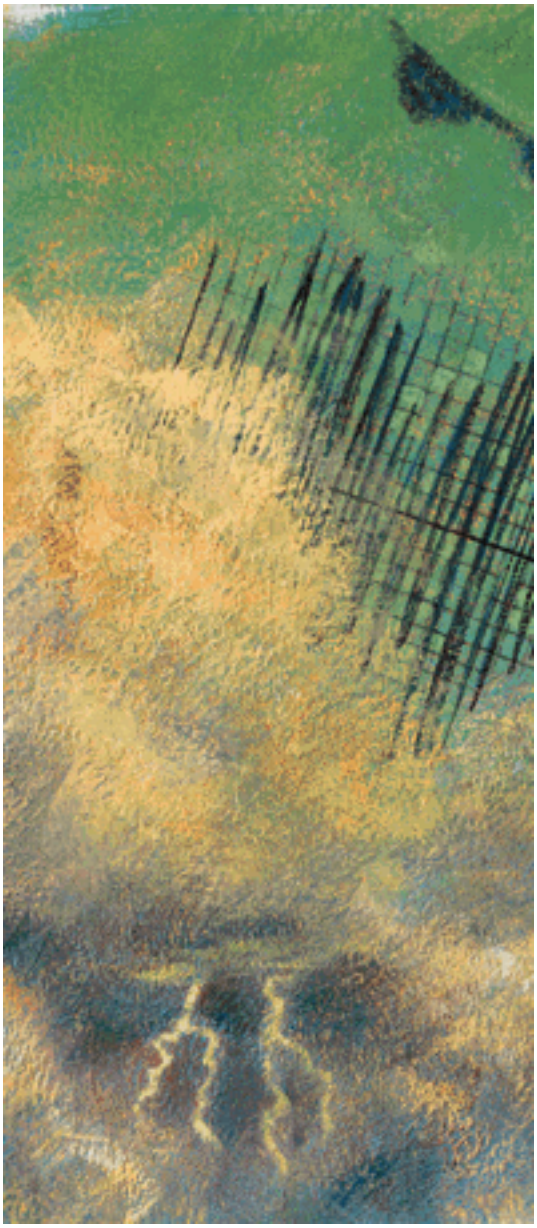
HANDLING THE COMPLEXITIES OF HIGH-TECH MANAGEMENT

Complex products, complicated technologies, rapid growth spurts, short product life cycles, and strategic inflection points create a unique set of challenges

BY MICHAEL McGRATH



Like the industry itself, the management of high-technology industry is fast-paced, complex, and highly risky. Success requires skills and abilities that are very different from those required in other industries, because high-technology businesses have some unique characteristics.

All high-technology businesses are based on a set of underlying technologies. These technologies are usually complicated, and they advance rapidly. They must be planned, developed, and replaced. High-technology executives have to understand these underlying technologies in order to make the appropriate judgments and decisions. This skill-set adds a challenge that executives of non-technology-sector companies do not need to manage.

The products themselves can be complex, as is the case with major software systems, supercomputers, digital wireless communications, and commercial airplanes, for example. Even small high-technology products can be complex; Merck's breakthrough drug for AIDS, Crixivan,® was constructed atom by atom. Not only are the products complex, the processes to manufacture them are as well. Manufacturing the Intel Pentium II processor chip with 7.5 million transistors at 0.35 microns (A human hair is approximately 100 microns) is an example. Sometimes high-technology products and services are so complex that very few people, and possibly nobody, in a company completely understand them. This has significant implications for management.

Technology-based products and services have very short life cycles because the underlying technology continuously evolves or is replaced by an alternative technology. Examples can be seen in all high-technology industries. Every 3-1/2 years, Intel replaces its entire microprocessor family with a new one that is several times more powerful. Microsoft expects that almost all of the products for its $14 billion in revenue will be obsolete within the next four years.

The primary challenge for high-technology businesses is not short *product* life

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cycles, but the short life cycle of entire *platforms* of products and sometimes the life cycle of the *markets* they serve. These latter two generally occur when the underlying technology evolves very rapidly or is replaced by a better technological approach. Sometimes referred to as strategic inflection points, these can occur every 5–10 years in high-technology businesses. While they occur in other industries (the Oil Shock in the mid-1970s and the Banking Crisis in the mid-1980s are examples), they occur much less frequently—possibly every 30 to 50 years.

