to read and understand financial statements and performance analysis. This effort is welcomed by the employees and accommodated by the plant schedules as necessary and valuable skill development.

[1] Hamel and Prahalad, p. 61.
[2] Hagstrom, Chapter 4.
[3] T. A. Stewart, "Your Company's Most Valuable Asset: Intellectual Capital," *Fortune*, October 3, 1994.
[4] T. A. Stewart, "Getting Real About Brainpower," *Fortune*, November 27, 1995.

References Cited in Section A—Background on analysis techniques employed in this project

[1] Dove, R. K., S. Benson, and S. Hartman. "A Structured Assessment System for Groups Analyzing Agility." *Fifth National Agility Conference Proceedings*. Bethlehem, PA: Agility Forum, 1996.

[2] Dove, R. K., S. Benson, and S. Hartman, et al. "Agile Practice Reference Base." *Agility Reports*. Bethlehem, PA: Agility Forum, 1995.

[3] Hartman, S. "Agility Trends and Attributes." *Fifth National Agility Conference Proceedings*. Bethlehem, PA: Agility Forum, 1996.

[4] Dove, R. K. "Business Practices Critical to Early Realization of Agile Enterprise." *Fifth National Agility Conference Proceedings*. Bethlehem, PA: Agility Forum, 1996.

[5] Dove, R. K. "Tools for Analyzing and Constructing Agile Capabilities." *Perspectives on Agility Series*. Bethlehem, PA: Agility Forum, 1996.

[6] Dove, R. K. *Twenty-Four Essays on Change Proficiency: The Dollars and Sense of Agility*. Paradigm Shift International, 1996.

[7] Software Process Capability Maturity Model, Software Engineering Institute, Carnegie-Mellon University (see http://www.sei.cmu.edu/ for documents).

Cited References in Section C

[1] Patterson, M. *Accelerating Innovation*. New York: Van Nostrand Reinhold, 1993.

[2] Collins, J., and J. Porras. *Built to Last.* New York: HarperBusiness, 1991.

[3] Nevens, T. M., et.al. "Commercializing Technology: What the Best Companies Do." *Harvard Business Review*, May–June 1990.

[4] Hammel, G., and C. K. Prahalad. *Competing for the Future.* Cambridge, MA: Harvard Business School Press, 1994.

[5] Simons, R. "Control in an Age of Empowerment." *Harvard Business Review*, March–April 1995.

[6] Drexler, K. E. *Engines of Creation.* Anchor Books, 1986.

[7] Stewart, T. A. "Getting Real About Brainpower." *Fortune*, November 27, 1995.

[8] D'Aveni, R. *Hypercompetition.* New York: Macmillan Publishing, 1994.

[9] Quinn, Anderson, and Finkelstein. "Managing Professional Intellect." *Harvard Business Review*, March–April 1996.

[10] Case, J. *Open-Book Management.* New York: HarperBusiness, 1995.

[11] Bernstein, P. L. "The New Religion of Risk Management." Harvard Business Review, March–April 1996.

[12] Hagstrom Jr., R. G. *The Warren Buffett Way.* New York: John Wiley & Sons, Inc.,1995.

[13] Slywotzky, A. *Value Migration*. Cambridge, MA: Harvard Business School Press, 1996.

[14] Stewart, T. A. "Your Company's Most Valuable Asset: Intellectual Capital." *Fortune*, October 3, 1994.

[15] Argyris, C. "Good Communication That Blocks Learning." *Harvard Business Review,* July–August 1994.

[16] McWilliams Inc., Brian. "Re-engineering the Small Factory." *Technology*, 1996, No. 1.

Other Relevant References

[1] Goldman, S., R. Nagel, and K. Preiss. *Agile Competitors and Virtual Organizations: Strategies for Enriching the Customer.* New York: Van Nostrand Reinhold, 1995.

[2] Sakai, K. *Bunsha: Company Division, What Good is a Stuffed Tiger.* Tokyo: Tayio Industries, 1985.

[3] K. Kevin. *Out of Control.* Addison-Wesley, 1994.

