

Decision making in high-tech firms: Perspectives of three executives

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Part science, part art, decision making is one of an executive's primary accountabilities. A firm's success or failure relies heavily on the quality of the decisions its top managers make. Judging from these conversations and interviews with senior execs in high-tech companies, the decision-making process is, on average, noticeably more egalitarian than in traditional, hierarchical companies. In manufacturing operations, technical specifications drive the process; in service firms, customer behavior does. But in the high-tech world, the process is based on a group-aided or participative management style, with a high toleration of employee error.

To decide is to make a choice among alternatives. In business, it is also a linking process between the basic decision functions of management—planning, organizing, staffing, directing, leading, and controlling—and organizational effectiveness. Consequently, the success or failure of a firm relies heavily on the quality of the decisions its leaders make on allocating resources and determining the future corporate direction. From an operational point of view, the quality of decision-making rests on the shoulders of the chief executive officers—the final planners and decision makers.

How do senior executives in high-tech companies think and make decisions? Do they differ from those in lower-tech firms? Do they base their decisions more heavily on the opinions of their boards of directors? Are there certain mindsets among them that can lead us to hypotheses and conclusions on high-tech decision making?

Von Glinow and Mohrman (1990) maintain that to distinguish a company as truly "high-tech," one should apply the following criteria to it:

1. The firm operates in an industry that employs highly skilled employees, many of whom are scientists, technologists, and engineers.
2. It has a significantly higher ratio of R&D expenditures to sales than traditional companies (typically about ten to one).
3. It is characterized by the fact that new technology makes existing technology obsolete very quickly. In fact, the dominant feature of technology is change.
4. It has a faster rate of growth due to the self-reinforcing feature of technology. The multiplex effect enables the emergence of a stream of new products and design processes.

To investigate decision making in high-tech companies, we conducted primary research among CEOs through informal conversations and a semi-structured interview process. Each of the executives was interviewed using the

same set of ten questions. Inspired by Frank Harrison's *The Managerial Decision-making Process* (1995), semi-structured interview questions were used for evaluating or measuring selected decision-making dimensions.

All three CEOs indicated that they are very rarely involved in the daily operations of their respective companies. Rather, they focus their efforts and abilities on strategic, long-range issues. *Not one executive agreed with a traditional definition of decision making as primarily being "problem-solving."* Instead, they all indicated that decision-making at their level was a matter of choice involving major organizational resources.

What follows are conversation transcripts from the interviews. The first was with Dr. Craig Barrett, CEO, Intel Corporation. The second was with Mr. Gary Tooker, former CEO and then Chairman of the Board of Directors at Motorola. The third interviewee was Mr. Jeffrey McKeever, Chairman and CEO of MicroAge, Inc.

Question 1: What do you think is the purpose of decision-making?

(Dimension to be measured: Perception of process, such as problem solving, choice, and so on)

Barrett: It's usually the transformation of information into some useful act. The purpose depends on how global you want to be. If we're talking really global, it's to "out-compete" the competition by moving faster, by making decisions faster, and by translating those decisions into action faster than the competition.

Interviewer: *In other words, you're trying to achieve a goal, trying to close a gap between what you have now and what you are trying to get to?*

Barrett: Yes, whether you are trying to do something substantially different. Or, if you are in a head-to-head competition with someone, just move faster in the marketplace than they do.

Tooker: That depends on the decision. In my view, decision making keeps the organization moving. Lack of it slows the organization down. Whether it be people decisions, allocation decisions, strategic decisions, or tactical decisions, I think the purpose is tied to the decision you're making. But if you want to say, "What is the purpose of decision-making?" I'd say it's to keep things moving.

Interviewer: *In summary, then, you believe that the purpose of decision making is to take actions that lead you towards your goals and objectives?*

Tooker: Absolutely, particularly in today's world when you're talking about the speed of decision-making. Sometimes product strategies have to be made in the hallways, as Jim Barksdale pointed out when he was with Netscape.