Application software products provide an interesting example of strategic inflection points. In the 1970s complex application products for accounting and manufacturing were designed for mainframe computers, typically running in a batch mode. In the 1980s these were displaced by application software products based on lower-cost minicomputer systems, running primarily in an online mode. By the 1990s minicomputer-based application products were themselves replaced by software applications based on desktop computers, running primarily in a client-server mode. Now Web-based applications threaten these products. Very few application software businesses survived the transition at these inflection points.

When a high-technology business catches a new technology wave at the right time, it enjoys a period of rapid growth. While rapid growth is exciting, perhaps no other single characteristic has caused as many failures and near failures. On the surface, rapid growth appears to be a sign of success, yet, underneath, it creates a constant struggle to remain in control.

Complex products, complicated technologies, rapid growth spurts, short product life cycles, and regular strategic inflection points all come together to create a unique set of management challenges for high-technology businesses. Successful executives grasp the implications and manage their businesses accordingly. There are several

management characteristics that distinguish successful high-technology businesses from those in other industries.

1. Spend More Time Managing the Future

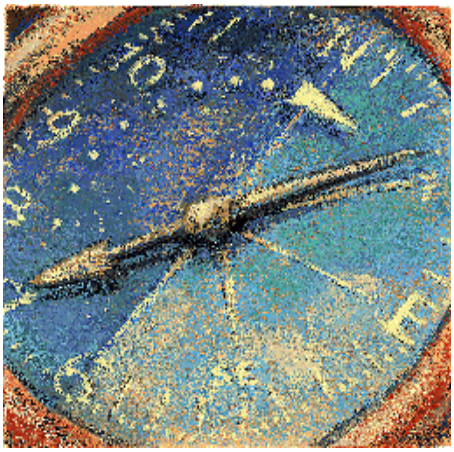
Short product life cycles require that emphasis be placed on having the right products at the right time. Successful executives know they need to "manage" their future or it will manage them. This means *proactively* understanding tomorrow's markets, foreseeing changing customer preferences, anticipating potential competitive offerings, interpreting the impact of emerging technologies, and defining the strategy for future products.

Since executives in technology-based industries spend much more time managing the future and less time managing short-term operations, business strategy is more important than financial planning. A high-technology business sets itself up for failure if it relies on a planning system that emphasizes budgeting and incremental change. This can potentially lull the company into a false sense of security that the future will be like the past. Successful businesses place their attention on management processes for business strategy, particularly product strategy, instead of budgeting processes. Some businesses have even turned product strategy into a unique competency.

High-technology businesses invest more in research and development than on anything else—typically 8%-10% of sales. Pharmaceutical companies, for example, invest approximately $400 million to develop a new drug. Intel typically works on developing its next two generations of microprocessors at any given time. Because of this significant investment in the future, it should not be surprising that the management team in a high-technology company spends a high proportion of its attention dealing with future products. In fact, the total investment by the high-technology business in managing the future often exceeds the cost of managing the present.

2. Anticipate Dramatic Change and Confront It Boldly

High-technology businesses are regularly confronted with changes so significant that current products are no longer competitive, and the company's very survival is challenged. These strategic inflection points occur when something, typically a new technology, reshapes an



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industry so completely that current product platforms, and all of the products from them, are no longer competitive. In many cases, customers begin to use a different type of product.

When a strategic inflection point occurs, it changes the entire basis of competition within an industry. A business that spent years developing competitive advantages and cultivating core competencies finds that these are no longer important.

Examples of failures at strategic inflection points are numerous among high-technology businesses. The microprocessor completely changed the computer industry as PCs replaced minicomputers and mainframes. In the short period of only four years (1991–1995), IBM's mainframe revenue "dropped off a cliff" from $12 billion to $4 billion. In another example, in the early 1980s word-processing application software packages for PCs, such as WordStar and WordPerfect, replaced word-processing equipment from Wang. Then, 10 years later, they were displaced themselves by integrated office application suites like Microsoft Office. In general, these businesses failed to see these strategic inflection points coming.

While there are many examples of failure at these inflection points, some executives thrive on this challenge. Bill Gates and Andy Grove are great examples. They anticipate the upcoming changes not only in time to react, but in time to use them to their competitive advantage. They have a management process—either formal or intuitive—to identify these upcoming changes. Microsoft has not only survived, but also prospered through several strategic inflection points in operating systems and applications software.

Even when they fail to anticipate a dramatic change, high-tech managers confront the need to change boldly instead of reacting defensively or explaining away impending changes as a fad. When Microsoft realized that it failed to anticipate the impact of the Internet, it reacted boldly by making massive investments in Internet products and building the Internet into everything it did. Intel recently reacted boldly by expanding into low-cost microprocessors when it underestimated the migration of PCs into that market segment.