[4] Kaplan, R. S., and D. P. Norton. "Putting the Balanced Scorecard to Work." *Harvard Business Review*, 1993.

[5] Senge, P. *The Fifth Discipline.* New York: Doubleday, 1990.

[6] Deutschman, A. "The Managing Wisdom of High-Tech Superstars." *Fortune*, October 1994.

[7] Case, J. "The Open-Book Revolution." *Inc.*, June 1995.

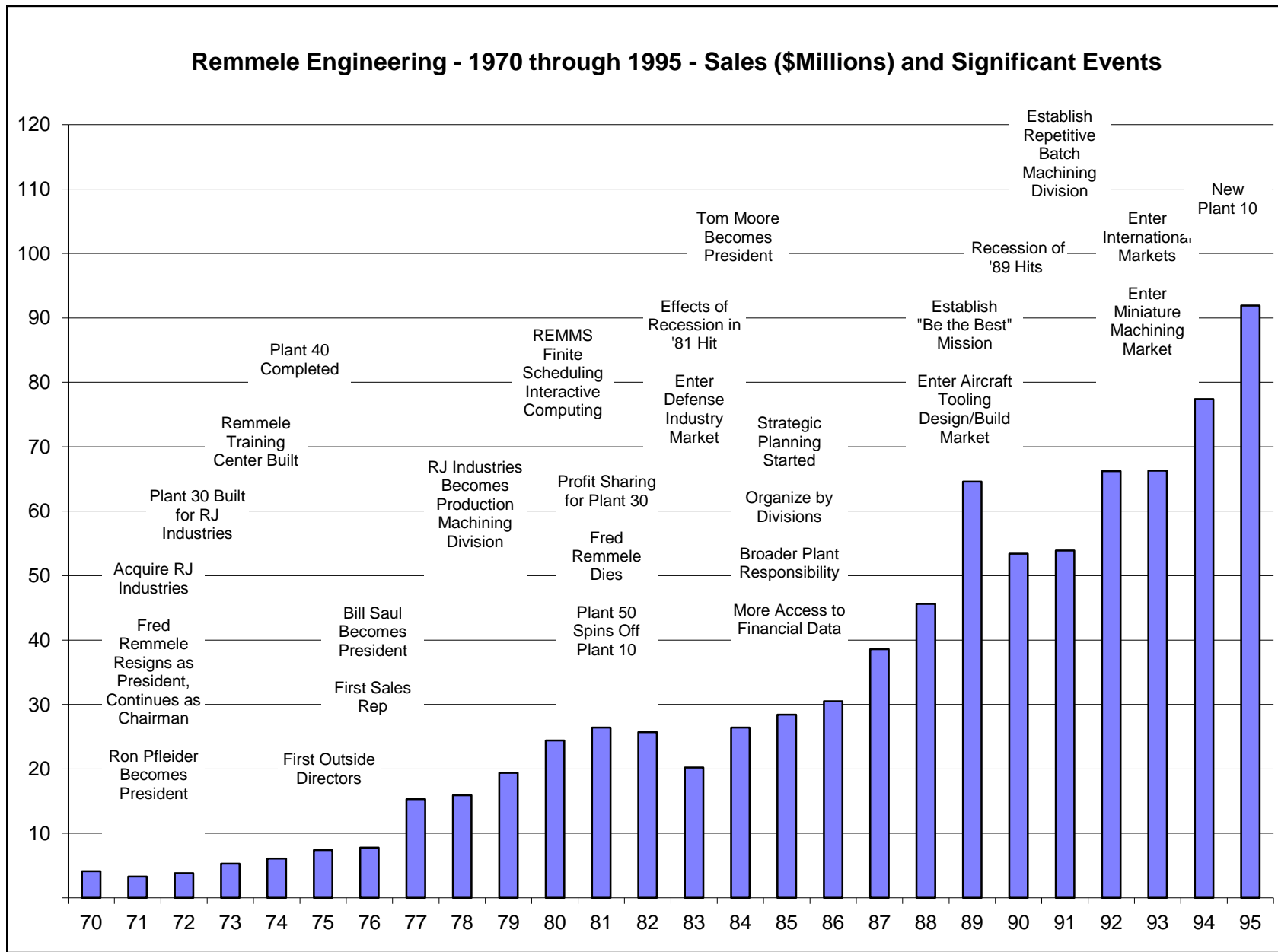[8] Goldstein, J. *The Unshackled Organization*. Productivity Press, 1994.