McKeever: I think that decision making is a very important and broad concept. In many ways it is a result of some need, which might be called cognitive dissonance, or some input that suggests that something has to be decided. One of the challenges, of course, in life is that many people come to you for a decision and the first thing you have to ask yourself is, is the decision necessary? The second concern is who should make the decision: Is this my decision,

"I think timing is really critical. You may conclude that the decision needs to be made, but if you make it prematurely you have less complete information."

or does this decision need to be made by someone else?—in which case you would direct the question to someone else. Maybe it should be directed to a middle manager or maybe it should be a board decision. Thirdly, this is a decision that maybe I'm the appropriate one to make, but will it require collaboration from others before I make it? Because decisions are usually made with a course of action in mind, a decision is of no value unless it leads to action. Generally when a course of action is required you are not the one that is going to do the action, so if you can incorporate the people who are implementers then the chances of actually getting the decision implemented increases dramatically. The fourth element is never make a decision before it needs to be made....Postpone it because you'll always have more information over time, or the need to make it may go away.

Interviewer: *So the purpose of decision making is to provide leadership to your organization, and one factor in leadership is making the decision at the right time.*

McKeever: I think timing is really critical. You may conclude that the decision needs to be made, but if you make it prematurely you have less complete information. Secondly, the decision changes the course of events afterwards.

Question 2: Do you have a method, system, etc. for determining the quality of the initial information that makes you aware of the potential need for a decision?

(Dimension to be measured: Initial information quality determination—"How do you know?")

Barrett: We don't grade the quality of the benchmarking that we do. It probably comes in with some sort of qualitative grade attached to it, but when you do market analysis or competitive benchmarking (benchmarking yourself against something else), you see the quality of the data. I guess we all ask, "Is this good data?" or judge it ourselves, but it doesn't come in with a letter grade associated with an A, B, C, or D—that type of qualitative rating.

Interviewer: So for most of it, you use modeling.

Barrett: Well, you either use modeling or gather information and data. We also compile industry analysts' feelings and comments and integrate all of this together to get some solid hunch or feel—that feel of which way the road is going.

Interviewer: Specifically, how do you determine the usefulness, accuracy, etc., of the information?

Barrett: I think you do that in a fairly structured way by being relatively careful to define exactly what decision you want to make up front. Then carefully analyze what information you think is necessary or appropriate to make that decision. You need to prioritize where you place your attention in terms of the significant data as opposed to the other mound of information that's potentially there.

Tooker: To me, there is no substitute for experience and judgment. By this I mean the following: Throughout my career I have never felt that I had all of the answers. So I have probably spent much more time asking questions. In our business at least, with the speed it moves, the technology that's involved, I think many people in a rush to make a decision do not have enough of the alternatives out in the open. So they may have two of the alternatives and say, "Okay, I'm going this way," but they didn't think through it enough when there were possibly three or four alternatives. One of the hidden ones might have been the best, and so the issue is making sure that either all or enough of the alternatives are out in the open to allow you to make the best decisions. Normally, it's called the scientific method.

Interviewer: In summary, your methodology appears to be to make sure that there is a good generation of alternatives to help ensure quality decisions.

Tooker: Correct.

McKeever: Absolutely. For one thing, when someone comes to you, you often have a bias about what they are talking about. If you have been in business for 20 to 30 years, chances are you've been there and done that. Their idea is generally not so new or innovative as they think. You have a strong prejudice about outcomes. That is a dangerous thing. One of the things you have to do very cognitively to be a good leader is not let your biases or your filters totally cloud the message someone's trying to deliver. The world is not static. The world is dynamic and

it may have different outcomes the second time around. Or the dynamics of the environment may be such that it might be a good idea this time around. I think one of the real dangers is you do in fact have a filter, you do in fact have biases, you do in fact have experiences. I think it easily clouds the issue. It is sad to see people become rigid and lose the ability to look at things in a new way.

Interviewer: They have some heuristics in mind, and are not flexible enough to change. Our biases and decision rules can be an aid to decision making, but we have to be aware of their existence.

