Preface

This paper was prepared in December, 1993 for the IPC '94 Conference to be held in April of 1994. We have preserved the stylistic requirements of the sponsoring organization, the Engineering Society of Detroit (ESD), with two exceptions. We use wider line spacing and footnotes rather than endnotes. These changes are made for the convenience of the reader.

An expanded report of this research, providing additional results and fuller discussions of the results presented here, will be available in 1994.

CORPORATE LEARNING FROM JAPAN: PARTNERING, PEOPLE, AND PROCESS TECHNOLOGY

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ABSTRACT

The Big Three today recognizes that the Japanese industry presents not simply a new competitor, but a substantially different model of competition. Japan's management of technology, particularly the "soft" technologies like QFD, SPC, and *jidoka,* has been both a key source of Japanese advantage and a serious challenge to our learning and transfer skills.

We examine the learning processes the U.S. automakers pursued and the lessons they learned in acquiring these technologies from their partnering relationships and cooperative projects with Japanese manufacturers. We develop a model of corporate learning that reflects these experiences, highlighting the successive stages of corporate learning, including the diffusion of what they learned throughout their own operations and its transfer to suppliers. Based upon interviews with participants in this adoption process from both the Japanese and American sides, we identify critical barriers to learning, discuss how learning varied over both stages of learning and four generic types of technology, and detail our results' implications for effective learning and appropriate personnel selection for such efforts.

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INTRODUCTION

OVERVIEW. Each of the Big Three has developed relationships with one or more Japanese automakers, providing them and their Japanese allies opportunities to learn from each other. Anecdotes about these learning relationships abound, and there is a pervasive "conventional wisdom" about the successes and failures of each effort. However, no outside analysts have examined these relationships and developed systematic information on the learning and technology transfer they fostered. The research reported here is a preliminary step in that direction. These results should aid American industry as it continues to adopt and adapt Japanese technology.[2]

We address five major issues. First, we explore the background and development of these collaborative relationships, focusing on the U.S. automakers' recognition and analysis of Japanese advantages, and how these have shifted over time. This provides an important context for understanding why and how the Big Three pursued joint activities that supported their learning from the Japanese. Second, we examine this corporate learning process itself, analyzing its parameters and development over time. In particular, we examine variations across the stages of the corporate learning process and for different types of learning targets. Third, we identify the critical barriers to the industry's learning—those factors and circumstances that affect the amount and rate of learning. Fourth, we examine the learning process across four different types of technology. Fifth, we summarize the lessons learned by the participants in these corporate learning efforts, to suggest some of the key considerations supporting successful transfer of learning and technology between corporations.

METHOD. Our project focuses on the paired collaborative activities of the U.S. Big Three with three Japanese companies: Chrysler-Mitsubishi Motor Corporation (MMC), Ford-Mazda, and General Motors (GM)-Toyota at New United Motor Manufacturing, inc. (NUMMI). We interviewed 21 veterans of these ventures: three each at Chrysler, Mazda, and MMC; and four each at Ford, GM, and Toyota.[3] The Japanese interviews are an important aspect of our project,

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[2]Our research was funded by the Michigan Project on the Management of Japanese Technology (John C. Campbell, director), which is supported by the U.S. Air Force Office of Scientific Research. The interpretations of our results are our own, and should in no way be construed as representing the beliefs or views of any other party.

[3]Ms. Wendy Barhydt of OSAT assisted us in conducting a number of the interviews.

because they delineate the "source's" view of the learning and technology transfer process—what was missed, perhaps why it was missed, what sources of information were disregarded, etc. This information balances and fleshes out the "learner's" view, supplied by the American participants.

THE CONTEXT OF U.S.-JAPAN AUTOMOTIVE LEARNING RELATIONSHIPS

EARLY PERIOD. During the late 1960s and early 1970s, the U.S. industry recognized the emergence of Japan as an important player in the worldwide automotive industry, as Japan rapidly replaced Europe as the low-cost, high-quality source of small, entry-level vehicles. The U.S. industry held divergent views on the sources of early Japanese competitive advantages, ranging from inexpensive, compliant labor and more efficient production systems to government-industry cooperation and the low value of the yen.