3. Establish a Core Strategic Vision

A core strategic vision defines where a company is going, how it will get there, and why it will be successful. This vision is much

more important in high-technology businesses than it is in others. In many industries, the same strategic vision may be sustainable for decades. In fact, it may last through an entire generation or more of management. In these situations, a formal core strategic vision is not very important. Managers view things as static: "This is the way things are, and we expect them to stay the same," might be their motto.

This is not the case in high-technology businesses, where strategic vision may become obsolete in four or five years. Compaq successfully changed its core strategic vision, and its resulting strategic direction, twice in six years. Its spectacular financial performance reflects the result of these changes. On the other hand, some high-technology businesses neglected to change their core strategic vision when they needed to, managing their business like companies expecting the future would be like the past. Apple Computer, Digital Equipment, and Wang come to mind.

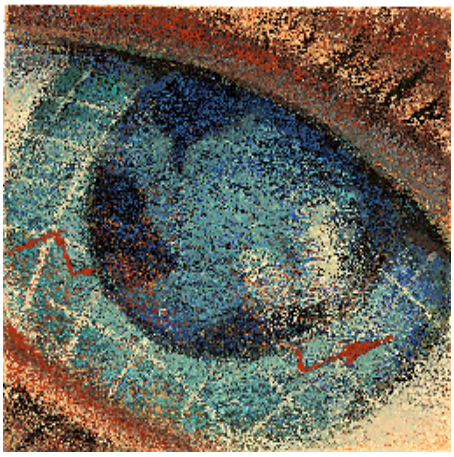
Not only does a core strategic vision change more often in high-technology businesses, it also plays a much more important role. The greater complexity of high-technology products and services dictates that more people are involved in making decisions that influence the future. Everything cannot be done by a small executive team who "knows the vision." The key to success is defining the best core strategic vision and communicating it clearly so that it is shared by everyone involved in making the business successful.

4. Manage Growth

High-technology companies are typically high-growth companies, but managing growth is a precarious balancing act. If a company grows too fast, it risks getting out of control. If it does not grow as fast as competitors or expectations, it risks becoming a loser.

Growing too fast is like running downhill; you cannot stop until you fall. When a business grows too fast, the resulting strain on management processes, organization, and systems can be tremendous. Successful managers of a $50 million business will not necessarily be successful in a $300 million business. Responsibilities change with company size, and the skills and experience needed to be successful can be very different.

Management capabilities must grow and develop as a company grows.



A core strategic vision is more important in high-technology business than in any other

This may not be a problem if a company doubles in size over seven or eight years, but how many managers can double their capabilities every two years? Rapidly growing companies quickly exceed the capacity of their managers. As a result, they often suffer from ineffective management in key positions, high turnover, and lack of continuity as they continually bring in new managers with inconsistent experiences and approaches.

Avid Technology provides an example. It created truly innovative systems for low-cost, high-quality video editing and production. As a result, the company grew from $32 million in 1991 to more than $400 million in 1995, almost doubling in size every year. The number of employees at Avid increased from 162 to 1,476 in four years. The pressure to continue growing rapidly was intense. Then the strain of growth got to Avid. Its growth spurt ended abruptly in 1996, and it lost $59 million.

Netscape provides yet another example of a rapidly growing business, more than tripling its number of employees, from 800 to 2,600, in less than two years during 1996 and 1997. How can companies like Avid and Netscape hire that many experienced people, keep reorganizing to manage the increased number of employees, and put the necessary management processes in place? Usually they cannot. Growth slowed for Netscape, and the company cut 400 employees in January 1998.

The obvious, but naive, answer to managing growth is to slow down. Once a company starts to grow at 40% or more per year, however, it is difficult for it to accept annual growth of only 10%. External pressure from investors, particularly in publicly held companies, can be intense. The stock market has already rewarded the company with a premium stock price based on a high P/E ratio which anticipates that rapid growth will continue. Slowing growth to maintain or regain control will usually cause the stock price to fall significantly. Investors and employees with stock options will react as though the company has failed or let them down. In some situations, if a business slows down, its competitors will get ahead, and it may never be able to catch up.

There is another risk that comes from not managing growth. A high-technology business may grow rapidly by quickly consuming all of its opportunities. It may not have anything in line to fuel the next growth curve. The result? It stalls. Ironically, investors cannot distinguish this type of slowdown from the previous

case, where a company is trying to control growth. So they penalize both. Making sure that there is a continuous stream of opportunities is an important part of managing growth in a high-growth business.

