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**CHAPTER 6**

Assessing Future Markets

for New Technologies

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*The challenge of assessing future markets for new technologies is to determine*

*the demand for products that don’t exist from customers who don’t yet*

*know about them. At the same time, the trajectory of technology development*

*and speed of market acceptance are also uncertain. In this market vacuum,*

*there is not enough oxygen to sustain traditional methods of marketing*

*assessment. But there are a variety of approaches that can be used to better*

*understand market potential in this environment. This chapter examines*

*the adoption patterns for new technologies, strategies for continuous exploration*

*and learning, and the “triangulation” of insights about lead users, latent*

*needs and inf lection points. These strategies can give character and*

*dimension to the embryonic and evolving markets for emerging technologies,*

*providing clues to their ultimate potential.*

**W**hat will the market be for *automated*

*highway systems* and when will it emerge? These “smart highways”

will enable vehicle control (with collision warning and avoidance and navigation

help), automated toll systems, and even automated driving and steering

lanes. They will require the integration of technology for automated

vehicular control, satellite-based global positioning systems, and roadway

sensor systems. If and when these technologies come together, will potential

customers be interested? The reactions of potential users to rental cars with

navigation aids or automated toll systems while commuting may provide

some clues about potential benef its, barriers to use, price sensitivity, and

eventual acceptance. As the systems technology continues to advance, however,

the big questions about the market remain: How quickly should trials

be launched? Who should take the lead role? Will regional governments128 Managing Markets

mandate these systems to solve problems of congestion? Will drivers be willing

to pay for the technology once the benef its are demonstrated?

Within a decade, *biochips* (formally known as DNA arrays)1 that have

the ability to analyze thousands of genes at one time should make it possible

to analyze a person’s genetic risks for scores of diseases. In the future,

patients with maladies such as a sore throat could have a culture tested with

a disposable biochip with the ability to check for a myriad of microbial

genes and determine exactly the right drugs to prescribe. How big is the

market for these disposable chips and when will it emerge? Technologists

must be able to economically produce biochips that can accurately detect

gene glitches that cause disease. Patients and doctors must be convinced the

tests help by guiding preventive therapy for example, and insurance companies

must be willing to pay for the tests. In the meantime, numerous

startup companies are exploring the breadth of applications and big pharmaceutical

companies are placing their bets by investing in these companies.

The next generation of *rapid prototyping technologies* use laser cutting

or ink-jet depositions of material to quickly transform complex threedimensional

CAD images into solid objects of powdered ceramics or metal.

At present, these shapes are models used to guide the product design process,

but in the future they can be saleable end products. The technology

could be used to make big objects such as tank turrets or airplane parts or

customize a tennis racket with a grip uniquely conf igured to f it an individual

player’s hand. Which applications will prove a feasible basis for a

market?

Each of these technologies has exciting prospects. But the history of

emerging technologies is that early champions held compelling visions about

the future market prospects. Whether the envisioned markets materialized

depended on resolving a series of uncertainties.

The Challenge of

Emerging Markets

The turbulence and uncertainties of future markets for new technologies

confound the research approaches that have been honed for assessing established

markets. Seldom are there precedents or sales histories to study. Because

the applications are evolving, it is not clear who will be the most

attractive customers, when and how they will use the product, or what

they will be prepared to pay. Since the industry structure is embryonic,

there are many conf licting views and much speculation about potential rivals

or competing technologies. Assessing Future Markets 129

Assessments of markets for new technologies are further complicated by

the interaction between technological development and the rate of market

acceptance. Price and performance improvements come more quickly when

acceptance is accelerating. But this can only happen when the quality and

performance standards are in place and the product can be made, distributed,

and serviced.2 Lack of any one of these elements will slow acceptance

of the technology.

Before the technology is proven and cost-effective, and the market is

still in a nascent stage, the question is whether the market is big enough to

warrant a development project.3 This spawns many related questions: Does

the product satisfy a need or solve a persistent problem of a signif icant

group of customers better than the alternatives? Which segments and applications

will be the most attractive? In what order will they emerge?