These early views of Japan emphasized its potential as an attractive source for vehicles and parts. Each of the U.S. companies had a major early goal of sourcing specific products, essentially entry-level vehicles (subcompact passenger cars and small trucks). From the Japanese side, two companies sought broad financial and technical resources from the U.S. ally and access to the U.S. market. The third company sought support in testing the production climate in the United States, so that it might evaluate the feasibility of establishing its own production operation. All of the 10 U.S. and six Japanese interviewees we asked indicated that these initial goals of each party have indeed been met.[4] While responses varied from "fairly well" to "very satisfactory," there were no differences between the U.S. and Japanese participants, nor across the relational pairs.

LATER PERIOD. The Big Three soon came to view Japan as a direct competitive threat and a growing market as well. As the analysis of Japanese advantage shifted over time, U.S. interest in Japanese technology heightened, and each relationship developed and broadened to include an important goal of technical and organizational learning. The early U.S. interest in technology had targeted specific elements of manufacturing technology, ranging from methods for assuring product quality to techniques for changing stamping dies. Over time, this interest in technology has widened to include the total design and operation of manufacturing processes, and beyond

[4]Time pressures and differing response styles precluded asking each respondent each question. Consequently, we report the number of respondents asked a particular question as the base for that question, rather than the entire group of interviewees.

manufacturing, to product development systems and management of people and business processes in general. The U.S. interest in Japanese technology has thus enlarged from narrow production techniques through broader process issues to an overall manufacturing philosophy.

Have their Japanese partners been an important source of technical learning for the Big Three? All 21 of our respondents say they have been, with comments ranging from a simple "yes" to "absolutely." Seventeen report that this learning has primarily been in the area of production processes, while four suggest it has been balanced between process and product technology.

U.S. participants today view Japan as having lost its once formidable cost advantage, but maintaining shrinking advantages in product quality. Those quality advantages are seen as rooted in the Japanese industry's organizational effectiveness—or system discipline—that underpins many of its important achievements, from faster and more customer-attuned product development to more efficient vehicle assembly.

CORPORATE LEARNING

CHALLENGES. Corporate learning involves all the problems and challenges of individual learning, since individuals act as the agents of the corporation learning process. However, it also raises a series of issues and challenges of its own, including many we often consider characteristic of teaching. First, the corporation must set up a system to scan the environment and to process information, and the effectiveness of that system determines the practical value of any knowledge acquired. Corporate learning spans the acquisition and processing—storage, retrieval, and dissemination—of information and knowledge within the corporate entity. To say the "corporation" has learned means that the knowledge must be available within the corporation, disseminated appropriately, and retrievable to form a basis for action.

Second, effective corporate learning often results in changes in the behavior of numerous corporate members, often in different but complementary ways. Change is difficult, and it is particularly difficult in the large, complex organizations that dominate the vehicle manufacturing and major supplier levels of the automotive industry. If, as is often the case, individuals engage in denial to ward off information that requires change, corporations can raise the practice of denial to a fine art. Third, a critical element for corporations is defining the learning task—deciding what information is to be acquired, and how it might be useful. A final and extremely broad challenge to successful corporate learning is that corporations must select appropriate personnel to acquire the information,

and this often requires unusual individuals indeed. They must be sufficiently "outside" their own corporate culture to be relatively open to alternative methods and approaches, but enough "inside" to function effectively as teachers or change agents.

MODEL OF LEARNING STAGES. The first two critical stages in corporate learning are awareness and understanding. *Awareness* is the recognition that something should be learned and the definition of the learning target, whether a technique, technology, approach, procedure, or method. Corporate learning is a process that must be motivated by some expected individual and/or corporate benefit. *Understanding* means that the learning organization develops a comprehensive knowledge of the learning target. This includes a detailed grasp of the technology itself, but should also cover the circumstances, culture, and system that dictate and support it in the model organization, and a thorough identification of its effects—both intended and unintended, positive and negative—in the model organization. Successful completion of the understanding stage may entail cycling back to the awareness stage and re-specification of the learning target.