- Remmele contributed large amounts of personnel time, candid information, and permission to reprint the Appendix material on mission and strategy.
- Trademarks for Response Ability, Change Proficiency Maturity Model, and CPMM are held by Paradigm Shift International. The Maturity Model used as one of the tools for displaying the reference model was developed by PSI for analyzing and characterizing change proficiency competency.
- The Agility Forum sponsored this investigation and development of a first-ever enterprise-wide reference model on the enabling characteristic of an agile enterprise: change proficiency.

Appendix

     A.   Remmele Growth and Event Chart
     B.   Remmele Mission
     C.   Remmele Strategic Policies
     D.   Remmele Internal Business Analysis (Edited Selections)
     E.   Project Team Biographies

Remmele Engineering - 1970 through 1995 - Sales ($Millions) and Significant Events

Establish Repetitive Batch Machining Division

New Plant 10

Enter International Markets

Tom Moore Becomes President

Recession of '89 Hits

Enter Miniature Machining Market

Effects of Recession in '81 Hit

Establish "Be the Best" Mission

Plant 40 Completed

REMMS Finite Scheduling Interactive Computing

Enter Defense Industry Market

Enter Aircraft Tooling Design/Build Market

Remmele Training Center Built

RJ Industries Becomes Production Machining Division

Profit Sharing for Plant 30

Strategic Planning Started

Plant 30 Built for RJ Industries

Organize by Divisions

Acquire RJ Industries

Fred Remmele Dies

Broader Plant Responsibility

Fred Remmele Resigns as President, Continues as Chairman

Bill Saul Becomes President

Plant 50 Spins Off Plant 10

More Access to Financial Data

First Sales Rep

Ron Pfleider Becomes President

First Outside Directors

Axis values (y): 10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120

Years (x): 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95

Mission Statement

Our Goal

Our goal is to be the BEST company in our industry.

Who We Are

We are a company which specializes in high quality, difficult and complex work requiring innovative technologically advanced processes in the areas of: (1) contract fabricating, machining, and assembly; (2) designing and building of tooling; and (3) designing and building custom equipment for automating a variety of manufacturing processes.

Contract machining services are primarily directed toward high value-added machining of complex, close tolerance parts. These services encompass small lot non-repetitive machining, repetitive-batch machining, and high volume continuous-run machining. Customers for our services consist primarily of manufacturing industries throughout the world.

Why We Want To Be The Best

We want the satisfaction and pride of achievement associated with being important, highly skilled members of an organization that is constantly working toward being the BEST in its industry and, with our families to share the material rewards that this success brings.

When We Will Be The Best

To be the BEST in our industry, we will have a consistently growing number of loyal customers who recognize us as the leader in providing customer satisfaction. Our employees will demonstrate a high level of satisfaction with our company and their jobs. We will be recognized as a good corporate citizen by our employees and those people we impact in our communities, and our vendors will recognize us as an ethical and valuable customer. We will be at or among the top companies in our industry both in terms of sales and profitability, and we will maintain a record of consistent growth. As an aid in measuring our performance, we will compare ourselves annually to a select number of the top performing companies in our industry, and to the industry data available through our trade associations.

Strategic Policies

A. Guiding Principles

We at Remmele Engineering believe that conducting our business with the following principles in mind will ensure the accomplishment of our goals and provide job security for all.

Customer Satisfaction
- By aspiring to excellence in quality, delivery, and productivity, which will assure competitive prices.
- By committing to continuous improvement in every service or product we provide a customer.
- By treating everyone with courtesy, integrity, and friendliness.

Employee Satisfaction
- By making Remmele an economically secure and personally rewarding place to work.
- By providing an atmosphere of trust and open communication where people can continue to grow in knowledge, skill, responsibility, and compensation.
- By maintaining high standards of concern for the needs of the individual and the community.
- By involving everyone in our organization to ensure we accomplish our goals.
- By maintaining a clean, orderly, well lighted, and safe working environment.

