

APPLIED INNOVATION MANAGEMENT™

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**– TURNING THREAT
INTO OPPORTUNITY**

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Do it yourself
Try to identify your company's position in the industry life cycle; the fluid phase, the transition phase or the specific phase.
Try to search continuously for potential technologies and make sure the company is up to date.
Once a technological threat is identified , try to predict when it will start to affect your industry .
Recruit people with new competencies.
Look for managers with strong leadership skills who are able to re -direct an organization and motivating it to do so.
In the initial phases , try to look for high "learn on investment".
Make sure to separate development activities from the core business.
Keep looking for the dominant design and, if possible , influence it in your favour when interacting with other actors in the industry. Once the dominant design has emerged, act decisively.
Try to be the leader in terms of technology and cost. When a technology is developed rapidly, followers are usually not able to compete on either performance or price.
Once the technology begins to mature, look for new markets or new performance attributes rather than making the kinds of improvements no one needs.
Tools
Further reading

PART 1 INTRODUCTION

PART 1 PROVIDES AN INTRODUCTION TO THE APPLIED INNOVATION MANAGEMENT™-TOOL INCLUDING ADVICE ON HOW TO USE IT, WHAT YOU CAN EXPECT, INFORMATION ABOUT THE AUTHOR, A SHORT SUMMARY AND SOME BEST PRACTICE EXAMPLES.

About this tool

Welcome to the Forum

About the author

The knowledge in brief

The knowledge in practice

About this AIM™-tool

Applied Innovation Management™-tools are a series of capability tools for innovation management practitioners created in collaboration with experts in the field of innovation management from leading companies, business schools and universities. This particular tool examines how radical innovation can be managed, despite the seemingly insurmountable problems created by the transition from one technology to another. This tool examines how this can be achieved by looking at how industries evolve and why some firms succeed while others fail in those shifts. It provides a description of how industries transform over time, as well as advice and evidence on coping with the problems.

Radical innovations have frequently turned entire industries on their heads. History shows us that large, successful firms may very suddenly become vulnerable when the underlying technology shifts. Therefore, it is important that firms understand:

- how industries evolve over time and how they can be transformed by radical innovation
- the main potential problems that will occur in such transitions
- how these challenges can be handled in order to turn the threats into opportunities.

THIS IS WHAT YOU CAN EXPECT

This Applied Innovation Management™-tool provides you with hands on instructions on how to work with mastering radical innovation in your organization and enable you to:

- get a basic understanding of both the problems and solutions connected to mastering radical innovation
- achieve more constructive and higher quality management team discussion by providing a common ground and a common language about preparing for mastering radical innovation
- better reflect on the structure of your company and take action to create an organizational structure that supports mastering of radical innovation
- identify a range of tools and products that support implementation of the knowledge presented in the manual.

About the author

Christian Sandström works at CBI, Center for Business Innovation, at Chalmers University of Technology in Gothenburg, Sweden. He writes and speaks about disruptive innovation and technological change. Among other things, Christian has conducted detailed studies of how Hasselblad and Facit sought to handle their respective technological shifts.

Christian holds a PhD in innovation management. Some of his work, including the dissertation can be found at www.christiansandstrom.org



Christian Sandström

Why should organizations improve their innovation management skills?

– Markets are more interconnected than ever before in human history and the pace of technological progress is phenomenal. Under those conditions, firms that don't innovate will see their profits fade away unless they look for new ways of doing business. Therefore, knowledge about how innovation can be managed in a systematic way becomes a key strategic asset for a firm's long term growth.

Welcome to the Forum

The InnovationManagementForum.com provides a platform and channel of communication exclusively dedicated to innovation management. You are also invited to discuss questions that you might have about how to implement the knowledge presented in this tool in your organization. This is a valuable opportunity to exchange experiences with likeminded and with colleagues from around the world. The author of this tool will also take part in these discussions.

➡ www.innovationmanagementforum.com (open and free for everyone)



THE KNOWLEDGE

IN BRIEF

Large, successful firms often encounter problems when a technological revolution sweeps through an industry. Polaroid went bankrupt due to the shift from film based photography to digital imaging. In Sweden, Hasselblad, a highly profitable niche player in the camera industry, went from stable revenues into balancing on the brink of bankruptcy within only a few years. It is a myth that such firms run into difficulties because they are ignorant or incompetent. On the contrary, they often identify and embrace the shift at an early point. Yet still they fail.

This Applied Innovation Management™-tool explains this paradox and reports upon evidence regarding how firms can master technological revolutions. There are many reasons why established firms are toppled by entrants due to technological change. A large part of their competence base in terms of R&D, manufacturing and existing business models may be rendered obsolete by the new technology. Hence, when an industry is heading for a technological revolution, a firm's resources and capabilities must be renewed over a longer period of time.

History has shown that it is better to enter too early than too late. In the initial phases, companies should look for a high "learn on investment" rather than a high return on investment. Once the dominant design emerges firms must act decisively since a growing and transforming industry usually implies much more intense competition. Once the technological shift is in full swing, development tends to be very rapid. Therefore, those companies that adopt a follower strategy will be unable to compete on either performance or price.

IN PRACTICE

Below are some examples of how companies have tried to turn the technological threat into an opportunity.

Canon decided to enter digital imaging at an early point. The company explored the technology and even launched some cameras during the mid 1980s. While these products were inferior along virtually all dimensions, the development work generated important knowledge that enabled Canon to follow the technology and enter decisively in the mid 1990s when the technology became more attractive. Using forecasting techniques based upon the logic of S-curves, in 1994 Kodak made a surprisingly accurate forecast regarding the future diffusion of digital imaging.

Back in the 1980s Hasselblad invested in learning more about digital imaging by using it for other purposes than cameras. Digital telephoto transmission was one of the applications created by Hasselblad in which it dominated up to the early 1990s. It allowed the company to increase its knowledge about the new technology and reap good revenues. In 1989, 25 percent of Hasselblad's bottom line came from digital imaging products.

Once digital cameras started to mature and "the pixel war" was over, Casio turned to other attributes such as shutter speed and the ability to capture many images in a very short period of time. Its cameras can photograph events that often are not visible to the human eye. Hence, the company tried to sustain competitiveness looking beyond pure image quality and finding new ways to use cameras.

PART 2

UNDERSTANDING THEORY & BACKGROUND

PART 2 PROVIDES A DISCUSSION OF SOME OF THE CHALLENGES RELATED TO THE SUBJECT OF THIS TOOL. IT INCLUDES EXAMPLES AND A THEORETICAL FRAMEWORK FOR UNDERSTANDING THE MECHANISMS INVOLVED IN THE EMERGENCE OF NEW TECHNOLOGIES.

Radical innovation emptied the building

How industries evolve and mature

Why does the new technologies create difficulties?

- competence becomes incompetence

- business models and positions lose value

- existing customers may not demand the new technology

RADICAL INNOVATION EMPTIED THE BUILDING!