McKeever: We all do. The difference between good decision making and bad decision making is not to let that cloud your judgment to hear or see it in a new way. Part of my philosophy is the following: Truth is a probability statement. We don't know truth; we think we know truth. At one time it was believed the earth was flat, but it turns out it was round. For instance, my doctor tells me to take certain vitamins. Then I read in *Time* magazine four years later that maybe that wasn't such a good idea. So I call my doctor, and he says, "Oh yeah, we're not prescribing it anymore." Obviously, truth for my doctor had changed. Unfortunately, there is no recall system in the medical profession.

Interviewer: I tell my students that probability is a state of mind, but now I can tell them that truth is a probability statement.

Question 3: What is the outline of the mechanics involved in your most commonly used decision-making processes?

(Dimension to be measured: The decision-making process most commonly used at this level of management, i.e., rational, Simmons, garbage can, group, participative management, and so on)

Barrett: If you were to walk around Intel, you would see in a lot of our conference rooms a simple model, a six-step model. It really looks fine in the global sense. There are three big steps, which break down into six questions. The three steps are: (1) you basically have a free discussion of what's going on; (2) you generate some form of clear decision out of that discussion; and (3) you get everybody to buy into it. Either you agree and commit, or you disagree and commit to support that decision, then you all charge after it until you decide maybe it was wrong. If it was wrong, you all agree to come back and revisit it. But below those three things—free discussion, clearly making decisions, and agreeing to commit even if you disagree with it—we ask everybody to ask themselves six questions: (1) What decision are you trying to make? (2) When does it have to be made? (3) Who will decide? (4) Who needs to be consulted before a decision is made? (5) After you make it, who needs to ratify it; in other

words, who could potentially veto it? (6) And lastly, who needs to be informed of the decision?

Interviewer: *Now is this at all levels of your organization?*

Barrett: This is essentially at all levels.

Interviewer: *Would you call that more of a group style of management or participative management, or what would you call this?*

Barrett: Well, this is a group- or peer-level type of decision-making process. As many companies do today, we try to drive the decision making down to the lowest possible level. One of the immediate difficulties you run into as you drive the decision-making process down into the corporation is: How do you grow a decision from adolescence into action? Unless you can answer these six questions that I threw at you, the likelihood of being successful is relatively small. What we do is preach this in the corporation, at all levels. We try to have people practice it so that they don't get frustrated when they think they've made a decision and only have it torpedoed or not hold, or have someone else come along and say, "No, you can't do that." If you have good answers to all of your six questions, then you have a pretty good chance to make and implement a good decision.

Tooker: As an engineer, I look to logic first and foremost, but at the same time I think there's a lot of intuition that goes into decision making. A lot of intuition is based on judgment and experience. Some people are more street smart and rely more on intuition. Others use a more rigorous academic analysis. I probably use a combination of logic and intuition based on experience.

McKeever: I have a lot of models. But ultimately any decision process is an art form. So I try to apply the various models to the circumstances. Also, intuition shouldn't be overlooked. I think some of the best executives are those that are able to call upon their intuition. They could make the decision without all the information and come up with the right direction.

Interviewer: *Your point is well taken, and is often neglected in our teaching of mathematical models.*

McKeever: When I was getting my MBA in the early '70s, there was a lot of literature about the decision-making process. Some of the examples came out of the military. The one that sticks in my mind most is Robert McNamara, who I had a chance to know personally. He's obviously a brilliant guy who made some bad decisions. You can see it in the F-111 aircraft. This is an example of an aircraft that was designed based on brilliant logic, but failed to be effective. The decision to be in the Vietnam war and how we ran the war was based on a very logical decision-making process made by McNamara and his boss President Johnson, but it was totally wrong. As an MBA student in the early '70s I was excited about a lot of new models

associated with the decision-making process. The longer I'm in business, the more I come to realize that it's good to have models, but there is no single right model. Judgment is still the critical ingredient.

Question 4: How do you determine who should be making certain decisions?

(Dimension to be measured: Dependence of decision-making level on type of and nature of decision)

Barrett: Our general feeling here is that we work in a knowledge-based industry, and knowledge is king. You have to have the knowledge to make the decisions. What we tend to do is try to throw it to the lowest level where the knowledge base exists. But again, making the technical decision is one aspect of the decision-making process. That's why we have this kind of six-step process that I mentioned to you before. You rely on your technical people to make their best technical decision and then you can superimpose some economic, business, customer, or strategic aspect on top of their technical knowledge to get the best possible decision.