As the project progresses, a new set of questions emerges that demands

greater precision. How large is the prospective market, and how quickly

will this potential be realized? Here numerous assumptions have to be made

about the technology improvement trajectory, the availability of standards

and supporting infrastructure, benef its and costs to target customers relative

to competing alternatives, and the collective investment of competitors

in market development.

This chapter is about how firms have learned how to answer these questions.

Yet those who have lived through the emergence of a market for an

emerging technology know that def initive answers are elusive; there are

too many qualif ications and contingencies and the answer depends in part

on the actions of the f irm and its rivals who are also trying to answer the

same questions. A more realistic goal is to reduce the uncertainty to a manageable

level and gain actionable insights ahead of these rivals. Once this

goal is within sight, a new set of questions about how to gain and hold a

viable competitive position in the emerging opportunity space comes to

the fore. The frameworks, methods, and best practices that are covered in

this chapter can help illuminate these issues.4

**Three Approaches**

Useful assessments of future markets for emerging technologies, when uncertainties

are intolerably high, are guided by the following premises:

**1.** *Diffusion and adoption.* Each emerging technology will diffuse at a

different rate and pace into their prospective markets. Some markets

leap ahead while others languish for years before gradually taking off. 130 Managing Markets

Others never come close to realizing their potential before they are

pushed aside by rival technologies. Each path is the outcome of the interplay

between contending forces that inhibit or facilitate the rate of

diffusion.

**2.** *Exploration and learning.* Advantage comes from informed anticipation.

The emphasis should be on rapidly learning from a series of

market probes with successively refined versions of the product, using

the lessons from each probe to guide the subsequent stages in the development

process, and anticipating critical inf lection points in the

market ahead of competitors. Winners are able to surface opportunities

faster, invest in more attractive options, and shape the market to

their benef it.

**3.** *Triangulation for insights.* The ability to absorb uncertainty and anticipate

opportunities faster is enhanced by divergent thinking

processes that surface and explore a wide range of possibilities, rather

than convergent thinking that seeks a closure on a satisfactory answer.

This need is best served by starting with diverse market research

methods, with different assumptions, levels of analysis, and sources of

data. Insights come from a process of triangulation that looks for convergence

of conclusions across the different methods. A corollary to

this premise is that (conventional) market research methods have limited

utility because they were designed for other purposes. Different

research approaches are needed when the customer requirements

aren’t known, usage situations can’t be described, and prospective

customers can’t envision the product concept.

Diffusion and Adoption of Really

New Products

New product innovations take time to spread or diffuse into markets. Some

innovations have a long gestation period and then grow explosively, while

others penetrate their potential market very slowly and exhibit modest sales

growth for many years. The diversity in patterns of growth can be largely

explained by the following characteristics of the product:5

• The *perceived advantages* of the new product relative to the best available

alternative. The value, set by the perceived relative benefits minus

the perceived relative costs, must be suff iciently compelling to motivate

the switch. Assessing Future Markets 131

• The *risk* perceived by prospective buyers because of their uncertainty

about performance, fears of economic losses, or concerns about standards

changing.

• *Bar riers to adoption* (such as a commitment to existing facilities, investment

in the previous generation of technology or regulatory restrictions)

which slow acceptance.

• *Opportunities to learn and try.* Not only must the new product be

readily available (for trial, purchase, and servicing), but the buyer must

also be informed of the benef its and persuaded to try it.

The main driver of the rate of diffusion is perceived relative advantage,

but the other three factors can dampen or impede this rate.

The erratic history of videoconferencing shows the importance of the

perceptions of relative advantage. Initially, the developers of these systems

thought videoconferencing would be a substitute for travel. Meetings

among people from different cities would be conducted by audio and visual

transmissions between these locations, with great savings in time and

expense compared to bringing people to one place. Increasingly, the

prospective users of videoconferencing accept that significant travel savings

are possible, although the immediate and high set-up costs are often more

salient than the subsequent savings. The problem is that these prospective

users discount the benefits because they don’t believe that electronic meetings

can deliver the subtlety and richness of face-to-face encounters. Thus,

videoconferencing is now being perceived as a complement rather than a

substitute for travel. Face-to-face meetings are needed to nurture relationships

and build teams, while videoconferencing is used for the ongoing

coordination needed to sustain these relationships between

get-togethers. This change in perceived benef its has meant that videoconferencing

has been growing in parallel with business travel.