In 2003, the Swedish camera manufacturer Hasselblad moved into a new building in downtown Gothenburg, Sweden. In 2005 the building was empty! The shift from film-based photography to digital imaging had put the company in deep trouble and the new building had become too large. Having enjoyed several decades of stable profits and a dominant position in the high-end camera segment, Hasselblad was teetering on the brink of bankruptcy. Radical Innovation had emptied the building.

Time and again, we have seen how large, profitable and admired companies suddenly become vulnerable when the underlying technology changes. This phenomenon is almost as old as capitalism, and there are many historical examples of established firms encountering problems under conditions of discontinuous change. None of the typewriter manufacturers survived the shift to personal computers; the shift from sailing ships to steam engines put incumbent firms in great trouble; and all companies operating in the ice industry went out of business with the rise of fridges.

When vacuum tube radios were displaced by transistor radios established firms, such as RCA, lost market share to entrant firms such as Sony. Mini-mill technology for steel production emerged in Northern Italy in the 1960s and the large integrated steel mill manufacturers in France, Germany and Belgium encountered severe difficulties over the succeeding decades. The ongoing shift from analogue video surveillance to digital cameras connected over the Internet has paved the way for entrant firms, such as Axis, Mobotix and Indigo Vision, while Pelco and other incumbent firms have failed to dominate the new technology. Hence, it seems that history is repeating itself.

The collapse of large, successful companies due to technological shifts has often caused huge surprise, in the press and among investors. Frequently, investors fail to assess the impact of the new technology since they underestimate the dynamics of the changes. In

April 1994, a financial analyst at Prudential made the following statement regarding Kodak's entry into digital imaging: "Shareholders will revolt once the meagre (and distant) potential returns from electronic imaging become clear... we are eager to see shareholders' reactions when they realize how much of their money is squandered on "digital nonsense".

As technological shifts take over and established firms encounter problems, the same investors and the mass media are often critical of the company and its management. Frequently, the firm is blamed for excessive bureaucracy, ignorance and incompetence.

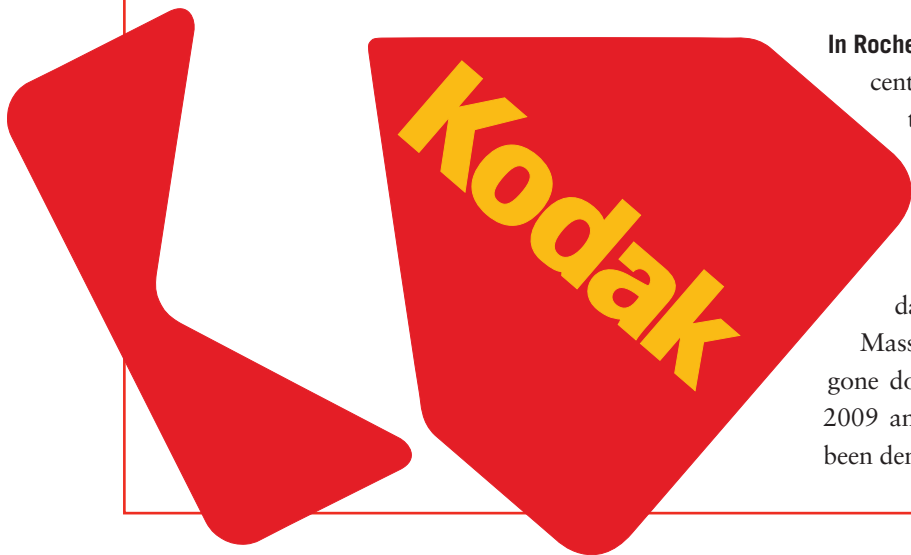
Common sense tells us that it is unlikely that firms that employ some of the world's brightest scientists and engineers would fail to understand these profound changes – moreover, a glimpse at the history of these companies is usually enough to confirm this. At Kodak, a technology substitution forecast made in 1994 concluded that digital imaging would capture 50 percent of the market by 2004. This statement turned out to be almost accurate – since this occurred in 2003. Also Kodak (like Hasselblad, RCA, and other firms) not only recognized the threat, but sought to respond and develop the technology. Nevertheless, so many firms failed! This manual tries to explain why, and what could have been done. It provides a description of how industries transform over time, as well as advice and evidence on coping with the problems.



In 2003, the Swedish camera manufacturer Hasselblad moved into a new building in downtown Gothenburg, Sweden. In 2005 the building was empty!

*Hasselblad's new building in downtown Gothenburg.
Photo: Jan Jörnmark.
www.jornmark.se*

THE DESTRUCTION OF KODAK



In Rochester (NY), Eastman Kodak throughout the 20th century was referred to as “The Great Yellow Father” since the company had such a strong position in its hometown and was an active part of the community. In the early 1980s, more than 60,000 people in Rochester (a town of about 230,000 inhabitants) worked for Kodak: this figure has declined to less than 10,000. Massive layoffs have taken place, Kodak’s stock has gone down from \$US88 in 1999 to around \$US3 in 2009 and several Kodak buildings in Rochester have been demolished.

HOW INDUSTRIES EVOLVE AND MATURE

In order to understand the challenges related to technological shifts it is necessary first to describe how industries emerge, stabilize and mature over time. An industry usually starts to prosper around a product innovation, e.g. a car, a film-based camera or a mechanical calculator – the Fluid Phase. In this fluid phase extensive experimentation in general takes place and firms struggle to find the right way to make a viable product from the technology. After a period of exploration a dominant design eventually emerges.

The dominant design can be thought of as the design that companies must adapt to in order to be in the marketplace. For instance, while several attempts at personal digital cameras were made in the early 1990s, the dominant design was defined in 1995 with Casio's QV-10. It was the first camera with an LCD screen, a concept that was very appealing since it allowed users to view images instantly and take new ones if necessary.

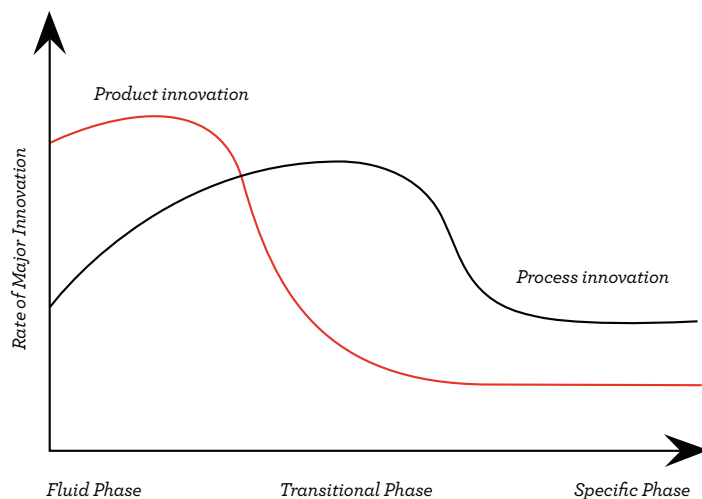


FIGURE 1 *An industry evolves over time according to the pattern described in figure 1 (Utterback, 1994). It prospers around a product innovation and, in the first phase, extensive experimentation takes place. As the dominant design emerges, the focus shifts towards process innovation and incremental improvements. Over time, the overall rate of innovation decreases and the firm becomes vulnerable to technological change.*

The dominant design should be regarded as a milestone event in any industry, because afterwards, the rules of the game change significantly. The next phase, the Transitional Phase is when more process innovations are introduced. Incremental improvements are made at product level, but the focus shifts towards finding new and more efficient ways of producing, thereby lowering costs and achieving higher market penetration.