Growth
- By attracting and further training outstanding people who are intelligent, honest, hard-working, skilled, and self-motivated to excel.
- By maintaining an innovative environment through challenging the status quo, embracing change, and encouraging informed risk taking.
- By regularly investing in the best tools, systems, and equipment available to be effective and competitive.
- By following a strong, well planned, effective marketing program.
- By formulating detailed, specific action plans to aid in accomplishing our goals.

Community Service
- By being a good corporate citizen, protecting our environment and supporting worthwhile community activities.

Profits
- Sufficient to accomplish these goals and provide a fair return to our stockholders.

Success in following these principles will result in an ever increasing number of satisfied customers, the retention and growth of our people, and increasing profitability to be shared with all employees.

B. Customer Satisfaction Policy

Meeting customer expectations results in customer satisfaction. Customer satisfaction goes far beyond the products we manufacture and encompasses the total business relationship between our customers and all our people and activities within our company. Leadership in the marketplace can only be sustained by constantly meeting or exceeding the expectations of our customers and anticipating their future needs through continuous improvement of our products and services.

Consistent with our Guiding Principles, we will accomplish this through teamwork and employee involvement; by regularly investing in the best equipment, tools and systems available; and by investing in the ongoing training and development of our people to enable each of us to perform in a manner that meets or exceeds the expectations of our customers.

C. Organization

1. To better serve our customers we will utilize small (200 people or less) focused plants to ensure good communication, maximize the involvement and commitment of our people, and ensure responsiveness.
2. 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.
3. Emphasize communication at all levels within the company so all our people will understand (1) what is going on in the business, (2) the issues the company is facing, and (3) how they can help.
4. During times when sufficient work is not available, we will implement a series of responses to try to cause additional business to happen while simultaneously reducing working hours to match the available workload. Recognizing that our people are our most valuable resource, we view layoffs as the last resort to be undertaken only during a sustained severe business downturn when the survival of the company may be at stake.

D. Management

1. We will continue to develop a supervisory team that successfully plans and leads in reaching objectives that benefit our company and all of those associated with it.
2. We will continue to encourage all members of the supervisory team through various forms of education, to increase their managerial skills, such as:
   a) Enhancement of our interpersonal skills so that:
      (1) Our communications are candid and open;
      (2) We develop the trust of our peers and subordinates;
      (3) We constructively manage conflict;
      (4) We are aware of our use of, and do not abuse, power;
      (5) We develop competence through delegation;
      (6) We accept and support the need for change.
   b) Improvement of our group process skills so that:
      (1) Our communications are candid and open;
      (2) We accept the ideas and communications of others;
      (3) We are supportive and cooperative;
      (4) Our focus is on team building;
      (5) We have more productive meetings;
      (6) We accept and support the need for change.
   c) Increase our verbal and written communication skills so that:
      (1) We eliminate "jargon" when talking with customers and others in the company;
      (2) Our written communications are clear and concise;
      (3) All of our communications reflect care and competence.
3. We will continue to encourage all members of the supervisory team to increase their technical skills through various forms of education; i.e., college courses, seminars, in-house training, etc. In addition, we must develop a structured program of continuous technical training for each managerial and technical field, i.e., design engineer, designer, project manager, plant manager, etc.
4. We will continue to manage with honesty, thoughtfulness, compassion, humility, courage, and enthusiasm. We will demand of ourselves, and encourage from those with whom we work, the highest standards of performance, emotional stability and maturity, consulting supervision and leadership.
5. Continuous improvement of quality and productivity are an integral part of our management philosophy.