Relative advantage depends on the performance inherent in the technology

and the intensity of stimulative efforts by competitors offering

the new technology. Not even the most promising technology will f ind a

market unless the collective efforts and investments of the competitors to

innovate, market, and reduce the cost of the technology can unlock the potential.

These factors work together to determine how soon the trajectory

of performance of the emerging technology will meet and then exceed the

trajectory of market demand. The prospects for the electric car depend on

when it will be able to (1) go 120 miles before needing a battery charge,

(2) reach a top speed of 80 mph, (3) accelerate from 0 to 60 mph in under132 Managing Markets

10 seconds, while (4) being readily available at a competitive price. Unless

and until these performance thresholds are crossed, the electric car will appeal

only to a specialized segment.6

**Stimulating Diffusion**

While extrapolative models of technology evolution such as Moore’s Law

can help assess the rate of performance improvement, the stimulative effects

of investments and price cutting by competitors are tougher to assess. It is

an inherently dynamic process in which investment decisions hinge in expected

growth which in turn is a cause and consequence of competitive

activity. This iterative sequence is shown in Figure 6.1.

The process is triggered by pioneers who act on the belief that it is usually

better to be a pioneer than a follower.7 Consequently, the promise of

an untapped or emergent market invariably attracts numerous aspirants.

Each entrant is likely to make investments in technology development, facilities,

and entry programs that may not fully account for other entrants

**Figure 6.1**

**Drivers of Market Growth**132 Managing Markets

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with similar plans. The intensifying competition also puts downward pressure

on prices, as cumulative experience helps to lower costs. It is the combined

impact of these investments and real price declines that stimulates

market growth by increasing the market potential and/or accelerating the

rate of growth toward that potential. Among the stimulants of more rapid

diffusion are:

• *Innovation.* Progress in technology is largely driven by the competitive

need to match what the rivals have already achieved while f inding

new edges that the rivals can’t easily imitate.8 The more intense

the rivalry; the more will be spent on R&D, and the greater the urgency

to bring the results to market. The growth of the facsimile

transmission market illustrates how innovation drives market growth.

The basic fax technology has existed since the early 1960s, although

lack of speed and poor image quality precluded initial usage. The f irst

machines were analog devices requiring four to six minutes to transmit

a single page. It was the advent in the early 1980s of digital machines

capable of higher resolution plus faster transmission speeds of 15

to 30 seconds per page that gave the fax a relative advantage over telex.

These advances were accelerated by intense competition among 13

separate manufacturers in Japan. As competition shifted to making

digital capabilities available at lower prices and more convenient formats,

the fax machine became affordable for small business, home

workers, and departments within large organizations. With more machines

to communicate with the utility of those in place increased

rapidly (what are called network externalities). As a result, fax sales

and usage accelerated in 1987, with the number of fax machines installed

in the United States reaching 2.5 million in 1989, up from 1

million in early 1988. The number of pages transmitted by fax grew

at a compound annual rate of 37 percent in the early 1990s. This

growth came at the expense of telex traff ic, which decreased by 50

percent between 1984 and 1987 and has continued to decline.

• *Price.* The most important stimulus to growth is likely to be declining

real prices relative to substitutes. The main reasons for the real

price declines of technology-based products are: (1) experience effects,

as a joint result of cumulative learning, economies of scale, and technological

breakthroughs that result in productivity increases and cost

declines, and (2) a persistent squeeze on the size of the margin between

the prevailing prices and average total costs due to competitive134 Managing Markets

forces. The rate of decline in the relative price also has a direct impact

on the expansion of market potential by increasing the number of new

users who enter the market, and encouraging heavier usage among

current users. To some extent, the rate of decline is also a self-fulfilling

prophecy. As lower prices expand the market and stimulate sales, the

faster increase in cumulated experience enables costs to be lowered,

followed eventually by lower prices and the cycle continues.