But corporate learning goes beyond the mere possession of knowledge, the typical definition of learning at the individual level. True organizational learning implies a correlated change in corporate behavior, often called innovation. Large and differentiated corporations, like the auto companies, frequently test out and refine innovations in pilot or demonstration sites. *Demonstration*, the third stage, is an initial limited, hesitant, and small scale replication of the target behavior in the learning organization. Such experiments provide the opportunity for adapting the innovation, and may require repeating the understanding stage to refine the pilot for wider use.

Corporations then implement the innovation throughout their organizations, a process often called internal diffusion or implementation. *Implementation*, the fourth stage, routinely requires significant and substantial internal change for large corporations, and that can be a daunting task. It may also spark repetition of the understanding stage and even the demonstration stage, as the variety of local circumstances requires further adaptation of the innovation.

Finally, a fifth stage is often necessary to ensure that the learning is adopted throughout the value-added chain. *Transfer* requires the learning organization to be a teaching organization, communicating and diffusing what it has learned to its supply base, beyond its own corporate walls. Problems at the transfer stage may again require cycling back through earlier stages to ensure appropriate adaptation, since the suppliers are likely to be quite different in their structure and tasks. So, too, the manufacturer may find it must use different techniques for motivating adoption and change at its suppliers than those that are appropriate and effective internally.

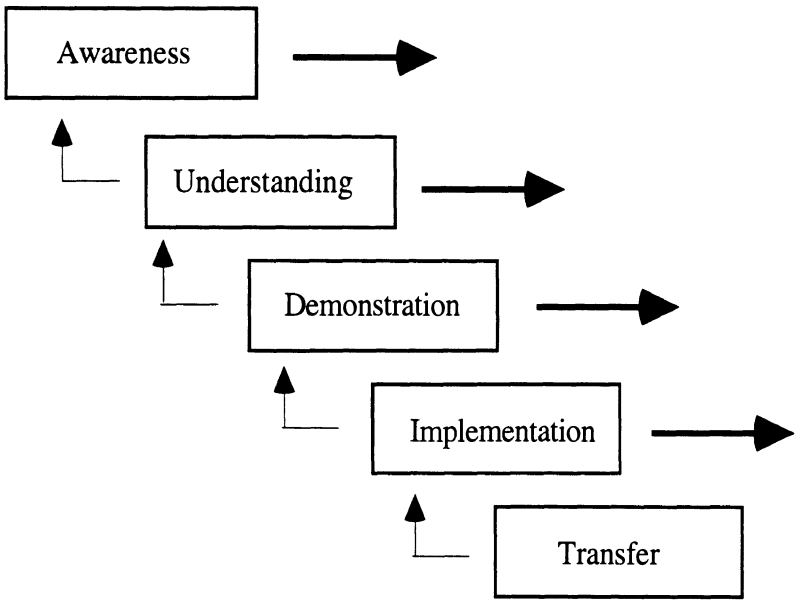

FIGURE 1 AUDIT MODEL OF LEARNING

Figure 1 displays this AUDIT model of the corporate learning process. We believe that the learning process in large U.S. organizations is inherently chaotic, partially reflecting the lack of concerted organizational attention to learning as a specific task.[5] Thus, although our AUDIT model describes corporate learning as a series of stages, we recognize that reality is often much less rational and systematic. Learning more often than not proceeds unevenly across the different functional areas and locations within the company, and companies trying to learn under intense competitive pressure often try to accelerate or even omit some of these stages. Our model's feedback arrows only begin to suggest how nonlinear the process is likely to be in reality.

BARRIERS TO LEARNING

We provided our 11 U.S. and 10 Japanese participants a list of 33 reported barriers to organizational learning and change, and asked them to identify the major barriers that hindered U.S. learning from Japan.[6] These barriers were organized into five major categories: Business

[5]See Robert E. Cole Strategies for Learning, Berkeley: University of California Press, 1989, Chapter 3, for an excellent discussion of how ambiguity and uncertainty influence corporate decisions. We suggest that these factors also help account for the low frequency of concerted corporate learning efforts.

[6]These barriers are largely drawn from a cooperative project between Ernst & Young and OSAT, The Car Company of the Future, conducted in 1991/92.