E. Community and Industry

1. We will support worthwhile community projects by:
   a) Donating at least two percent of pre-tax profits to various charities and programs.
   b) Our Matching Gift program.
2. We will encourage our people to support community activities by:
   a) Recognizing the need for good citizens to run for public office and encouraging people to do so.

b) Having people serve on advisory boards to schools and foundations.
c) Encouraging people to take an active part in other community activities, such as church, civic, and youth groups.
3. Through our company communications system and, more importantly, through our actions, we will strive to be a good corporate citizen. Realizing that it is important to our long-range survival to be part of a vital, growing industry, we will:
   a) Support our trade associations, e.g., NTMA, AMT, NPMA, and local and national professional associations with the needs of our company, e.g., APICS, SME, TCPMA, through membership and active participation.
   b) Assist other companies in establishing machinist and machine operator training programs.
   c) Assist our industry in various other training programs for the overall improvement of management standards.
   d) Be a good competitor and follow ethical standards of business conduct.
4. We will protect the environment by acting in an environmentally responsible manner, conforming to environmental law, communicating this responsibility to the entire organization, and periodically auditing this conformance.

F. Market

As a supplier to many companies much larger than ourselves, we must avoid dependence on any single industry or customer to avoid excessive risk and maintain our independence. To accomplish this we will apply the following guidelines.

1. Attempt to limit our sales to 15% of our total sales volume to any single customer or major corporate division and to 30% of our total sales volume to any single industry.
2. Attempt to limit sales of each plant within the guidelines of allocating no more than 30% of the available hours to a single customer or division of a major corporation.

G. Resources

1. Minimize short- and long-term borrowing by ensuring that our ratio of debt to equity does not exceed 25%. This policy coincides with the independence and freedom of choice that come from being financially secure. "The lender cannot dictate business decisions to us."
2. To ensure that we keep our productive equipment up-to-date we will invest each year an amount at least equal to our depreciation in new equipment.

Organizational Structure and Characteristics

1. Products and Services – Our business consists of four basic business segments:
   a) General Machining Division (Plants 10 and 40): This Division serves customers that require precision machining services in the design and build of tooling; low quantity part and assembly manufacturing; or production parts and assemblies in the size range over a two-foot cube. The parts are generally complex and difficult to machine. They require close tolerances and encompass a broad range of part sizes up to 75 tons.
   b) Production Machining Division (Plant 30): This Division specializes in high quantity, continuous run production utilizing a focused-factory organization concept. Plant 30 is currently in the process of developing new capabilities to manufacture small parts (smaller than a one-inch cube) also in production quantities.
   c) Repetitive Batch Machining Division (Plant 20): This Division specializes in smaller quantities of parts up to a two-foot cube in size that are manufactured in repetitive lots. Our manufacturing focus in this plant is based on Flexible Manufacturing Systems.
   d) Automation Division (Plant 50): This Division designs and builds special machines and systems for automating nonstandard applications of assembly and testing, web handling, and metal removal and fabrication.

Contract Machining & Fabrication Plant Missions

Volume Part Size	Low Quantity	Repetitive Batch Production	Continuous Run Production
Up to 75-Tons, Up to 100-Feet	Plant 40	Plant 40	Plant 40
Up to Ten-Tons, Up to Ten-Feet, Over Two-Foot Cube	Plant 10	Plant 10	Plant 10
Two-Foot Cube to One-Inch Cube	Plant 10	Plant 20	Plant 30
One-Inch Cube and Below	Plant 30	Plant 30	Plant 30

2. Organization – Our organizational structure is built around highly autonomous business units which are focused on different market segments, and which have developed capabilities to meet the needs of each segment. These business units are linked with the following centralized functions:
   - Financial and general accounting activities are centralized to provide consistent performance monitoring.
   - Human resources activities are centralized to assure consistent and equitable administration of all human resource practices.
   - The leadership of our organization of independent sales representatives is consolidated company-wide to benefit from economies of scale, and to avoid conflicting activity and messages in the marketplace.
   - Information systems support is centralized to reduce duplication of effort at the plant level and to maintain system and database integration were necessary.
   - Our capital expenditures are coordinated and controlled on a centralized basis, although responsibility for their initiation and specification rests with the business units.