• *Collective investments in education and access.* The acceptance of an

innovation will be hampered if the target customers are not aware of it,

do not fully understand the benefits, are not persuaded of its merits, or

cannot find it. Investments in overcoming these barriers are critical in

achieving the market’s growth rate potential. The greater the levels of

collective spending on advertising, personal selling, promotional support,

and distribution coverage, the greater the impact on the perceived

value of the product, which in turn accelerates market growth.

This spending is better viewed as an investment with multiyear

benef its. The purpose is to lead prospective customers through the

stages of the adoption process: **awareness** →**knowledge** →**interest**

→**evaluation** →**trial** →**adoption.** This is an education process,

that is most effective with personal selling that enables a two-way

interaction to identify needs and problems, and show how they can be

overcome with tailored solutions. In the emergent stage of the market,

individual f irms make these investments both to grow the market

and preempt other rivals. As growth accelerates and competition

intensif ies, the purpose shifts to gaining or sustaining an advantage

and defend market share. However, it is the combined effect of all advertising

messages, sales calls, and trade show programs that moves

customers slowly or quickly through the response hierarchy. If expectations

for the emerging technology are bright, then investments are

heavy; conversely if expectations are modest, or conf idence is lacking

then collective investments are modest. In this respect, their collective

behavior becomes a self-fulf illing prophecy.

**Rate of Adoption**

The speed of diffusion of an innovation into a market depends on the number

of buyers who progress through the adoption process, when they start,

and how quickly they make the decision to try. This was a crucial issue for

strategists in the market for digital imaging technologies that enable imagesAssessing Future Markets 135

to be saved in a computer and sent over the Internet to be printed out by

a digital mail box that uses ink-jet technology. Prospects for relative advantage

depend on cutting costs (in 1998, a 4 6-inch silver halide print

cost 8¢ versus 50¢ for a digital image) and improving quality (which meant

increasing the number of pixels by a factor of 5 or 10 so images didn’t look

grainy). Meanwhile there were entrenched habits to overcome. Instead of

dropping a roll of film off at a photo store, would consumers prefer to input

them to a PC? Would they be willing to invest the time to manipulate photos

in a computer? How valuable is the benefit of using the PC to store photos?

Would they be willing to pay extra for a scanner and printer and put

up with the headaches of hooking up the system? The answer was that some

consumers would quickly see that the benef its outweigh the costs and inconveniences.

Who are these early adopters and how can they be identified?

Prospective customers for a discontinuous innovation will self-select into

segments based on degree of risk aversion and intensity of need. This leads

to differences in time of adoption that can be represented as a bell-shaped

curve when plotted over time. After a slow start, an increasing number of

people adopt the innovation, this number reaches a peak, and then declines

as fewer non-adopters remain, as illustrated in Figure 6.2. The adoption

curve can be divided into segments, such that the early and late majority

are one standard deviation away from the mean, while early adopters and

laggards are at least two standard deviations away.

These f ive segments have distinct identities, behaviors, and requirements,

9 demanding different strategies:

**1.** *Innovators* *technology enthusiasts.* These people are committed to

the possibility that any new technology in their area of interest has

promise, and are willing to take the time to master it. They are often

“lead users” who have needs in advance of the rest of the market.

They not only help to prove the new product but their endorsement

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is key to acceptance by the other segments. Later in the chapter we

will describe how to study this inf luential segment.

**2.** *Early adopters* *visionaries.* These adopters see the opportunity presented

by the new capability to change the rules of competition in

their market. They help to publicize the new technology, but are

costly to support because they require special adaptation to their requirements.

Often these visionaries are in specialized niches, such as

the businesses that are attracted to hybrid digital camera/cell phones

that can take pictures in the f ield and instantly send them to a remote

image printer.

**3.** *Early majority* *pragmatists.* This is a large group that decides to

adopt only when the benef its of the technology are well proven, and

the risks are tolerable. They typically buy from the leading f irm because

in a technology market these vendors usually have the most reliable

conf iguration and attract the largest number of third-party

companies into the aftermarket.