Systems (four barriers); Management Leadership (eight barriers); Learning Style (four barriers); Organizational Culture (10 barriers); and Strategy Communication/Implementation (seven barriers).

U.S. AND JAPANESE VIEWS. There is no evidence that the barriers to learning differ across these three paired relationships. However, there do appear to be some differences between the U.S. and Japanese participants' views of the major barriers to U.S. learning. First, U.S. interviewees identified more barriers, an average of nearly seven compared with a Japanese average of just over three. Second, comparing the distribution of reported barriers against a random response model suggests further differences between the two groups. Japanese respondents were somewhat more likely than expected to report Business System barriers (21 percent of their selections versus 12 percent of possible selections), and somewhat fewer Strategy Communication and Implementation barriers (nine percent versus 21 percent). On the other hand, U.S. participants were somewhat more likely than expected to report Learning Style barriers (21 percent versus 12 percent), but showed no marked under-reporting in any specific category. It is difficult to say whether these differences reflect differing information available to the learners and teachers, or some cultural influence affecting how events are perceived or reported.

Examination of individual barriers provides further confirmation of our overall finding that there is little difference across the three collaborative efforts, but some differences between Japanese and U.S. participants' reports of barriers. While space precludes discussion of all the barriers, table 1 displays the six barriers that received six or more mentions.

GENERAL BARRIERS. Ten U.S. respondents identified a learning style barrier—a narrow focus of learning efforts ("cherry-picking", "quick fix")—as a major barrier. It tied for second on the Japanese barrier list. However, it may rank higher in reality, because Japanese respondents frequently referred (in other parts of the interview) to the "superficial" efforts of the U.S. learners.

Interviewee comments referred to remembered pressure to accelerate the learning process, to identify the 20 percent of Japanese practices that would yield 90 percent of the effect, to focus on the essentials and speed it up, and similar demands. These respondents provided numerous examples of efforts to find short-cuts, to identify some drastically simpler way to achieve the same level of effectiveness as their Japanese partners had attained. The almost universal failure of these efforts created difficulties, lengthening the learning process, undercutting the perceived value of the learning effort, and undermining confidence in the organization's ability to learn. We suspect that

this tendency to look for short-cuts and quick fixes reflects the same impatience that drives the U.S. preference for corporate improvement activities that promise massive gains and quantum leaps in performance over the incremental improvement strategies popular in Japan.

TABLE 1 DISTRIBUTION OF REPORTED BARRIERS, BY REPORTER ROLE

Barriers	**Reporter Role**	
	Teacher (10)	**Learner (11)**
Learning Style		
Narrow focus of learning efforts ("cherry-picking", "quick fix")	3 (30%)	10 (91%)
Resistance to learning from the Japanese	1 (10%)	6 (55%)
Organizational Culture		
Language barriers	7 (70%)	2 (18%)
General company resistance to ideas or practices from outside (NIH)	2 (20%)	4 (36%)
Business Systems		
Change effort inconsistent with current reward structure	2 (20%)	4 (36%)
Management Leadership		
Inadequate leadership from top management	3 (30%)	3 (27%)

We did not ask directly how long various learning efforts should take, but some of the Japanese participants volunteered relevant comments. One described the company's experience with transferring its own production approach to two affiliated companies. These programs took five years in one case and 10 years in the other to reach a point of reasonably complete adoption in the learning companies, even though these efforts were more resource-rich and under greater control of the teaching company than was the case in its collaboration with the U.S. manufacturer. Two other respondents discussed specific efforts with U.S. partners that took three to four years to reach a satisfactory state of transfer, and described each as appropriate and reasonable in duration.

Six U.S. respondents and one Japanese participant also identified another learning style barrier: specific resistance to learning from the Japanese. This was variously attributed to lingering resentments rooted in World War II and to a smugness about the relative capabilities of the two industries. Both of these attitudes were described as problems in early days—and stages—of the relationships that are now largely eliminated.

Seven Japanese, but only two U.S. respondents identified language as a major barrier. The language burden has clearly fallen on the Japanese side in these cooperative relationships, reflecting the low U.S. levels of foreign language training. The Japanese respondents are well aware that this limits the participation of Japanese to those with English language skills, or career lines that justify the investment in developing English language proficiency. Moreover, they recognize that this can create translation difficulties and false perceptions of agreement and understanding based on misunderstood communication.