Tooker: Historically at Motorola, the issue was to try to push the decision-making down. The people closest to the details were believed to be the ones who make the best decisions. Recently, more decisions have been top-down as leadership has provided more specific directions.

McKeever: One of my outside directors gave me what at first seemed like a good idea. So I mentioned it to a couple of my top people to see what they thought. When I mentioned it to my wife, she gave me what I call the "How will it look in the newspaper?" And she put a little spin on it like what I might do. And suddenly it didn't sound like such a good idea. In general, who should be making decisions is a function of the impact of the decision, but you should also bounce the ideas off people you trust. Often people unrelated to the decision can give you interesting insights.

Question 5: Which decisions (if any) do you delegate to others? Why?

(Dimensions to be measured: (1) Frequency of delegating decision-making authority to subordinates; (2) Indicator of level of "Ivory Tower" syndrome in decision-making process)

Barrett: As many as possible. The issue is that in our industry the bulk of decisions have a technical content and you tend to rely on your technical specialists to a very large extent to come in and try to pose issues and pose problems and decisions on the basis of technical merit. Then you can superimpose your business judgment. But you try to drive these decisions down to the folks who have the technical knowledge.

Interviewer: Do you attempt to minimize the impact of your position's authority in the decision-making process? If so, how?

Barrett: Of course we all try to do that. You always try to minimize the autocratic aspect of the process.

Interviewer: Do you have a method?

Barrett: Self-restraint. I delegate responsibility and authority to subordinates, refrain from trying to make a decision when I'm removed from the technical competency—all sorts of things like that.

Tooker: Some of that has to do with our structure. For example, in each of our major sectors, like the semiconductor business, the president of the semiconductor sector has total responsibility for that business. So we expect

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him to make the decisions for that business—obviously, within a framework of a budget or strategic plan, but the decisions for that business are his. When there are decisions that cross two or three sectors, or are corporate-wide, then we get consultation and the CEO decides. We may empower a subset of the management committee to work on an issue and come to us with their decision or recommendation.

McKeever: Remember that decisions have to be implemented. If you don't get people involved in the decision-making process, your chances of success are very, very small, especially if the decision is going to affect them. I'll put it two different ways. I may float a question out to a group and let them all talk about it. I will tend to steer them towards my solution in as subtle a way as I can. In the process, they have a chance to understand the issues and begin to get clarity about why a certain choice is going to be made. And then, of course, if you keep your mind open you may in fact decide that this predetermined decision wasn't the right one after all.

Interviewer: So you're more like a Captain Picard than a Captain Kirk.

McKeever: Exactly.

Question 6: How do you determine the quality of your decision-making process? During the process?

(Dimensions to be measured: (1) Process monitoring; (2) If participative, running the decision past others before finalizing it)

Barrett: We don't dwell on this on a daily basis. But while you're making decisions, you always try to answer: Is it statistically significant? Does it make any sense? Did you follow the decision-making profile or methodology we have? We tend not to dwell extensively on "witch-hunts" after the fact. Once again, we have this "disagree-and-commit" mentality that drives the system. Nobody benefits by showing that a decision was wrong because once you've made a decision, it's incumbent upon everyone to support it and make it successful. So we tend not to have people who are preoccupied with "I didn't agree with that and I'm going to gloat when they crash and burn."

Interviewer: What do you do before you finalize a decision?

Barrett: I think the usual process I go through is one of making sure that I've comprehended the significant data, that I don't have any major blind spots. If I have blind spots I would try to fill them in. You can't always fill them in. Occasionally you just have to recognize that it's more valuable to get the decision made than it is to collect more data. And recognizing that, you're taking a chance without all of the data, but it's more important to move forward than it is to sit there and gridlock.

Interviewer: Do you run these past the other managers at your level?