As products become cheaper and better, diffusion increases and the slope of the S-curve becomes steeper. One example is the car industry and Henry Ford's introduction of the assembly line. Through this process innovation, costs decreased significantly and Ford was able to reach the mass market. While many companies used assembly lines, Ford achieved competitive advantage in being the first to use resellers. Hence, it is important also to find the right business model in order to achieve a dominant position.

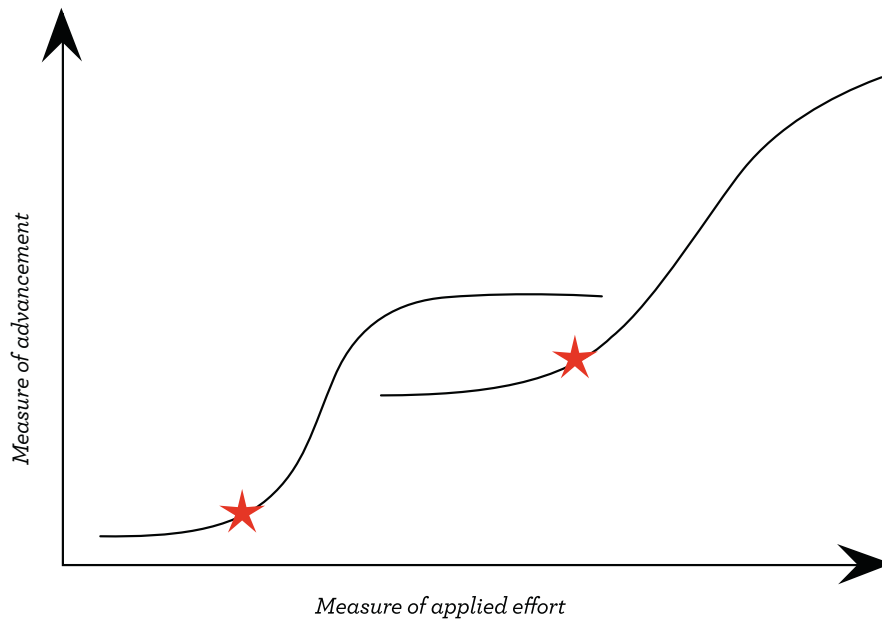


FIGURE 2 illustrates how an initially inferior technology eventually displaces the former technology.

Those firms that enter at the point when the two technologies are equivalent are often left behind since development is very rapid in this phase. Hence, a wise firm chooses to enter before the new technology has reached a sufficient performance level.

As the industry matures, the rate of product and process innovation decreases. At the same time, economies of scale become more important and small firms are burnt out or consolidated. Figure 3 depicts how the number of firms in the US automotive industry changed over time. Once the dominant design emerged and the assembly line had been adopted by most manufacturers, the number of firms started to decline rapidly.

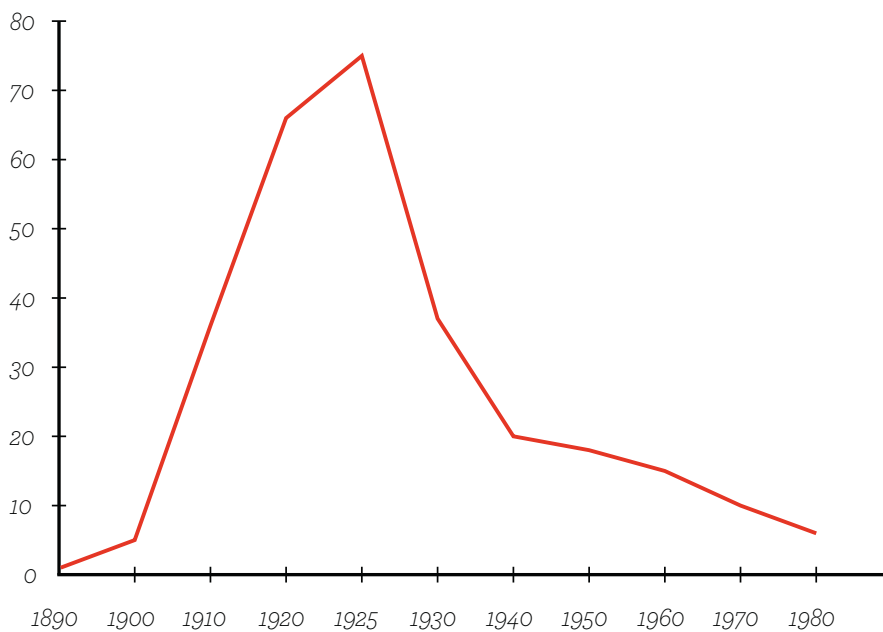


FIGURE 3 illustrates how the number of firms rises and later declines in the US automotive industry due to the changing nature of innovation as described in the industry life cycle (Abernathy and Utterback, 1975).

Therefore, towards the end of the industry lifecycle, the industry has achieved stability and consolidation. Entry barriers are often high at this point, the industry may be dominated by a couple of large actors with highly specialized product related knowledge and machinery. The mechanical calculator industry followed this pattern and had reached a state of maturity in the 1950s. The mechanical technology had been modified into a state of perfection, process innovations and machinery had been developed and the industry was dominated by a few large firms.

WHY DOES THE NEW TECHNOLOGY CREATE DIFFICULTIES?

In the previous description of how industries evolve over time, it becomes easier to understand the challenges related to mastering a technological revolution. A mature and profitable industry often appears to be very stable and continues to deliver impressive profits, however it is in fact very vulnerable. There are several reasons for this which are outlined below.

BECAUSE COMPETENCE = INCOMPETENCE

An incumbent firm in a mature industry has in general developed a competence base related to the underlying technology. Engineering expertise, manufacturing skills, machinery and corporate values are well established. Therefore, an established firm is very vulnerable to changes in the technology since such a shift may render the existing competence base obsolete. In the early 1970s, Facit, a Swedish manufacturer of mechanical calculators, typewriters and office furniture went from record profits to huge losses and layoffs within a few years. The reason was the rise in electronic calculators which became progressively cheaper, better and smaller. The sudden collapse of this corporate giant attracted a lot of media attention. Facit's top management was blamed for not recognizing the impact that electronics would have on the industry.