A Japanese respondent provided a nice illustration of the problem. A key tenet of modern Japanese automotive production is that production must cease when problems are encountered. Stopping the line to address quality problems prevents the production of bad product, while stopping it to resolve process problems often averts more costly interruptions later. Most U.S. discussions of this concept of *jidoka* treat it primarily as a technique that allows workers to stop the line when a problem develops, albeit in a climate where meeting production goals discourages line stops. Such a portrayal suggests that it is a mechanism to encourage worker involvement and commitment to improving quality, and even of worker empowerment and control. This view perhaps accounts for some of the resistance this practice has engendered in some U.S. automotive plants.

However, our respondent pointed out that the production system will not achieve maximal quality and productivity if workers *may* stop the line. Rather, the workers *must* stop the line if a problem occurs because it is the subsequent problem-solving activities that make the system work. Thus the key to *jidoka* is not conferring discretionary authority upon the workers, but rather imposing obligatory responsibility upon them. The respondent then apologized for being so hard on the U.S. partner, since the understanding of this distinction has escaped some of the interviewee's own colleagues, as well as some managers at other Japanese companies. Indeed, in a rare confluence of events, we had been told during a visit to a different Japanese company that, workers had the authority to stop the line but were not encouraged to do so! While there clearly is a conceptual barrier to understanding operative here, if one cannot overcome the language barrier, one cannot even engage in the conceptual debate.

Most of the U.S. participants dismissed language barriers as an issue, reporting no problems at all. We suspect that they were simply unaware of how much their lack of understanding Japanese contributed to the difficulties and duration of their learning, in at least some instances. Moreover, even if the translation burden falling on one side alone does not create communication problems, it does result in a major and highly visible imbalance in the costs of collaborative efforts. This can become not only a source of friction, but also a factor that discourages these joint efforts.

Another organizational culture barrier, the NIH syndrome, was identified by four U.S. and two Japanese respondents.[7] Five U.S. respondents also identified a major barrier not on our list—resistance to accepting the applicability of the Japanese company's practices to their own company. This was distinguished from the more familiar NIH primarily on the grounds that it was a case-by-case rejection based on specific reasons. As a Japanese respondent indicated "You can overestimate the cultural differences as well as underestimate them."

Four U.S. and two Japanese respondents identified a business system barrier, the inconsistency of the change effort with the current reward structures, as a major barrier to U.S learning. Their comments suggested that there are risks associated with change, and that the current reward structure reinforces the status quo and discourages change. Moreover, knowledge can be a source of U.S. corporate power, and thus individuals may restrict it until sharing confers advantage.

Three Japanese and three U.S. participants identified inadequate leadership from top management as a major barrier. These Japanese respondents felt that U.S. top management failed to be sufficiently active in the collaborative efforts, and gave unclear signals as to the corporate goals driving the efforts. The U.S. participants stressed that this was an occasional problem, typically evident in specific stages of projects, but that their own top management were effective leaders.

The picture of learning and change barriers that emerges is frankly less general and more specific than we had anticipated. Only two barriers were identified by a majority of either U.S. or Japanese respondents, and just one was identified by a majority of all respondents. Similarly, only six of the 33 barriers (18 percent) received no identifications at all.

BARRIERS ACROSS STAGES. We asked eight U.S. and six Japanese participants if these barriers differ over the various stages of learning in our AUDIT model. All the U.S. respondents said that they did. However, three suggested that barriers were more a problem in the early stages, while four suggested that they posed more problems later, and one felt that the specific barriers simply shifted across stages. Three Japanese respondents felt that the barriers were more severe in the earlier stages, while one thought them more severe in the later stages of the learning process.

[7]NIH (for Not Invented Here) is a phrase suggesting a mind closed to outside influences.

Some respondents clearly felt that certain barriers tend to disappear as the learning corporation moves through the stages—once overcome, they are eliminated. One interviewee suggested that resistance to learning from the Japanese was a particular barrier at the implementation stage, as learning transferred to the larger company, but largely moot at the transfer stage. Suppliers target resistance to the U.S. manufacturer, not to the Japanese, as the source of the demanded changes.