Barrett: As I mentioned to you before, there are two of us who work very closely together and we are in contact, if not face-to-face, through electronic mail. In the space of a few minutes you can throw anything by anyone else. What we also tend to do is partition our decision-making responsibility into various areas. One person worries more about operational, engineering, and manufacturing issues, and another person worries more about customer and product strategy issues and so forth. We tend to have our areas of specialty and we bounce things off of each other. But usually it's more important to get the decision made than it is to make sure that everybody is 100 percent in line with it. I think after five, ten, twenty years you get to know the people you're working with and can read them pretty well, even without having talked to them.

Tooker: Results achieved determine the quality of decisions. Feedback on results is factored into future decisions.

Interviewer: Regarding a subset of that question, do you do anything before you finalize a decision? Let's say you think you have made the right decision, but do you run it past your corporate planning director or somebody, or just run it past a few

selected people? Is there any personal thing you do before you finalize your decisions?

Tooker: We might seek input. At other times we may set the decision aside for a couple of days and then re-test our conclusions again before finalizing it.

McKeever: If you go back to my flying analogies, every time I fly an airplane I think about the decision-making process. What could I have done to improve the flight? Flight is an imperfect process, whether it's in an airline or in your own plane. There are a lot of things going on, and it's never quite perfect. Part of flying is the postmortem on what you could have done better. With business, I often Monday-morning quarterback my decisions. I try not to be obsessed, but on the other hand it's very insightful to go back and reexamine a decision. What I tend to do, which people who work with me figure out fairly quickly, is I'll tend to float a proposition as if I'm behind it and then somewhere in the course of the debate I'll change my position. It drives yes men crazy. We were doing this just last night. There's an acquisition we might do and I decided quite early on that I didn't want to do it but on the other hand I don't want my biases to get in the way. I was floating this decision to a half-dozen senior people. There was one point in the conversation when my CFO observed it is one thing to take both sides of a case, it is more complicated when you do it in the same sentence. We found ourselves saying, "Here is why we don't want to do it," then turning around and saying "Here is why we want to do it." If, as a participant in this type of decision, you try to play the game of pleasing, you find yourself looking foolish. Because you don't know where we're coming from, you'd better speak your own mind.

Interviewer: And that prevents you from making mistakes if your staff doesn't get involved with groupthink?

McKeever: I tend to reject the views of yes men. Yes men usually don't do well at MicroAge. We couldn't have gotten where we are with yes men.

Interviewer: Many times I've found that when people are trying to finalize a decision they look for confirming information. They don't take the time to look for nonconfirming information.

McKeever: When you have a hammer all you see is nails.

Interviewer: That's correct. Do you have any process in looking for nonconfirming information, or have a naysayer?

McKeever: I do have people I go to who I view as pretty good contrarians. One fellow is a consultant who was a board director in the early '80s, and at the time I didn't much care for him as a board director. After he left the board in 1988, I got a chance to hire him back as a consultant. Fulbright scholar, very bright guy, and is very much willing to speak his mind and present contrary opinions. I have a group of friends who I have been associated with over a decade and they are more than willing

to tell me when my idea stinks. They are people I know I can go to who will tend to present a contrary point of view. That's always useful.

Interviewer: When I was with Bunker Hill Mining and Smelting Company as their strategic planner and we would go down to Houston Gulf Resources, as they were our parent company, there was one person we never liked. He was the devil's advocate. Our chairman was always very nice and polite during the meetings when we presented our plan. But this one guy was always sticking the knife in and I never liked him either. But he really sharpened us up and we were really prepared well because we knew we would be subjected to that.

McKeever: You need people like that in an environment to improve the quality of your decision-making process.

Question 7: How do you evaluate the results of your decision-making process?

(Dimension to be measured: Results evaluation)

Barrett: Quarterly.

Interviewer: P&Ls, market share, that kind of thing?