Facit was a highly successful Swedish manufacturer of mechanical calculators. With the shift to electronics, the firm went from record profits into a state of bankruptcy within a few years (Facit photos: Christian Sandström).



Facit's competence base was related to mechanics. Thus, the company was built around cogwheels, a competence that lost its value once digital calculators emerged.

However, a brief look into the corporate archives of the firm suffices to realize that that management did indeed recognize the electronic threat in the early 1960s.

The reason for Facit's difficulties despite having understood the looming change, was that almost the entire resource base in Facit was related to mechanics, not electronics.

Gert Persson, an electronic engineer and former Facit employee, speaking retrospectively said that "The cogwheels in the mechanical calculators were the soul of the company". With the shift to electronics, this cogwheel soul lost its value, and became a disadvantage for Facit entering the new technology.

BECAUSE BUSINESS MODELS AND POSITIONS LOSE VALUE

In the same way that a company builds a relatively rigid competence base over time, it also builds a position and a business model in relation to competitors and its value chain. For instance, firms that made both cameras and film essentially developed a "razorblade" type business model, i.e. like Gillette which made much of its money from selling razor blades, these companies profits were based on the continuous consumption of film, rather than selling cameras. This is illustrated in Kodak's famous slogan: "You press the button, we do the rest".

"Doing the rest" was a business model that also implied that Kodak was vertically integrated. They did almost every-

thing in the value chain – basic research, manufacturing, sales, marketing and photofinishing. The rise of digital imaging had huge implications for those firms whose positions and business models were related to "doing the rest".

BECAUSE EXISTING CUSTOMERS MAY NOT DEMAND THE NEW TECHNOLOGY

Another problem faced by incumbent firms is that the new technology may offer initially worse performance. Customers tend to associate brands and products to certain values and properties. Therefore, it becomes very difficult to find a financial logic for committing to the new technology. Why invest in risky and expensive ventures which customers won't value, when this money could be invested in the core business?

Firms that are heading for a technological shift usually experience internal competition over resources. In the end, resources tend to be allocated to those projects aimed at satisfying existing customers leaving the new technology starved of investment. This is precisely what occurred in Hasselblad in the early 1990s. There were two development teams – one for analogue and one for digital photography. These teams had to compete for the scarce resources available for development. Consequently, the firm became increasingly polarized and by the mid 1990s all internal development of digital imaging was stopped.

These examples illustrate that established firms often recognize the technological threat, but still tend to fail.

PART 3

METHODOLOGY & PRACTICE INSIGHTS

THIS PART PROVIDES SOME SOLUTIONS AND SUGGESTIONS ABOUT HOW TO MASTER RADICAL INNOVATION. THE SOLUTIONS ARE BASED ON A THEORETICAL FRAMEWORK AND PRACTICAL EXAMPLES.

How to master radical innovation

- in the fluid phase

- in the transitional phase

- in the specific phase

Concluding remark

Mistakes we learnt from

HOW TO MASTER RADICAL INNOVATION

Some of the main reasons why established firms fail when new technologies are introduced have now been outlined. Is there anything that companies can do to survive such profound change? The abovementioned firms faced huge challenges and in many cases mere survival might be regarded as a successful outcome since so many companies went out of business. How-

ever, there are examples of established firms that succeeded in the transition to a new technology – and there is a lot to learn from them. Different strategies are needed at different points in time: management responses to each phase/problem in the industry life cycle are described below.

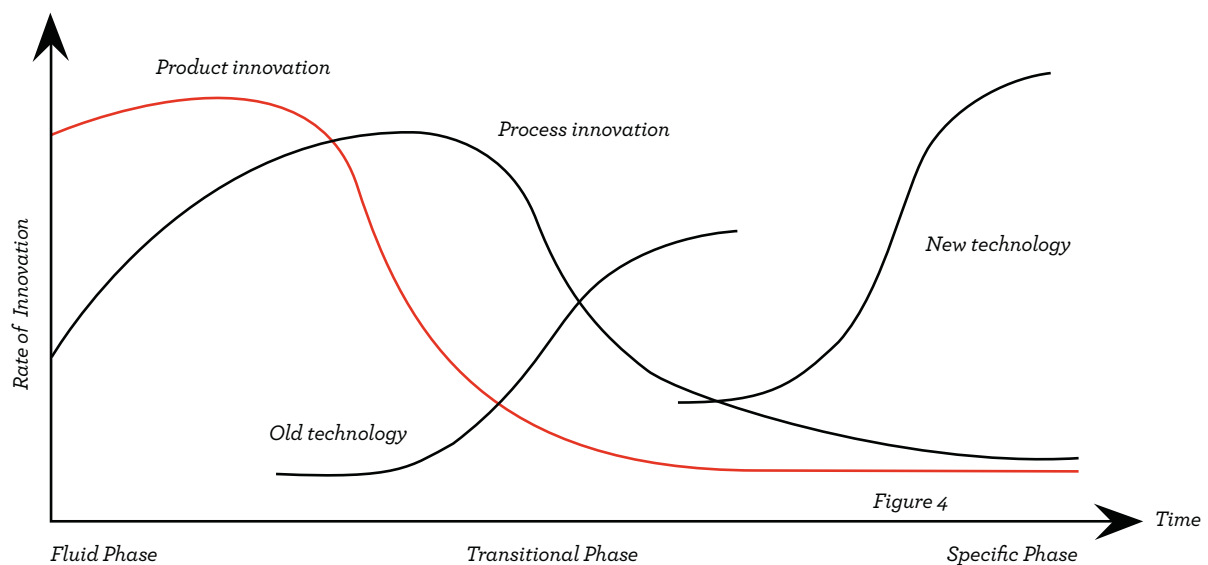


FIGURE 4 As the industry reaches a more mature phase it may seem very stable and profitable for established firms. But it is in fact highly vulnerable to technological change. If a new technology is introduced, these companies may find it difficult to renew their competence base which has been developed around the maturing technology. They therefore encounter problems when trying to shift to the emerging technology.

THE FLUID PHASE – TURN MONEY INTO KNOWLEDGE

As stated earlier, incumbent firms rarely fail to acknowledge and understand that a technological shift is on the way. The problem seems to be how and when to respond. It may be very expensive to enter at a very early point, given the initially poor prospects for the new technology. On the other hand, waiting and freeriding on the development work of others has often turned out to be a very risky strategy. Given that technological changes may render the existing competence base obsolete it is of the utmost importance to renew the firm's resources and capabilities at an early point. Therefore, incumbent firms need to explore the new technology in the fluid phase, for the simple reason that later on is too late. In this phase, money should be turned into knowledge, which can be reconverted into money later, when the shift comes into motion.