Those who reported more difficulty in the later stages of learning emphasized that corporate learning requires numerous cycles through the various stages. In particular, a number of respondents felt strongly that implementation and transfer are extremely likely to require reformulated understanding. Others felt that new and especially difficult barriers emerge as the learning corporation passes the demonstration stage and tries to implement and transfer what it has learned, thereby involving more and more people and new groups. Awareness and understanding may not require a commitment to change, but the change efforts of later learning stages raise more resistance. Finally, a number of respondents commented that management leadership can fade after the awareness stage, and may not be subsequently replaced by appropriate managers. Management can also become impatient with projects that take a long time, and increase the pressure on participants to hurry the process along and to search out the "minimax" solution—the "silver bullet" that requires the minimum effort to yield the maximum benefit.

BARRIERS ACROSS LEARNING TARGETS. Five of eight U.S. and five of seven Japanese participants indicated that the barriers did not differ depending on whether the learning target was technical or not, while the other five all thought the U.S. experienced fewer barriers in technical learning. These respondents felt that technical learning has two inherent advantages: first, it deals with concrete, visible objects; and second, it is blessed with a common technical language. Countering this argument, some participants noted that these "advantages" in fact make technical learning deceptively simple, and often result in comfortable miscommunication. Thus, understanding can be more apparent than real, and technology projects can meet major barriers in the implementation stage as a result. One Japanese respondent noted that technical learning is particularly subject to resistance based on NIH, since engineers prefer to develop their own technical solutions and are reluctant to "borrow" from others.

PROCESS TECHNOLOGIES AND LEARNING

Japanese managers more often consider manufacturing as an integrated system or process, while Americans more often focus on the subsystems that comprise the manufacturing process. Perhaps because of this, the technology challenge that Japan poses to the United States in the automotive industry, as in many industries, has been less in the product technologies, and more in the process technologies. It is also clear that many of the Japanese advantages in process technology over the past two decades have been rooted less in the specific hardware employed for production, and more in the supporting infrastructure, or software, surrounding that hardware.[8] Such differences in the American and Japanese approaches to technology shaped and influenced the ways that American manufacturers learned from their Japanese colleagues—from the initial identification of targets of learning, through the full understanding of the model behavior, the execution of demonstration projects, the implementation of change throughout the company, and the transfer of that learning to the supply base.

TYPES OF PROCESS TECHNOLOGY. We find it useful to consider process technologies as the routine performance of critical behavior—be it metal forming, shaping, machining, joining, or any of myriad other production activities. We distinguish four types of process technologies, based on two underlying dimensions.[9] The first dimension is the primary location of the performance of the critical routine behavior. If that performance is embedded in a machine, we label the technology "hard," while if it is vested in humans, we call it "soft." Hard technologies abound in automotive production, and include robots, stamping presses, lathes, and many more. Soft automotive technologies include many engineering routines, SPC, JIT, and *jidoka,* as well as others.

The second dimension of technology is the scope of its operational target. "Focused" technologies target relatively narrow and specific elements or operations in a process, while "linking" technologies, target the coordination or connection of sets of focused elements or operations.

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[8]David E. Cole and Michael S. Flynn, "The U.S. Automotive Industry: Technology and Competitiveness." Chapter in Is New Technology Enough?: Making and Remaking U.S. Basic Industries, Donald A. Hicks, ed. (Washington: The American Enterprise Institute, 1988), pp. 86-161.

[9]Michael S. Flynn, "JIT in the U.S. Automotive Supplier Industry." In Just-In-Time Produktion + Zulieferung Erfahrungsberichte. (Passau: Universitat Passau September, 1986): Band 2, 988-1012.