**4.** *Late majority* *conservatives.* This segment adopts an innovation

only after a majority of people have tried it. They tend to be pricesensitive,

skeptical of their ability to derive any value from the innovation,

and very demanding. They have high needs for service support

and assurance, but are usually not willing to pay much to have their

demands met, which reinforces their doubts.

**5.** *Laggards* *tradition bound.* These people are suspicious of changes,

and are likely to adopt the innovation only when they have no choice

or it takes on a measure of tradition itself.

The immediate implication of this model is that markets for discontinuous

innovations should be developed by proceeding from one segment

profile to the next. Once the visionaries are interested, make sure they are

satisf ied so they will be good references for the much larger group of pragmatists.

At this point, the strategy shifts to trying to become market leader

and set the de facto standard.

The compelling logic of this sequential market development strategy

may be seriously f lawed, however, because the early adopters often have almost

nothing in common with the pragmatic early majority. Whereas the

visionaries were risk-takers, intuitive in approach and motivated by future

opportunities, the pragmatists are just that—analytic, more evolutionary

than revolutionary, and motivated by solving present problems.10 While

the visionaries accept the bare product itself to get the superior performance

or new functions, the pragmatists won’t adopt until they have aAssessing Future Markets 137

complete product that meets all their requirements. Thus, to make the transition,

high technology f irms found they had to target specif ic segments

within the mainstream market, and develop a fully augmented offering,

rather than trying to diffuse their resources across many different end-use

segments.

Continuous Exploration

of Markets

Most successful discontinuous innovations follow a halting development

path, marked by stop-and-go metamorphoses, before “emerging” from a

series of market experiments with a feasible application. The trial-anderror

learning that led to General Electric’s digital X-ray, and the replacement

of f ilm with computerized imaging is typical. Basic research began

in 1975 in the aerospace business. Sometimes the technology was aimed at

industrial applications, and at other times, medical diagnostic imaging.

After languishing in 1989, it was revived in 1993 when the Internet opened

up the possibility of online medical consulting using digital images. This

time the technology was ready and there was a strong champion to drive

the project forward. The f irst machine was successfully shipped in 1996.

This iterative sequence has been termed “probe and learn” to denote a

process of successive approximations and accumulating learning.11 The path

to market for f iber optics, cellular phones, and CT scanners was found to

be guided by probes with immature versions of the product, learning from

those probes and trying again in different market segments. This process has

a great deal in common with the generic market sensing process that recycles

as shown in Figure 6.3.

The process of market learning is typically sparked by an emerging problem

or opportunity, a technological advance or a belief that further innovation

requires deeper insights into latent needs. This begins the active

collection and distribution of information from prospective customers

about their problems and requirements, decision criteria and constraints,

early reaction to experiences with prototypes in beta versions, as well as ongoing

monitoring of secondary sources and competitive activity.

**Framing the Inquiry**

This critical step asks: What are we trying to learn about? What decisions

have to be made and what alternatives should be considered? The market

inquiry should be viewed as insurance against making bad decisions. It138 Managing Markets

should not be done to satisfy curiosity or justify a decision that has already

been made.

The inquiry needs to be especially alert to a variety of possible market

concepts that precede the establishment of a dominant design. As late as

1994, there was considerable uncertainty about which concept for personal

digital assistants (PDAs) would eventually prevail.12 The possibilities included

(1) palmtops configured like miniature PCs that could run PC software;

(2) electronic organizers with a diary, address book, and calculator;

(3) mobile phones with computer capabilities; or (4) pen-based computers

without keyboards that could perform some of the above functions. Each

was vying to become the industry standard. It was not until 1996 that the

now ubiquitous Palm Pilot emerged as the early winner.

By contrast, once the dominant design has emerged and the market is already

established, the market concept and product requirements can be

quite tightly specif ied early in the development process. Indeed, this is one

of the keys to successful product innovation in established high-technology

markets.13 A robust product def inition that is well grounded in customer

and user needs assessment is an essential guidance mechanism for the entire

stage-gate process, enabling the development team to make trade-offs and

design choices quickly.

**Interpreting and Acting**

Before the welter of conf licting, biased and incomplete information can

be used, it has to be interpreted so patterns can be revealed and understood.