   Important requirements and characteristics of this organizational structure are as follows:
   a) Profit and loss accountability reside at each plant.
   b) Our plants have been focused on different market segments recognizing that these segments have different competitive patterns technical demands, and customer needs and, therefore, require different technical capabilities and management systems.
   c) Autonomy and decentralization in the areas of decision making that are critical to meeting customer needs, and achieving profit goals are important to our long-term success.
   d) By decentralizing key decision making at the plant level we become more responsive to customer needs and get more ownership of our business processes.

e) A minimal hierarchy with division management teams focusing on building capabilities at plant level and operating with minimum staff necessary to avoid duplication of expenses and utilize critical management skills.

f) A strong commitment to selecting outstanding people and to investing in their training and development to insure they have the skills necessary to function effectively and reach their full potential.

g) The effective use of teams, particularly at the plant level, for increased involvement of individuals in decision making and effective execution of projects.

h) The creative use of a collaborative process without a staff structure whereby people with similar types of responsibilities meet periodically to find innovative ways to link their business units together and share information, expertise and technology. Examples of this would be individuals in functions such as marketing, purchasing, manufacturing engineering, project management, etc.

i) A strong commitment to sharing resources between our plants.

Rick Dove

Rick Dove is Chairman and CEO of Paradigm Shift International, an enterprise research and guidance firm focused on agile operations and competitiveness. PSI provides analysis, guidance, and program development for corporations exploring Agility values and transformation strategies. Resources are leading experts practicing at the forefront of applied Agility in all enterprise areas.

Dove co-chaired the "21st Century Manufacturing Enterprise Strategy" project at Lehigh University that gave birth to the concept of enterprise Agility and is a leading investigator in the field. In 1994 he established the Agility Forum's research agenda as its Director of Strategic Analysis. He has pioneered the development of metrics, analysis, and benchmarking techniques for agile practices; he has led working groups on Agile Production, Agile Operations, and Agile Business Practices; he writes a monthly column on Agility for *Automotive Production Magazine*; he conducts executive seminars and corporate training sessions; and he is a frequent speaker and keynoter at international and corporate conferences.

Prior to 1991 Dove was a principal in a variety of corporate start-up and turnaround ventures. He has raised venture funding, led companies, and founded and fixed companies in the computer, office products, systems integration, software, and food processing industries. Since 1985 he has focused on enterprise competitiveness.

Dove has chaired the Technical Review Board and Computer Integrated Operations SIG of the National Center for Manufacturing Sciences. He has been active in the formative stages of the Intelligent Manufacturing Systems (IMS) initiative for international manufacturing research and has done business in China, Japan, and Europe.

Dove did graduate work as a Ph.D. candidate in Computer Science at the University of California in Berkeley and holds a BSEE from Carnegie-Mellon University. Publication list available on request.

Career Activities
1991-　　　　PARADIGM SHIFT INTERNATIONAL, Oakland, CA, Founder, Chairman/CEO.
1994–1995: AGILITY FORUM, Lehigh University, Director, Strategic Analysis.
1987–1991: FLEXIS CONTROLS (nee SAVOIR), Hayward, CA, President/CEO and Chairman.
1982–1987: THE MARKETING FORUM, Oakland, CA, Founder, President/CEO.
1977–1981: FRIDEN-ALCATEL, Hayward, CA, Director of Engineering, Director of Marketing, Vice President.
1975–1985: MONTCLAIR WINERY, Oakland, CA, Founder, President/CEO, and winemaker.
1971–1977: BALL COMPUTER PRODUCTS, Sunnyvale, CA, Vice President, Director of Marketing.
1969–1971: BERKELEY COMPUTER CORPORATION, Berkeley, CA, Systems Developer, Manager of Support.
1965–1969: CARNEGIE-MELLON UNIVERSITY, Pittsburgh, PA, Computer Science, Systems Developer.
1961–1965: WESTINGHOUSE RESEARCH LABS, Churchill Boro, PA, Computer Science, Systems Developer.