Crossing the two dimensions yields the four types of technology displayed in table 2. To be sure, typologies are crude conceptual devices rather than strict descriptions of reality, and many technologies are in reality mixed types.[10]

TABLE 2 PROCESS TECHNOLOGY TYPES AND EXAMPLES

		Operational Target	
		Focused	**Linking**
Performance Location	**Hard**	Robot	Transfer Line
	Soft	SPC	JIT

Many authors make the use of machinery essential to the definition of technology, excluding what we call soft technologies from consideration. We include soft technologies because we think that routinization of behavior is the critical definer of technology, rather than machine performance of that behavior. On a production line, both the robot and the assembler engage in routine critical performance, and it is the routine itself that makes both activities technologies. Conceptually separating them into technology and nontechnology categories influences when and how we consider them, and inappropriately narrows our view of the context that surrounds them.

TECHNOLOGIES AND THE LEARNING PROCESS. We asked our respondents whether the U.S. learning process differed across these four types of technologies. All eight U.S. respondents, and five of seven Japanese respondents said that the learning process did differ for these technology types, while one indicated it did not. The seventh Japanese respondent reported never being sure exactly what the U.S. learning process might be.

The respondents generally described an initial attraction to the hard technologies, followed by eventual recognition of the importance of the soft technologies. But this presented difficulties, because hard technologies can be fairly straightforwardly copied and implemented, while soft technologies, because they involve people, almost always require some adaptation to the learning organization's people and extant processes. Similarly, focused technologies are more readily

[10]SPC is an interesting case, since the monitoring and data collection activities that underpin the analysis are increasingly automated. If these activities are viewed as critical, then SPC may be shifting from more of a soft technology to more of a hard technology. Of course, if analysis and interpretation are viewed as more critical, then it remains largely a soft technology.

grasped and understood than linking technologies; they are typically simpler by their nature. Finally, the most difficult technologies to learn are the soft/linking ones, but these are the ones that yield the greatest payoff. They are difficult to understand and challenging to implement because they are complex and depend on an intricate web of supporting structures and activities.

We also specifically asked if the U.S. participants more readily recognized the value of some of these types of technologies. Consistent with their comments on the U.S. learning process, all four Japanese respondents said that U.S. participants more readily recognized the value of the hard technologies, at least in the initial phases of the relationships. Four of six U.S. participants agreed, while one thought that the U.S. companies quickly recognized the greater value of the soft technologies, and another felt that they readily recognized the value of all four types.

All eight U.S. and all five Japanese respondents said that some technologies were easier than others to learn. The consensus is that hard/focused technologies are most easily learned, hard/linking are somewhat easier than soft/focused, and that soft/linking technologies are the most difficult to learn. This result is displayed in figure 2.

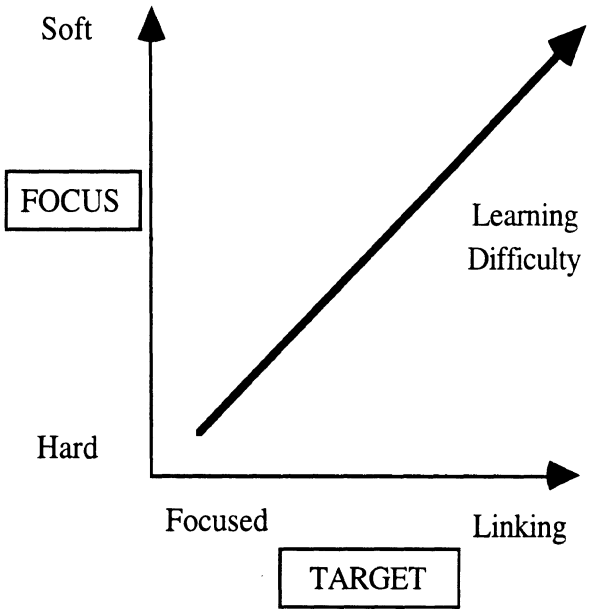

FIGURE 2 LEARNING DIFFICULTY AS A FUNCTION OF TECHNOLOGY TYPE

The respondents' comments suggest that hard technologies face fewer barriers than soft technologies across all learning stages, perhaps primarily because of their more restricted implications for change. Focused technologies face fewer barriers than linking ones across all stages. Not surprisingly, then, the soft/linking technologies face the most barriers across all stages. If the hard and focused technologies face fewer barriers, this is especially the case at the awareness and understanding stages and may reflect their greater familiarity and conceptual simplicity. The implementation stage for soft/linking technologies can also encounter massive barriers because of the extensive coordination they typically require.