An example of a company that has not only survived, but also prospered from a technological shift is Canon. Despite its background as a company manufacturing analogue cameras, the firm succeeded in the shift to digital imaging. Some of the first filmless cameras started to emerge in the early 1980s. The road from these expensive prototypes with a poor image quality to today's cameras has been long and bumpy.

RECRUIT NEW PEOPLE

Since the required competence was different from what they had in-house, Canon recruited engineers and managers from companies in the consumer electronics industry. A lot of internal development was done and this new competence made it easier to follow advances in the field. Thus, the "absorptive capacity" of the firm was enhanced at an early point.

While Facit tried to do the same thing during the early 1960s, it was difficult to find skilled electronic engineers in Sweden at that time. Thus, not only Facit, but the whole country lacked expertise, which exacerbated the company's difficulties. Today's more mobile global labour market should make ease these situations.

LOOK FOR A HIGH "LEARN ON INVESTMENT"

In 1986 Canon launched one of its first filmless cameras. The RC-701 cost \$US3,000 and offered poor image quality. Needless to say, at this price it did not achieve success. However, to regard this product as a failure would be wrong. Canon had achieved high investment in learning, which was vital to master the eventual technological shift. Hence, in the fluid phase, an incumbent firm should try to turn money into new knowledge, in order that this knowledge can be turned into new money once a shift takes off.

Canon had achieved high investment in learning, which was vital to master the eventual technological shift.

SEPARATE DEVELOPMENT FROM THE MAINSTREAM BUSINESS

Canon was careful to separate digital development from its core business. Digital imaging was developed in an independent organization enabling future business to be protected from the day to day internal competition for resources. At the same time, the company continued to capitalize on its existing business.

EXPERIMENT WITH NEW BUSINESS MODELS

Incumbent firms need to experiment with new business models in the fluid phase. Frequently, established firms regard a technological shift as a technological challenge. While this may be true in some cases, the technology may render existing business models obsolete requiring firms need to experiment along this dimension.

Polaroid went bankrupt in 2001. Like Kodak, Polaroid made its money on sales of film not cameras, which

had induced inertia since the razorblade business model historically had served these firms so well. After heavy investment in digital imaging, Polaroid was unable to find a way to leverage its business model. The company was paralysed by conflicts in the mid 1990s and eventually sold off its digital capabilities and reinvested in its core business. This strategy was good in the short term but instantly bankrupted the company when the imaging revolution took off.

LOOK FOR LEAD-USERS AND NON-CUSTOMERS

It is possible sometimes to develop technology by targeting lead-users, i.e. users that are significantly different from the mainstream in terms of skills, interest and purchasing power. Also, it is important not to underestimate the opportunities related to new customers. The transistor radio became a cult product in the 1950s and 1960s as a result of marketing targeted to teenagers and other consumers who had never possessed radios. They were accepting of the poor sound quality since the new technology enabled portability, a new performance dimension that was appreciated. The success of Sony and other manufacturers of transistor radios is largely attributable to their ability to identify new customers, and find new ways to reach them. Established firms are usually good at experimenting with new technologies, but tend to overlook the importance of experimenting along the market dimensions.

STRONG LEADERSHIP

History suggests that companies which undergo a technological revolution face huge challenges. New technologies im-

ply that firms need to "unlearn" and transform their resources, processes and values. Needless to say, such profound change evokes much emotion within a company. This makes it vital to have a strong leadership which dares to point to the new direction at the expense of a glorious corporate history. The National Cash Register (NCR) company managed the transition to electronics in the 1970s. One of the main reasons for this appears to be very strong leadership and a willingness to change.

Top management has a crucial role in the incubation of new technologies in showing commitment in both words and actions. Otherwise the status quo will prevail since established firms are efficient and highly competent at what they already do. My search of the Facit archives initially was to find the decision point – where it all went wrong. After a week of reading, I concluded, that very worryingly, there had been no such point. The company went into a crisis via the status quo, i.e. due to lack of decision making, which supported a business as usual situation that ultimately led to the collapse of the firm. Summing up, in the fluid phase firms must build new capabilities, which can be used ones the shift comes into motion.

THE TRANSITIONAL PHASE – TURNING NEW KNOWLEDGE INTO NEW MONEY

It is now time to turn the previously acquired knowledge into money. While Canon invested a lot in digital imaging during the 1980s and early 1990s the company was far from being an industry leader. It seem that this changed when digital imag-

Top management has a crucial role in the incubation of new technologies in showing commitment in both words and actions.

ing reached its transition phase, when it was clear what a digital camera should look like.

INFLUENCE THE DOMINANT DESIGN AND THEN ACT DECISIVELY

When casio launched the first camera featuring an LCD screen in 1995, many companies started to commit more resources to digital technology. Incremental improvements were introduced rapidly by several firms and, towards the late 1990s, the digital "avalanche" began. At this point, Canon acted decisively and com-

mitted huge resources to developing cheaper and better cameras. Its activity prior to the emergence of the dominant design enabled Canon to influence and participate in this design. Many of the Japanese camera manufacturers were involved in setting the standards, through frequent interaction over several years. The ones that had not entered at that point were unable to influence or take part in negotiations relating to the dominant design.

Diffusion in the camera industry followed the S-curve logic, and within a few years, digital imaging went from being a marginal part of the industry into be-



Casio came up with what later became the dominant design for a digital camera. A key feature was the LCD screen, which enabled the user to see the image as soon as it had been captured.

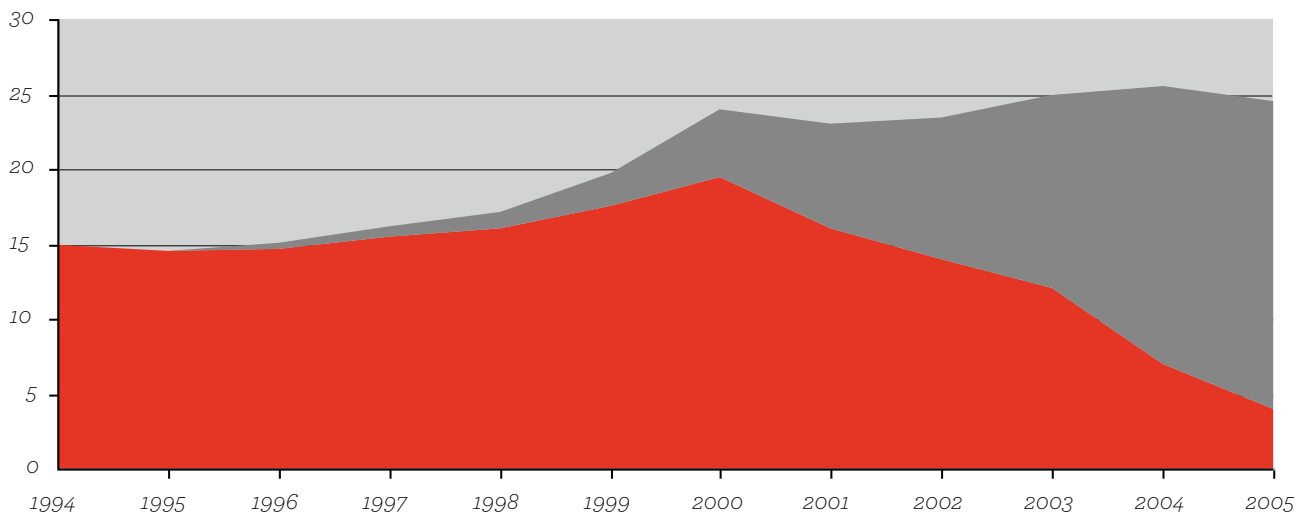


FIGURE 5 Number of film and digital cameras sold in the United States - - millions.