Selected Professional Activities
- Chairman, Agile Business Practices Focus Group, Agility Forum, 1995/96.
- Chairman, Program Committee, Agility Forum Annual Conference, Atlanta, GA, March 1995.
- Chairman/Organizer, Agile Maquiladora Conference, El Paso, TX, October 1994.
- Chairman, Strategic Analysis Working Group, Agility Forum, 1994/95.
- Chairman, Agile Operations/Production Focus Group, Agility Forum, 1992/93/94/95.
- Chairman, Plenary Session: People/Partnerships/Technology; member Exec Committee, IPC '94 Conference.
- Chairman, Agile Production Migration Strategies Session, IPC Conference, 4/94.
- Chairman/Organizer: Agility and How it Relates to Your Organization, Hewlett Packard Seminars, 1993.
- Chairman, Plenary Session: Intelligent Manufacturing; member Exec Committee, IPC '93 Conference.
- Chairman, DARPA MADE Agile Production Working Group, 1992/93.
- Chairman, Forum: Manufacturing Agenda in the '90s, SME Autofact Conference, November, 1992.
- Chairman, Systems Architecture Session, SME Autofact Conference, November, 1992.
- Chairman, Automation Engineering Session, International Programmable Control Conference, 4/92.
- Chairman, Plenary Session: Enabling Flexibility; member Executive Committee, IPC Conference, 4/92.
- Co-Principal Investigator, 21st Century Manufacturing Enterprise Strategy, Lehigh University, 1991.
- Co-Chairman, Agile Manufacturing Conference, Orlando, FL, December '91, Lehigh University.
- Chairman/Organizer, IMS International Session, SME Autofact Conference, Chicago, 11/91.
- Chairman, Technical Review Board, National Center for Manufacturing Sciences, 1990/91.
- Chairman, Computer Integrated Operations Strategic Initiative Group, NCMS, 1990/91.
- Chairman, IMS International Session, IPC Conference, co-sponsored by ESD and NCMS, 4/91.

Susan E. Hartman

Sue Hartman is a partner in Resultant Manufacturing Services, a technology-based consulting firm specializing in program management, business assessment, and the optimization of manufacturing and business processes. She has over 21 years of diversified leadership experience in research, product development, international business development, and manufacturing management.

Before joining RMS, Hartman held management positions in both new product development and manufacturing at Eastman Kodak Company. There she successfully dealt head-on with the types of challenges she now tackles for RMS clients. Her expertise in equipment manufacturing includes management of a total flow organization that incorporated the research, design, development, and manufacturing of $100 million of capital equipment. In driving market growth and earnings for both domestic and international markets, she developed and executed strategic plans as well as investment and asset management strategies. Among other accomplishments, she applied a new product development process that shortened commercialization cycles and improved product launch effectiveness, at the same time she gained ISO 9002 certification.

Hartman is an active contributor to the emerging field of agile enterprise, and chairs the Agile Operations Industry Group for the Agility Forum. She has tested and refined a Structured Assessment System for Agility benchmarking and has organized and led group Agility assessments at AT&T, Honeywell Avionics, Gateway 2000, Mazak Corp., Remmele Engineering, and elsewhere; and was a project leader for the Agile Process and Equipment portion of the initial *Agile Practice Reference Base* developed at the Agility Forum.

Hartman's earlier Kodak experience also included more than nine years in the Eastman Kodak Laboratories conducting hands-on, fundamental research. She has published many technical articles and has been awarded numerous patents. Professional organizations she belongs to include the American Chemical Society, the American Society for Quality Control, and the Society of Manufacturing Engineers.

Hartman has a B.S. in Chemistry, Magna Cum Laude, from Juniata College in Huntingdon, Pennsylvania. She subsequently completed formal courses in International Business Operations, European Management Development Forum, Performance Management, Marketing Management, Workforce Diversity, Quality Leadership Process, Reengineering, JIT, MRPII, ISO9000, Malcolm Baldrige Quality Criteria, Principles of Finance/Accounting, Statistical Process Control, Fundamentals of Radiology, Management of Hazardous Waste, and Principles of Polymer Science.

Career Experience

1993–   RESULTANT MANUFACTURING SERVICES, Partner. Recent projects include business assessment and recommendations for an electro-optical equipment manufacturer that resulted in a $2.3 million cost savings; structuring and coordinating a $1.2 million development project for a medical digital archiving system; evaluating productivity and competitiveness of small- to medium-sized manufacturing firms for the New York Industrial Effectiveness Program with recommendations and improvement implementations.