By definition, the success of high-technology businesses depends on how well they apply their underlying technologies

Successful high-growth company management understands the limits of its capabilities. It keeps expanding its capabilities, often stretching them to their limits, but it controls growth within the limits of these capabilities. Successful executives know their company cannot discover its limitations—as its processes and organization fail under the strain of growth—and then fix them. Instead, they put in place the organizational and process capabilities that they anticipate they will need and then grow into them. Most importantly, they make sure that they have identified a sufficient stream of opportunities to continue to fuel their growth.

5. Expand into New Markets

Opportunities to expand into new markets occur more frequently in high-technology businesses. As technologies evolve or new technologies are developed, they create numerous opportunities for new products in new markets. Successful high-technology businesses envision their future in terms of ever-changing markets and products. They know that in 10 years they will be very different than they are today. Intel originally made memory chips; today it makes microprocessors. Microsoft originally marketed software languages; today it markets everything.

A deliberate strategy is the key to expanding into new markets. Businesses that are good at taking advantage of new opportunities have both an explicit process and a culture for expanding into new markets. They are excellent at anticipating how customers can benefit from new products. They identify opportunities for leveraging their capabilities and continually invest in these as part of their product strategy process.

6. Foster Technical Competence

By definition, the success of high-technology businesses depends on how well they apply their underlying technologies. As technologies evolve, successful companies change the products and product platforms using these technologies. Technical expertise is critical. High-technology executives cannot provide the appropriate direction or make sound decisions without understanding the underlying technology of their products.

It is not only the R&D management that must be technically competent. Managers from all disciplines need a sufficient level of technical capability. Manufacturing managers need to understand many of the technical concepts upon which their product is based. Marketing and sales managers must be familiar with their products; otherwise, they will sell products that do not fit customer expectations. Financial managers need to understand the product in order to value inventories, compute cost of sales, and control operating costs. Finally, general managers need a sufficient understanding of how products work, how they are made, how they are used, and how they can be improved to be able to manage their product life cycles.

Successful high-technology executives tend to have a technical background and typically invest the time necessary to stay abreast of relevant technology trends. Some companies have a technology management process to brief executives on what they need to know and trigger decisions as they are needed. By comparison, executives in other industries that are not technology-based do not need to focus much time and attention on technology, so they have more time to manage other aspects of their businesses. Perhaps this is why they are vulnerable when a new technology changes their industry.

7. Be Decisive

Executives in high-technology businesses make more decisions than do executives in other industries. In addition to normal business decisions, they regularly face major decisions regarding new products as well as the continuation of mature products. They must make choices among emerging technologies and prioritize opportunities in new markets. Not only are these decisions more frequent, the complexity of products makes them much more complex.

With more frequent and more complex decisions, there is an increased opportunity for making mistakes. Yet, interestingly, when a high-technology business fails, it usually is not due to a bad decision. It is usually because executives did not make a decision *when* one was needed. They simply were not aware that a decision was necessary. They did not realize the increased importance of proactive decision-making in high-technology businesses.

Good decision-making is more than simply being quick to make judgments. Executives need to know when to make specific decisions, understand who should make each decision, apply sufficient skill and experience, and have sufficient information. Having the right fuel to make the right decision requires the right management process. Good decision-making does not happen intuitively.

8. Recognize the Importance of Core Management Processes

Because the management of complex products is itself more complex, it is necessary to break responsibilities into manageable pieces. Senior executives cannot get involved in overseeing details.

Compounding the challenges, there is more to be managed in high-technology businesses. To deal with this complexity and volume, successful high-technology businesses rely more heavily on management processes than other businesses do.

Process-based management is different from the traditional command-and-control approach in functional organizations. It integrates related activities across functions instead of grouping them by function. It puts much more autonomous authority in the hands of management *teams*. It does this by empowering them within broad but specific objectives rather than by delegating specific tasks or responsibilities to individual managers.

Successful high-technology businesses consciously invest in their core management processes, especially product development, product strategy, and supply-chain integration. They realize that these are competencies that provide competitive advantage. This is why high-technology businesses have been pioneers in the advancement of cross-functional management processes.

Leadership Is More Important than Management or Administrative Skills

Successful high-technology executives clearly stress the importance of leadership over management or administration. They think longer term, creating a shared vision to guide the work of others. They anticipate critical changes and lead their business through these changes. They make sure that all important decisions are made by those who should make them, because they do not want their business to drift in the wrong direction.

By being technically competent, they set an example for others.

Finally, they pay more attention to building the future capabilities of their business than they do to managing it.

None of this is easy. Many who try to transfer from other industries into technology-based industries find the transition difficult. They do not understand the special characteristics of high-technology business and the special skills it commands of its leaders. ■

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