LESSONS LEARNED

Our interviews closed with a series of questions that explored the respondents' views of how they would change the process if again facing a major task of corporate technology learning and transfer. These questions yielded a long and highly differentiated list of suggestions from both U.S. and Japanese participants. This is not surprising, since our respondents were thinking back on very different experiences at different points in time and from different functional perspectives. We have done our best to distill a few comments that struck us as thematic, reflecting views that seem to be shared among the participants, or insightful, reflecting views that seem to summarize the experiences of many of the participants.

CORPORATE LEARNING AND PERSONNEL. We first offer a few comments on the issue of personnel selection, a final and extremely broad challenge to successful corporate learning. Corporations must select appropriate personnel to acquire the information, and this often requires unusual individuals indeed. Our interviews yielded numerous comments on the necessary qualities of personnel assigned to major learning tasks, and our summary of these qualities then provides a framework for the organizational lessons as well.

We think of these people as engaged in a QUEST, since success requires them to question, understand, evaluate, shape, and transfer a wide range of information. First, they must be able to *question* the basic assumptions and approaches of their home corporation, to permit them to see the benefits and advantages of alternatives. This is much more difficult than it may seem, because we all come to accept the familiar as normal, comfortable, and best. Second, they must be able to *understand* the system of the teaching corporation, its broad supports and consequences. In essence, they must be able to perform a systems analysis of what they see in the teaching corporation, while mastering the details of the specific learning target.

Third, they must be able to carefully *evaluate* the critical and optional elements of the system they see, to reach an understanding sufficiently deep to guide the learning corporation's efforts to identify core elements without falling into the trap of "cherry-picking." Fourth, they must be able to *shape* those core elements to fit the learning corporation, which assumes a deep knowledge of their home corporation and the skills of an adapter, not a copyist. Fifth they must be able to *transfer* what they learn and develop to the learning corporation. Thus, not only must the learners be good students, but they also must be good teachers, since they will often be the first line of dissemination of the information they acquire. These roles may therefore have to be played by different people, and that suggests an ability to team as the final prerequisite for individuals who will act as leaders in corporate learning relationships.

LESSONS. The specific lessons learned reported to us by the respondents roughly fit within these categories. That is, the lessons about how to structure the corporate learning task address the tasks that the individuals who are assigned to learn must themselves accomplish.

Question

Recognize at the outset that learning will almost certainly take a major commitment of time, financial, and human resources, especially as the complexity and breadth of the targets expand. Do not enter a learning relationship without appropriate resources, because the return will be commensurate with the investment.

For major learning efforts, involve too many people rather than too few, involve them too early rather than too late, select them from too many functions and levels rather than too few, and permit too much time rather than too little to complete the task.

Ask "why?" more often and "what?" less often to ensure proper coverage of critical elements.

Understand

Strive for full understanding of the learning target in the teaching organization—especially its supporting system and context—before proceeding to the demonstration stage.

Recognize that full understanding of the practices of other industries will require investments in language training and proficiency to ensure accurate and full understanding of the model organization and to facilitate appropriate adaptation to the learning organization.

Evaluate

Forward planning across stages is critical; but learning stages are not linear, so keep the plan flexible to accommodate feedback and correction, as the corporation learns from its failures.

Pursue learning in an incremental, small-step fashion, both to permit evaluation of efforts and to permit identified successes that encourage and motivate learning.

Shape

Avoid either underestimating or overestimating the importance of the cultural and corporate context. Do not copy what you find, but expect techniques, approaches, processes, and methods to be adaptable to your own system.

Transfer

Structure rewards to encourage both individual learning efforts, and the transfer of that learning to other corporate targets.

Top management should involve itself in the learning activities and become teachers themselves; be slow, rather than fast, to turn new efforts loose.

Carefully select and staff a demonstration site that is commonplace, avoiding a "skunk works" or atypical site. Seek projects small enough to be manageable, but big enough to be viewed as serious by personnel at the next stage, the implementors.

A fundamental lesson is that learning relationships themselves must be nurtured and supported. Recognize that a learning relationship, like any other, must be balanced; both corporations must benefit from the relationship for it to continue.