ing the standard. The S-curve suggests that it is too late to enter the new technology once the shift has begun. The resources and capabilities needed to master such a change must have been developed in preceding decades: those firms which haven't done so often end up in deep trouble. Hence, big firms need to learn how to look out for small trends before they become megatrends: once a new technology is translated into a mainstream product, it is too late.

It remains to be seen whether or not the dominant analogue players in the video surveillance industry will manage the ongoing transition to digital, Internet protocol-based surveillance. History would suggest that it will be challenging and that those which haven't renewed their resource base yet may face a gloomy future.

It is in this phase that most cannibalization of the old technology takes place, which is why firms such as Facit and Hasselblad began to encounter problems as the shift accelerated. Since being "too late" can imply large losses, incumbents may find themselves in a Catch 22 situation where they need more money in order to develop the new technology, but do not have it because their current technology is not generating the required revenues. Those that enter a new technology early may experience a virtuous rather than a vicious

circle. This seems to be the case for e.g. firms such as Axis, Mobotix and Indigo Vision in the video surveillance industry: these firms entered early, benefited from this and have re-invested these resources, thereby sustaining their headstart.

THE SPECIFIC PHASE - LOOK FOR NEW WAYS OF COMPETING

Once the dominant design has emerged, competition becomes fiercer: at this point, both incumbent firms and entrants may be burned out.

**WIN THE "PIXEL WAR" –
AND MOVE FORWARD**

In the camera industry, a pixel war broke out, during which new, cheaper and better cameras were launched at a furious pace. Economic historians sometimes refer to "the great calculator war" in the early 1970s. In a Klondike manner, more and more firms entered the industry and tried to make money by manufacturing calculators. While the market grew at staggering rates of 40– 50 percent annually this by no means guaran-

teed sustained profits. On the contrary, more than 30 companies left the industry in these years and only the technology leaders such as Sharp, Casio and Texas Instruments survived in the long term. Hence, when entering a war based on rapid incremental improvements, being a follower is not a viable option.

LOOK FOR NEW PERFORMANCE DIMENSIONS

Once the industry has started to consolidate, pixel type wars will no longer emerge since the new technology has reached a sufficient performance level. As the new technology starts to overshoot the demands of its mainstream customers, it is time to focus on new performance attributes and identify new segments. In the camera industry, Canon and Nikon others, moved to making semiprofessional, digital single lens reflex cameras. Some firms, e.g. Casio, have focused on other performance attributes such as the ability to capture many images in a very short space of time. The industry has reached a stable and well consolidated phase, where it may once again be vulnerable to technological shifts.

CONCLUDING REMARKS

Large, successful firms often encounter problems when a technological revolution sweeps through their industry. It is a myth that such firms are busted because they fail to recognize the threat. They often are able to identify and embrace the shift at an early point, but still fail. In this manual I have argued that it is possible to handle those shifts and highlighted some ways of doing so.

In the early phases it is necessary first to seek knowledge rather than money – and preferably through a separate organization. Once the technological shift takes off, competition increases significantly and those companies that adopt follower strategies can be left behind. As the industry starts to mature it is increasingly important to find new markets and focus on different performance attributes in order to keep abreast of or overtake customer demand.

MISTAKES WE LEARNT FROM

- 1 Polaroid entered digital** imaging in the 1980s and did a lot of development work. However, it made no similar investment in finding a viable business model for the new technology. The shift to digital imaging was regarded as a technological challenge. Since it did not find a business model that was not related to making money on film, the company abandoned most of its digital imaging efforts in the mid 1990s. In 2001, Polaroid went bankrupt.
- 2 In the mid 1990s** at Hasselblad, the digital and the analogue divisions had to fight for the same pool of resources. The firm became

increasingly polarized and eventually the digital imaging project was stopped since it was more difficult to find a financial logic for a technology with initially lower performance.

- 3 Facit, the Swedish** manufacturer of mechanical calculators, sought to handle the shift to electronics by collaborating with the Japanese company Sharp. In the beginning this strategy saved Facit from losing market shares, but as the pace of development increased Facit was left behind since it could not obtain the latest products from Sharp.

PART 4

USING & IMPLEMENTING THE KNOWLEDGE

THIS PART INCORPORATES A SERIES OF ADVICES THAT WILL HELP YOU USE AND IMPLEMENT THE KNOWLEDGE GAINED FROM THE PREVIOUS SECTIONS, IN YOUR OWN ORGANIZATION. THE ADVICES ARE FOLLOWED BY COMMENTS FROM THE AUTHOR. SOME OF THESE COMMENTS INCLUDE EXAMPLES. YOU WILL RECOGNIZE MUCH OF THIS FROM THE PREVIOUS PARTS OF THE TOOL. ADVICES, COMMENTS AND EXAMPLES CAN BE USED AS GUIDANCE TO HELP YOU REFLECT ON AND FIND SOLUTIONS TO QUESTIONS THAT YOU NEED TO WORK WITH WHEN IMPLEMENTING THE KNOWLEDGE IN YOUR OWN ORGANIZATION.

Try to identify your company's position in the industry life cycle.

Try to search continuously for potential technologies.

Once a technological threat is identified, try to predict when it will start to affect your industry.

Recruit people with new competencies.

Look for managers with strong leadership skills.

Try to look for high "learn on investment".

Make sure to separate development activities from the core business.

Keep looking for the dominant design and, if possible, influence.

Try to be the leader in terms of technology and cost.

Once the technology begins to mature, look for new markets.

DO IT YOURSELF

The **fluid phase** is characterized by a lot of uncertainty, in terms of both technologies and business models. The industry is populated by many, relatively small companies and extensive experimentation takes place. Most companies focus on product innovation.

In the **transitional phase** there is much less uncertainty. The dominant design has emerged and incremental improvements take place at a rapid pace. Economies of scale become increasingly important, firms focus more on process innovation and the industry becomes more consolidated.

In the **specific phase** the rate of innovation is slower. A few large players dominate the market and price competition is intense. In this phase, firms are highly vulnerable to changes in the underlying technology.