Barrett: Another cultural aspect of our company is that we tend not to dwell so much on the successes; we tend to dwell on and learn from things that did not go well. Learning from things that did not go well usually involves, "Why did we do this, why did we do that, and why did we make

"I do have people I go to who I view as pretty good contrarians."

this decision?" So we don't end up making that mistake or misstep a second time. So we do postmortems and operating reviews on what went well and what didn't go well. This isn't always a terribly structured thing; we're pretty much real-time, and we are volatile. We actively practice approaches like "constructive confrontation," where we'll focus on attacking problems and not people. When you focus on attacking problems without attacking people, it's very easy to get to the heart of an issue: "Why did this go wrong? What did we do that we shouldn't have done here?"

Tooker: Review results and why they were achieved.

McKeever: You have to figure out if you won or lost. Like the lyrics of a country and western song, sometimes when you're winning, you're losing. You have to be careful when you're winning.

Interviewer: In terms of evaluation, do you formally go back to review your decisions, or have special meetings?

McKeever: We do postmortems frequently. For instance, we have a national convention each year. After the convention we'll go back and review the processes to determine what went right, what went wrong. With the board of directors we certainly will review prior decisions and what went right and wrong. I have a saying: Success is never certain and failure is never final. I've seen too many people who, once they make a decision, that's it. That's the only way to go. They have precluded a lot of chances to recover from bad decisions. Nimbleness is important. A related issue is the problem that occurs when an organization begins to believe its own public relations. Public relations is a lot like poison. It's OK as long as you don't swallow it.

Question 8: If the results of your decision-making process are different from what you expected, do you start the process over, change the process, ignore the difference, etc.? Why?

(Dimension to be measured: Control and feedback)

Barrett: I don't think I've found anything that is fundamentally wrong with our decision-making process. If you operate in the kind of realm we do, which is high-tech and fast-moving, not only does the technology move but the customer demands more, and the competition moves rapidly. We never expect that 100 percent of our decisions about products, marketplaces, etc., are going to be successful. We're very willing to accept a certain fallout from our decisions.

Tooker: The first thing you do is find out what went wrong. In some cases, if you did everything right or according to plan, and the competition did something unexpected, then your problem was not anticipating what the competition was going to do. You have to sharpen your benchmarking capabilities, look at why you were surprised, if that's the case. If you missed some of what you were counting on doing, then it's a matter of going back and correcting that. If you, in a worst case, made a certain decision, went down a certain path, and it was wrong, then you have to go back and look: Did you get all the alternatives out? Why did you draw the conclusion you did? And how do you avoid drawing the wrong conclusion so you don't make the same error next time?

McKeever: Life is an art form; you're constantly sifting through everything you've learned about life. Accept what works and reject what doesn't and constantly go back and decide if that would be appropriate for the next time around. I think it's dangerous to get too rigid.

Question 9: What in your opinion is the worst decision an executive can make?

(Dimension to be measured: Quality anchor for the low end of the decision-making behavior scale.)

Barrett: I think the worst decision you could make is assuming that you are a greater technical expert than some of your subordinates on a given topic.

Tooker: Probably not making a decision, because this stops everybody in the organization.

McKeever: I think the worst decision is to not make a decision. That goes back to the issue of timing. Don't make a decision before you need to. But don't abdicate the need to make a decision when it's time. When that moment passes, you can't go back.... Making decisions, even if they are not the best, is much better than not making a decision. One of my top guys and I were talking the other day and we decided after 20 years of decision making that what is more important than making the right decision is how we implement it.

Interviewer: *Perhaps the Pareto Rule is working here: 80 percent is the implementation and only 20 percent is the decision.*

McKeever: Implementation of a poor strategy is better than having a great strategy unimplemented.

Question 10: How would you summarize your decision-making process?

(Dimension to be measured: Verification and overview of the process.)

Barrett: Quite often it's loud, it's egalitarian, it's open, and it's decisive. What we tend to do is empower, push it down to the lowest possible level. Anybody who engages their brain before they engage their tongue is allowed to speak their mind. You can have people that are three, four, five, or six different levels in the corporation, in the same room, jousting with one another about the pros and cons of this or that. It's very clear that the role of management is to drive the decision to be made. Once a decision is made, it is a requirement that everybody be involved, buy in, or disagree, and commit. If you didn't agree with where we are, if the decision didn't go your way, that's tough. Disagree and commit or get out of the way. No backbiting, no second-guessing, no nothing. We make a decision, we charge ahead. If later on we collectively say, "Hey, this wasn't the way to go," then we'll revisit it posthaste.