These interpretations are guided by mental models that affect theAssessing Future Markets 139

information that is sought, selected, and simplified. Interpretations of market

signals about nascent or emerging markets are especially diff icult because

the mental models of managers are incomplete and poorly structured,

and prospective customers usually have difficulty envisioning the final version

from their experience with the crude early version. Instead of relying

on direct customer feedback, the interpretation must draw on contextual

information about latent needs, persistent problems or trends in requirements.

This is why a wide array of research approaches is needed.

The cumulative lessons are eventually lodged in the sprawling memory

of the organization—perhaps to be retrieved when needed. Too often,

however, there is collective amnesia about these lessons because of team

turnover, inadequate repositories for the f indings, or an unwillingness to

treat interim failures as learning experiences.

This market-learning process can be subverted in many ways, which accounts

for the wide variance across f irms in their ability to learn about

markets for emerging technologies, and anticipate when the time is right.

Studies of the organizational impediments to a f irm’s ability to learn about

markets f ind three persistent barriers.14 When *acquiring information* there

is a tendency to avoid ambiguity and presume greater familiarity with the

market than is warranted. This means that user requirements do not matter

as much as the “obvious” needs to improve performance. The enemy

of *information dissemination* is compartmentalized thinking where each

department or function focuses on its own goals, so information does not

cross boundaries or is interpreted very differently be each group. *Usage of*

*market information* is susceptible to inertia which means that the information

will be used only when it conforms to prior expectations and market

research methods and tools will be used only if they are deemed to be technically

adequate. A related barrier to learning is skepticism about disconf

irming information, which is subjected to much more criticism and

scrutiny.

Triangulation of Insights:

The Value of Multiple Methods

It has become conventional wisdom that methods such as concept tests,

focus groups, surveys, conjoint analysis, and market simulation are inappropriate

and even misleading when used in embryonic markets for disruptive/

discontinuous innovations.15 This is hardly surprising since these

methods were designed to understand opportunities and strategies for140 Managing Markets

incremental innovations in established markets. They are well suited to

support formal stage-gate product development processes, where requirements

are well-def ined, but fall apart under the weight of uncertainty and

proliferation of alternatives during the trial-and-error development of an

emerging technology.

This does not mean that one cannot systematically learn about nascent

markets with barely known requirements, applications, and attributes.

Available methods have to be adapted and new approaches fashioned to

accommodate endemic uncertainty. In deciding which methods to use, and

how to use them two considerations must be weighed.

First, no single method will suff ice, because all methods are f lawed or

limited in some important respect. Thus, analogies with markets for technologies

with similar characteristics are suspect because the situations may

not be comparable in critical but unknown respects. Similarly, surveys of

experts using Delphi methods to assemble composite forecasts of demand

may be no more than a pooling of collective ignorance. While a single

method is limited, a combination of methods—each asking the same question

in a different way and prone to different biases, with the various methods

yielding conclusions that are directionally similar—deserves greater

conf idence. The process of triangulation of results looks for common

themes and patterns after accounting for probable biases.

Second, it is a truism that prospective customers can’t envision radically

new products based on discontinuous innovations, and judge the early

versions of the emerging technology from the standpoint of the refined versions

of the established technology. However, they can be eloquent about

their needs, problems, usage or application situations, and changing requirements

that will dictate their eventual acceptances—but only if the

right questions are asked.

This point seems to have escaped many commentators, judging from the

following quotations:

Customers are notoriously lacking in foresight. Ten or f ifteen years

ago, how many of us were asking for cellular telephones, fax machines,

and copiers at home, MTV, 24 hour discount brokerages, cars

with on-board navigation systems . . .16

The familiar admonition to be customer-driven is of little value when

it is not at all clear who the customer is—when the market has never

experienced the features created by the new technology.17Assessing Future Markets 141

By dismissing conventional methods that obtain direct feedback from

prospective customers, they overlook rich possibilities for market insights

from indirect methods of inquiry.

The story of Corning’s early exploration of the most promising markets

for f iber optics has been cited as an example of the shortcomings of conventional

market research. A team of consultants proceeded to match the

key attributes and benef its of optical f ibers with potential market applications.