1972–1993 EASTMAN KODAK COMPANY
         1992–1993 Manager, Film Manufacturing and Supply Chain.
         1990–1992 Manager, Equipment Development and Manufacturing.
         1988–1990 Director, Marketing Plans and Programs.
         1985–1988 Unit Director, Intensify Screen Manufacturing.
         1984–1985 Product Development Engineer, X-Ray Film Development.
         1981–1984 Senior Development Engineer, Solvent Coating.
         1972–1981 Research Chemist, Research Laboratories.

Patents and Publications on Request

Steve Benson

Steve Benson, as SRB Consulting, provides contract management and analysis services for corporate, departmental, and project-level enterprise information systems. He specializes in productive and aggressive interim management during corporate executive search and corporate start-up activities, and for strategic product development and enterprise infrastructure development periods. Equally accomplished in manufacturing and management information systems, he is respected for technical leadership, managerial capabilities, and a broad business perspective. He will recruit and build professional and managerial personnel, establish priorities and requirements, and establish and manage effective development and implementation procedures. He will also guide design and implementation efforts to competitive leadership positions, whether they are for new products or new enterprise infrastructure.

Benson is a leader in the developing knowledge of agile enterprise support infrastructures and in information architectures that are highly reconfigurable and extensible. He chairs the Agile Information Technology Industry Group for the Agility Forum, he has tested and refined a Structured Assessment System for Agility benchmarking of information systems, and has organized and led group Agility assessments at Chrysler, Collins Avionics, General Motors, Mazak Corp., Pratt & Whitney, Rover, Texas Instruments, and elsewhere. He was a project leader for the Agile Information and Control Systems portion of the initial *Agile Practice Reference Base* developed at the Agility Forum. Among other SRB relationships, Benson functions as the CIO for the Agility Forum, guiding the development of its internal support group and information infrastructure.

Benson led the technology development and then, as acting president, the asset sale of Thesis Inc., a venture-backed developer of manufacturing execution systems for the semiconductor industry. He spent 16 years at Digital Equipment Corporation managing and developing internal MIS and manufacturing systems and provided state-of-the-art shop floor systems with 120 professionals working worldwide. The architecture became an example of the principles for agile systems and was deployed in almost all of Digital's manufacturing plants.

Benson holds a B.S. in Mathematics from Boston University. Publication list upon request.

Career Experience

1995–   SRB Consulting, Interim management services.

1993–1995 THESIS, INC., Vice President Software Engineering and Acting President. Led the technology development and then, as acting president, the asset sale of Thesis Inc., a venture-backed developer of manufacturing execution systems for the semiconductor industry.

1992–   PARADIGM SHIFT INTERNATIONAL, Vice President. Responsible for guidance and applied research in the evaluation, audit, and design of enterprise information systems.

1976–1992 DIGITAL EQUIPMENT CORPORATION. Representative to national initiatives for CIM and Enterprise programs, the Computer Integrated Operations Steering Committee at the National Center for Manufacturing Sciences, the Next Generation Controller Technical Review Board, RPI's CIM Industry Committee, and the Agile Production Industry Group of the Agility Forum.

      1982–1992 Sr. Software Engineering Manager. Developed internal shop-floor systems with 120 employees working worldwide; deployed in almost all of Digital's manufacturing plants.

      1981–1982 Software Engineering and MIS Manager, Kaufbeuren, Germany. Managed the implementation of MRP, Shop-Floor, and Financial Systems for high-volume disc plant.

      1978–1981 Software Engineering and MIS Manager, Galway, Ireland. Responsible for MIS at Digital's flagship manufacturing plant, developed first VAX-based manufacturing system, and one of the first distributed data base systems.

      1976–1978 Consultant Software Engineer. Developed shop-floor download/upload networks.

1974–1976 CODON CORP., Principle Software Engineer. Developed warehousing/distribution systems.

1973–1974 TRANSACTION TECHNOLOGY, INC., Sr. Software Engineer. Developed International Funds Transfer System for major money center bank.