Tooker: It's a matter of applying logic and experience. Some people, I suppose, are very rigorous in their decisions, using decision theory analysis. I think in some of the high-tech industries that would probably put you out of business based on the time it took. To me, there's no substitute for experience. And in our business, if we see we need a new set of experiences, then we go out and hire somebody that has those experiences. For example, as our product mix got more consumer-oriented, we actively made some changes. We have senior executive programs where we focus on a certain subject.

McKeever: Once again, if the purpose of the decision-making is implementation, it's a good idea to get the people involved who are going to implement. However, if you let the decision making be done by consensus, you end up with such poor decisions that it fails. IBM had that problem. There was an article in the *Wall Street Journal* about it. Whatever good ideas customers brought to them they would take it through a process. They had a great process, but by the time it got to a decision it was so watered down, so diluted, it meant nothing.

Conclusions and recommendations

In manufacturing companies, technical specifications often define how the decision-making process is to be directed. As people gain greater expertise in the process, they are granted more authority and responsibility. Consequently, decision making tends to be top-down in nature. In service firms, the focus is on understanding customer decision-making processes, which will vary with the type of service, the complexity of delivering it, and its cost. In the eyes of a customer, purchasing a suite at the Ritz is certainly different from purchasing a room at a Motel 8. Consequently, decision making is generally one of positioning the service in the mind of the customer. This

Don't be afraid to fail. It's probably better to fail at something new and innovative than be a success with something that has worked.

requires that managers understand customer involvement with the product and customer information-gathering methods and evaluation behavior.

But when it comes to high-tech firms, the executives we interviewed indicated that group decision-making is, on average, noticeably more egalitarian than in low-tech companies, for operational and strategic decisions alike. Determining who makes decisions is based on who has the knowledge and who has been empowered to make them. Managers frequently employ such methods as project management, group, or participative management in the process.

Tradition says that good managers should have more technical expertise than their subordinates. But in talking with

our CEOs it became very clear that this is a myth in technological organizations. Another perhaps surprising conclusion for some is that good managers in high-tech firms do not always know what is going on in their departments. Our executives voiced the opinion that the job of a manager is not to do the job but to define what has to be done. How to do it and how to make decisions about it are part of the decision-making process management delegates. This entails considerable individual empowerment.

However, as Dr. Barrett pointed out, a difficulty with employee empowerment not usually mentioned in management textbooks is that the employees can become very frustrated when they think they've made a correct decision only to have it negated or undermined by someone or something else in the firm. Without a system in place to prevent this common problem, they often withdraw from their decision-making responsibility, which nullifies the advantages of empowerment. High-tech executives discussed a corporate philosophy involving a higher "tolerance of errors" from employees than in hierarchical companies. Employees in more traditional firms have often been penalized in their careers for making poor decisions.

The executives we interviewed provided several recommendations for improving decision-making for other high-tech managers and doers.

1. It is important, perhaps surprisingly, to rely on intuition. Traditionally, managers are supposed to "know"; to say "I think" or "I feel" is considered a sign of managerial weakness or incompetence. But according to our CEOs, it takes a combination of knowledge, skills, experience, and intuition to be a good decision-maker.
2. In drawing on your intuitive powers, you should often say to yourself, "I base this decision on this kind of information," and then make it. Monitor what the impact of that decision is and ask yourself if it is what you thought it would be based on the information you had available.
3. Learn over time who provides good information. Find out which people tend to be too optimistic or pessimistic and which ones tend to be savvy business individuals. Evaluate the information and perceptions they bring to you.
4. Carefully learn how to formulate problems, and define exactly what decision you want to make. Then carefully analyze the information you think is necessary or appropriate to make that decision. Those trained in science and technology are generally better able to formulate problems to help themselves and others in solving the right problems.
5. Be more aware of the importance of timing. Don't wait for all the data before making a decision. If your experience tells you to go with the decision, and it seems

appropriate, then go with it. However, if you don't have a clear conception of the alternatives, keep gathering information.