TRY TO IDENTIFY YOUR COMPANY'S POSITION IN THE INDUSTRY LIFE CYCLE; THE FLUID PHASE, THE TRANSITION PHASE OR THE SPECIFIC PHASE.

AUTHORS COMMENT:

The fluid phase is characterized by a lot of uncertainty, in terms of both technologies and business models. The industry is populated by many, relatively small companies and extensive experimentation takes place. Most companies focus on product innovation.

An industry usually starts to prosper around a product innovation, e.g. a car, a film-based camera or a mechanical calculator. In this fluid phase extensive experimentation in general takes place and firms struggle to find the right way to make a viable product from the technology. After a period of exploration a dominant design eventually emerges. The dominant design can be thought of as the design that companies must adapt to in order to be in the marketplace.

For instance, while several attempts at personal digital cameras were made in the early 1990s, the dominant design was defined in 1995 with Casio's QV-10. It was the first camera with an LCD screen, a concept that was very appealing since it allowed users to view images instantly and take new ones if necessary. The dominant design should be regarded as a milestone event in any industry, because afterwards, the rules of the game change significantly.

In the next phase, the transitional phase there is much less uncertainty. The dominant design has emerged and incremental improvements take place at a rapid pace. Economies of scale become increasingly important, firms focus more on process innovation and the industry becomes more consolidated.

The transitional phase is when more process innovations are introduced. Incremental improvements are

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made at product level, but the focus shifts towards finding new and more efficient ways of producing, thereby lowering costs and achieving higher market penetration. As products become cheaper and better, diffusion increases and the slope of the S-curve becomes steeper.

One example is the car industry and Henry Ford's introduction of the assembly line. Through this process innovation, costs decreased significantly and Ford was able to reach the mass market. While many companies used assembly lines, Ford achieved competitive advantage in being the first to use resellers. Hence, it is important also to find the right business model in order to achieve a dominant position.

In the specific phase the rate of innovation is slower. A few large players dominate the market and price competition is intense. In this phase, firms are highly vulnerable to changes in the underlying technology. As the industry matures, the rate of product and process innovation decreases. At the same time, economies of scale become more important and small firms are burnt out or consolidated. Please see figure 3, page 11 for an example of this.

QUESTION TO READER:

In which phase of the industry life cycle is your company?

– One more hint to help you work this out, besides the comments above, is to look at the number of firms entering the industry and how much technological uncertainty that exists.

TRY TO SEARCH CONTINUOUSLY FOR POTENTIAL TECHNOLOGIES AND MAKE SURE THE COMPANY IS UP TO DATE.

AUTHOR'S COMMENT:

Incumbent firms rarely fail to acknowledge and understand that a technological shift is on the way. The problem seems to be how and also when to respond. It may be very expensive to enter at a very early point, given the initially poor prospects for the new technology. On the other hand, waiting and free-riding on the development work of others has often turned out to be a very risky strategy. Given that technological changes may render the existing competence base obsolete it is of the utmost importance to renew the firms resources and capabilities at an early point. Therefore, incumbent firms need to explore the new technology in the fluid phase, for the simple reason that later on is too late. In this phase, money should be turned into knowledge, which can be reconverted into money later, when the shift comes into motion.

An industry usually a company that has not only survived, but also prospered from a technological shift is Canon. Despite its background as a company manufacturing analogue cameras, the firm succeeded in the shift to digital imaging. Some of the first filmless cameras started to emerge in the early 1980s. The road from these expensive prototypes with a poor image quality to today's cameras has been long and bumpy. This is an example of an incumbent firm turning money into new knowledge, in order that this knowledge could be turned into new money once a shift took off.

Another way of searching and exploring new technologies is by targeting lead-users, i.e. users that are significantly different from the mainstream users in terms of skills, interest and purchasing power. Also, it is important not to underestimate the opportunities related to new customers. The transistor radio became a cult product in the 1950s and 1960s as a result of market-

ing targeted to teenagers and other consumers who had never possessed radios.

They were accepting of the poor sound quality since the new technology enabled portability, a new performance dimension that was appreciated. The success of Sony and other manufacturers of transistor radios is largely attributable to their ability to identify new customers, and find new ways to reach them. Established firms are usually good at experimenting with new technologies, but tend to overlook the importance of experimenting along the market dimensions.

See also: Look for a high "learn on investment", page 16.

QUESTION TO READER:

How do you keep on searching continuously for potential technologies and make sure your company is up to date?

– Use the input above to help you design a way of doing this in your organization! You can do it through internal R&D and collaborations with universities and lead users, which can be used as "listening posts". And don't forget to reserve resources for these kinds of initiatives, even though you don't know where they might lead.

3

ONCE A TECHNOLOGICAL THREAT IS IDENTIFIED , TRY TO PREDICT WHEN IT WILL START TO AFFECT YOUR INDUSTRY.

AUTHOR'S COMMENT:

Map the innovation in terms of its performance characteristics and how it creates value. Sometimes, your mainstream customers will not initially demand it, so make sure to look for new customer segments and maybe even new markets.

QUESTION TO READER:

How will you try to predict when the new technological threat will start to affect your industry?

– Recruit people with new competencies. One way might be to work with scenario analysis to try predicting when the identified technological threat will start having an impact on your industry. Another hint that might help you do it is trying to find out when this new technology will become appealing to your most profitable customers.

4

RECRUIT PEOPLE WITH NEW COMPETENCIES.

AUTHOR'S COMMENT:

To recruit people with new competencies, i. e. different from the competencies that you already have is difficult. This is because as a manager it is difficult to find out and understand if the people that you are recruiting have new competencies and skills since you don't have them yourself.

A good example of a company succeeding in recruiting new competences is when Canon embarked on it's explorations in digital imaging, the required competence was different from what they had in-house. So Canon recruited engineers and managers from companies in the

consumer electronics industry. A lot of internal development was done and this new competence made it easier to follow advances in the field. Thus, the "absorptive capacity" of the firm was enhanced at an early point.

While Facit tried to do the same thing during the early 1960s, it was difficult to find skilled electronic engineers in Sweden at that time. Thus, not only Facit, but the whole country lacked expertise, which exacerbated the company's difficulties. Today's more mobile global labour market should make ease these situations.

QUESTION TO READER:

How will you work with recruiting people with new competences?

– If the competence base is shifting, look for people who have a background in an industry that has been built upon this particular competence.

5

LOOK FOR MANAGERS WITH STRONG LEADERSHIP SKILLS WHO ARE ABLE TO RE -DIRECT AN ORGANIZATION AND MOTIVATING IT TO DO SO.

AUTHOR'S COMMENT:

History suggests that companies which undergo a technological revolution face huge challenges. New technologies imply that firms need to "unlearn" and transform their resources, processes and values.

Needless to say, such profound change evokes much emotion within a company. This makes it vital to have a strong leadership which dares to point to the new direction at the expense of a glorious corporate history.