The most promising candidate was judged to be local area networks

(LANs) because they needed high capacity and cost was not a major stumbling

block. This analysis pointed Corning *away* from the most signif icant

opportunity—long distance telephone lines.18 They could, however, have

adopted an indirect approach similar to the one used by Xerox to get an

early estimate of the market for fax machines (for details, see Chapter 2).

Instead of getting responses to concept statements, they looked at the latent

needs for the fax capability based on analysis of the frequency of customer

needs to send messages. Corning could have learned more by undertaking

detailed analyses of the future capacity requirements of long distance carriers

to estimate the future demand.

While the centerpiece of an assessment of a future market for an emerging

technology should be the results of probe-and-learn experiments, there

are four specific methods that help to interpret and extrapolate these results.

Lead user and latent needs analyses are especially useful while the market

is still emerging and the product concept is still f luid. As the market moves

toward take-off, more formal diffusion and information acceleration models

are appropriate.

**Learning from Lead Users**

The guiding premise of lead user analysis is that some prospective consumers

have pressing needs that may eventually be widespread in the market

and face them ahead of the rest of the market.19 Because they expect

large benefits from finding a solution to those needs, they innovate on their

own. These innovators and early adopters are often pioneers in their own

markets or activities—such as developing biochips—but find their progress

is being thwarted because they can’t f ind processes, materials, or instrumentation

that meets their novel requirements. In frustration they may try

to solve their problems by making their own equipment.

The virtues of lead user analysis can be seen by contrasting it with

established ways of identifying market trends and latent needs. Firms142 Managing Markets

customarily go to users at the center of the market, using methods such as

focus groups to get reactions to proposed concepts, site visits to observe

users at work, queries to sales representatives in contact with customers, or

customer evaluations of current products. The in-house development team

uses these inputs to brainstorm their way to new ideas. By contrast, lead

user analysis presumes that savvy users are already working on innovations

in response to their pressing needs. The job of the development team is to

find especially promising users and adapt their ideas to the business’s needs.

There are three kinds of lead users to be found. Of immediate interest

are those in the target application who have actually experimented with

developing prototypes. Thus, an auto manufacturer looking for designs for

innovative braking systems would talk to builders of race cars. Next are

those in analogous markets with similar applications. A health care firm interested

in antibacterial control products for humans might f ind a lead user

in veterinary sciences. Third are lead users involved with important attributes

of the general problem. Refrigerator makers could look at the supercomputer

industry where cooling technologies are critical to the operation

of the computers.

Lead users can be elusive. This is especially so when the emerging technology

has many possible applications. This was the problem faced by developers

of organic, light-emitting diodes that are light, bright, ultra thin

and f lexible, and easier to produce than most other types of f lat screens for

computers and television. Instead of conducting a survey of all prospective

applications to uncover a few lead users, it is better to start with an underlying

dimension these users desire. This would identify users who have

needs for bright screens that are very lightweight, such as makers of jetliners

seeking to reduce the weight of the current bulky ceiling light f ixtures.

Lead users are also highly dissatisf ied with existing products and are

actively searching for alternatives by participating in informal networks

and user groups.

Because these lead users have early experience with the problems the

emerging technology is trying to solve, they can provide rich and accurate

feedback about needs, application requirements, and reactions to design

concepts. They are also highly motivated to participate in beta tests, early

market probes, and joint development activities because the pay-off is so

great. They are also less likely to be deterred by the high initial prices

of the early development versions. In short, they are leading indicators that

are far more valuable than a random collection of prospects collected for a

focus group. Assessing Future Markets 143

Most lead user projects begin with a major trend that is changing the

arena being explored. Thus, a team focusing on improvements in medical

imaging was well aware of a trend toward the detection of ever smaller features

such as early-stage tumors. They started by contacting experts in radiology

to identify those working to solve the most challenging imaging

problems. Their next step was to ask these lead users if there was anyone

who was ahead in any aspect of the problem. These queries surfaced a separate

community of specialists in the military who were enhancing the resolution

of images with the aid of pattern recognition software. Eventually,

specialists from these different areas were assembled for a three-day workshop

to combine their technologies and experience to design product concepts

that could meet the needs of the medical imaging company. During

this process, the focus of the project shifted from the incremental improvement

question, of how to create higher resolution images, to enhancing

the radiologists ability to recognize medically signif icant patterns

in images. This had profound strategic implications and led the f irm to

master some new software technologies that their rivals didn’t understand.