6. Make sure every decision maker in the organization asks himself Intel's six questions: (1) What decision are you trying to make? (2) When does it have to be made? (3) Who will decide? (4) Who needs to be consulted first? (5) Who needs to ratify it (who could potentially veto it)? (6) Who needs to be informed of the decision made?
7. Don't be afraid to fail. It's probably better to fail at something new and innovative than be a success with something that has worked.

An interview with Bertrand Cambou, Corporate VP and Director of Section Technology SPS at Motorola, yielded the following advice:

You need to encourage failure in your organization, that it's OK to fail. However, every time you fail, you'd better analyze why and be sure you won't fail twice for the same thing. A learning organization is an organization that learns from its mistakes. As long as you have that learning process, failing is OK, because if you fail and understand why, and you put in place containment enough to be sure that you never fail again for the same reason, then down the road your organization will learn to make good decisions.

Research into intuition, the affective aspect of decision making, may prove beneficial for developing tools to use in selecting people who may have an advantage in the decision-making process. In other words, people who "feel" can consistently make faster and better decisions than people who need more time and information. In making faster and better decisions, one must recognize that decision making is both an art and a science. The art is based on experience, and the science is based on data. Experience builds hunches, intuition, and judgment, which expedites rapid decision-making and tells them "this is the right thing to do."

When choosing decision makers, it is important that they have (1) the related experience, (2) the ability to make quick decisions for competitive reasons, and (3) the ability to know what type of decision-making process is appropriate for a given situation. Role playing will bring out individual emotions and the urgency of making a decision so management can observe who is right for a particular position. Some personalities require a great deal of data to make decisions; some need the support and approval of their peers. In many firms, these people cannot make decisions when time is short, so they get nothing done. On the other hand, intuitive people make their

decisions based on the information they absorb from interacting with their environment. They have feelings and hunches about issues and often make the correct choices. In a fast-paced business environment, one must sometimes act quickly with limited information. This does not mean the correct decision will always be made.

Decision making is both an art and a science. The art is based on experience, and the science is based on data.

However, the concept of at least making a decision is better than no decision at all. More research into the emotional aspects of decision-making can create a higher level of awareness on this important ingredient in the process for technically trained individuals and others involved in managerial functions.

A subtle finding of this research suggests that the model that best describes how real managers actually make decisions is closer to the "garbage can model" of decision-making. In other words, although the executives we interviewed mostly strived to practice some form of rational decision making, the way they actually decided things was through a complex interaction with their subordinates, choice opportunities, problems, and solutions. Such a process can be political, and the quality of decisions depends on the systematic reaction to the combinations of streams of events. The notion of "optimizing" the rational model was played down. Executives admitted that they often have no more knowledge than their subordinates, and they use group processes to gain knowledge about the consequences of alternative choices.

Another significant yet largely ignored factor is timing. Our CEOs pointed out that timing is at least as important, if not more so, than the decision itself. For example, making a decision too early without enough information can be disastrous. On the other hand, making even the right decision too late can be just as bad; competitors can gain an advantage by making it first. Consequently, timing as an important element in the decision-making process is another neglected area ripe for research.

Finally, some salient advice from these executives is to minimize the impact of politics in decision making. They suggest trying not to express opinions prematurely, and to keep the discussion on alternative choices even if you

have a bias one way or the other. Another piece of advice is to play the role of devil's advocate. The point is that by sometimes advocating positions you don't personally believe in you can encourage individuals to participate and open up the dialogue. Try to solicit input from all your subordinates. Discuss a decision with affected individuals, then discuss it later with the group so you can get a sense of who might have to be drawn out and who has a particularly interesting or unique perspective. Someone who thinks he may have an unpopular or minority view may play politics and not give you the benefit of his thinking. Moreover, to minimize political influence in decision making, try to stay away from meetings, particularly when different functional areas and/or departments are having initial issue discussions. Having no position authority to sway project managers or other staff will encourage open and healthy discussion of decisions and issues. ○

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