A successful example is the National Cash Register (NCR) company that managed the transition to elec-

tronics in the 1970s. One of the main reasons for this appears to be very strong leadership and a willingness to change.

Remember that Top management always has a crucial role in the incubation of new technologies in showing commitment in both words and actions. Otherwise the status quo will prevail since established firms are efficient and highly competent at what they already do. My search of the Facit archives initially was to find the decision point – where it all went wrong. After a week of reading, I concluded, that very worryingly, there had been no such point. The company went into a crisis via the status quo, i.e. due to lack of decision making, which supported a business as usual situation that ultimately led to the collapse of the firm.

QUESTION TO READER:

Define the five most important skills that describe a strong leadership. How will you say that your company leadership relates to this?

6

IN THE INITIAL PHASES , TRY TO LOOK FOR HIGH "LEARN ON INVESTMENT".

AUTHOR'S COMMENT:

Despite the poor outlook for an early return on investments in terms on money, it is vital to invest in creating new knowledge, i.e. looking for a high "learn on investment" in the fluid phase.

An example of this, as mentioned earlier is Canon that launched one of its first filmless cameras in 1986. The RC-701 cost \$US3,000 and offered poor image quality. Needless to say, at this price it did not achieve success.

However, to regard this product as a failure would be wrong. Canon had achieved high investment in learning, which was vital to master the eventual technological shift. Hence, in the fluid phase, an incumbent firm should try to turn money into new knowledge, in order that this knowledge can be turned into new money once a shift takes off.

QUESTION TO READER:

How can your company find a "high learn on investment" in a new technology field which is affection your future business?

– One way of doing this is collaboration with other firms and interaction with universities and other knowledgeproviders.

7

MAKE SURE TO SEPARATE DEVELOPMENT ACTIVITIES FROM THE CORE BUSINESS.

AUTHOR'S COMMENT:

There are countless examples of god intentions going bad when companies fail to separate development activities from the core business. One of the main fail factors is the absence of clear boundaries between core business and development activities when it comes to allocation of resources. When tapping into the same pool of resources it's almost always the development activities that are the losers, since their results are much harder to prove...

A successful example is the way Canon acted. Canon was careful to separate digital development from its core business. Digital imaging was developed in an independent organization enabling future business to be protected from the day to day internal competition for resources. At the same time, the company continued to capitalize on its existing business.

QUESTION TO READER:

How will you make sure that your organization separate development activities and future business from the core business?

– One way is to work with separate budgets. Another useful tip might be to benchmark yourself against companies that have been successful in doing this and tap into their knowledge.

8

KEEP LOOKING FOR THE DOMINANT DESIGN AND, IF POSSIBLE, INFLUENCE IT IN YOUR FAVOUR WHEN INTERACTING WITH OTHER ACTORS IN THE INDUSTRY. ONCE THE DOMINANT DESIGN HAS EMERGED, ACT DECISIVELY.

AUTHOR'S COMMENT:

When Casio launched the first camera featuring an LCD screen in 1995, many companies started to commit more resources to digital technology. Incremental improvements were introduced rapidly by several firms and,

towards the late 1990s, the digital "avalanche" began.

At this point, Canon acted decisively and committed huge resources to developing cheaper and better cameras. Its activity prior to the emergence of the dominant design enabled Canon to influence and participate in this design. Many of the Japanese camera manufacturers were involved in setting the standards, through frequent interaction over several years. The ones that had not entered at that point were unable to influence or take part in negotiations relating to the dominant design.

QUESTION TO READER:

In what ways can you find and influence the dominant design?

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TRY TO BE THE LEADER IN TERMS OF TECHNOLOGY AND COST. WHEN A TECHNOLOGY IS DEVELOPED RAPIDLY, FOLLOWERS ARE USUALLY NOT ABLE TO COMPETE ON EITHER PERFORMANCE OR PRICE.

AUTHOR'S COMMENT:

Diffusion in the camera industry followed the S-curve logic, and within a few years, digital imaging went from being a marginal part of the industry into being the stan-

dard. The S-curve suggests that it is too late to enter the new technology once the shift has begun.

The resources and capabilities needed to master such a change must have been developed in preceding decades: those firms which haven't done so often end up in deep trouble. Hence, big firms need to learn how to look out for small trends before they become megatrends: once a new technology is translated into a mainstream product, it is too late.

QUESTION TO READER:

How can you ensure that your company is in a leading position in terms of technology and costs?

ONCE THE TECHNOLOGY BEGINS TO MATURE, LOOK FOR NEW MARKETS OR NEW PERFORMANCE ATTRIBUTES RATHER THAN MAKING THE KINDS OF IMPROVEMENTS NO ONE NEEDS.

AUTHOR'S COMMENT:

An example of Win the "pixel war" – and move forward. In the camera industry, a pixel war broke out, during which new, cheaper and better cameras were launched at a furious pace. Economic historians sometimes refer to "the great calculator war" in the early 1970s. In a Klondike manner, more and more firms entered the industry and tried to make money by manufacturing calculators.

While the market grew at staggering rates of 40–50 percent annually this by no means guaranteed sustained profits. On the contrary, more than 30 companies left the industry in these years and only the technology leaders such as Sharp, Casio and Texas Instruments survived in the long term. Hence, when entering a war based on rapid incremental improvements, being a follower is not a viable option.

Look for new performance dimensions. Once the industry has started to consolidate, pixel type wars will no longer emerge since the new technology has reached a sufficient performance level. As the new technology starts to overshoot the demands of its mainstream customers, it is time to focus on new performance attributes and identify new segments.

In the camera industry, Canon and Nikon others, moved to making semi-professional, digital single lens reflex cameras. Some firms, e.g. Casio, have focused on other performance attributes such as the ability to capture many images in a very short space of time. The industry has reached a stable and well consolidated phase, where it may once again be vulnerable to technological shifts.

QUESTION TO READER:

How will you make sure that your company does not get caught up in a "pixel war" i.e. a war based on rapid incremental improvements? And how will you make sure that your company focus on trying to find new performance attributes or new markets?

TOOLS

Work with scenario analysis and use the S-curve logic to predict when the new technology will displace your existing products. Kodak successfully forecast the digital revolution using this technique, hence, it is possible to predict the future.

In the early phases, work with concept development rather than product development. By lowering demands and focusing on knowledge creation, the risk that this effort will be dismissed as an addition cost will be reduced. 'Stage-gate' procedures are not to be preferred in the early phases.

Try to map technology supply to market demand in different segments of your industry. By doing so, potential nursing markets can be identified, making it easier to see when the new technology is starting to overshoot customer demand.

Use the Blue Ocean Strategy principles (reference below) in order to look for potential ways of competing once the technology starts to mature.

FURTHER READING

Suggestions of further reading to help the interested reader to explore the presented knowledge further.

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