**Learning about Latent Needs**

Sometimes the technology is at a point in its development when even lead

users have not emerged or the most attractive markets may be different

from those that f irst adopt the technology. Sometimes the technology can

address needs that customers do not even know they have. How does one

hear the unspoken voice of the market and identify these latent needs? One

way to improve the targeting of market opportunities is to look for indirect

evidence of market needs through an immersion into the customers’

world. It takes a “prepared” mind to devise the right method for surfacing

and understanding the latent needs that will be satisf ied by the emerging

technology. By def ining latent needs as evident but not yet obvious, we

are reminded that it will take energy, intuition, and informed judgments to

extract useful lessons from the following methods.

***Problem Identification.*** There is no better place to start than with the

problems and frustrations customers have with the currently available solutions

to their needs. The concept of relative advantage is based in the

ability of the new approach to deliver more benef its at a lower cost. The

attractiveness of biochips is their ability to address the doctor’s diff iculties

in arriving at a diagnosis and then prescribing the right drug. The costs of144 Managing Markets

the current trial-and-error approaches are highly visible; the most attractive

diagnostic opportunities are those where the costs are greatest.

Problem detection approaches can be used throughout the development

process to uncover barriers to acceptance of the emerging technology itself.

For example, despite high early interest in solar heating systems, few systems

were installed. As prospective customers learned more about total system

costs, including maintenance over the lifetime of the system and the

risks of f ire damage due to system failure, their interest waned.

***Story-Telling.*** Another kind of dialogue asks customers how they behave

and how they truly feel. Kimberly-Clark listened over and over to stories

from parents before they realized that parents viewed diapers as clothing

that signals particular stages of development, not as waste-disposal fodder.

Armed with this insight, they developed training pants that looked and f it

like underwear, yet still kept accidents on the inside. Such f inely detailed

stories and case experiences help surface unanticipated purchase criteria.

While these techniques have apparently not been applied to probing for

underlying beliefs and motives about emerging technologies, there is no

reason they couldn’t be adapted.

***Observation.*** The advantages of observation over direct inquiry are that

it occurs in a natural setting and doesn’t interrupt the usual f low of activity;

second, that people give nonverbal cues of their feelings as well as spontaneous,

unsolicited comments that are stimulated by an actual product or

prototype; and third, trained observers with knowledge of technical possibilities

can see solutions to unarticulated needs or problems which users

could not conceive.20 This is why f irms like Sony and Sharp have set up

“antennae shops” so they can watch prospective customers pick up and try

to use their new products. The salespeople are trained to delve into the

reasons for the observed reactions.

**Anticipating Inf lections**

An inf lection is a noticeable shift in the character of demand that presents

opportunities to seize or lose advantage. An inf lection point is encountered

when the slope of a curve (mathematically, the second derivative) changes,

as when it goes from concave to convex. In the ambiguous and uncertain

market for an emerging technology, rewards come from anticipating these

inf lections ahead of everyone else. Assessing Future Markets 145

The two inf lection points that matter are (1) the take-off in market demand

as the product starts to diffuse beyond the lead users and technology

enthusiasts, and (2) the onset of aggressive competition aiming to capture

the most attractive opportunities. Because market turning points are the

product of the interplay between contending forces that facilitate or inhibit

growth, there will be confusing signals and conf licting points of view. The

anticipation of an inf lection point is foremost a question of being able to

read the pattern in the signs. This requires knowing which indicators to pay

attention to, and an ability and willingness to separate the signals of transition

from the background noise. This takes a combination of methodical

guesswork, tracking of leading indicators, and diffusion modeling.

***Methodical Guesswork.*** This in effect is what Forrester research did

in 1999 to forecast a take-off in Internet advertising revenues from $550

million in 1997 to $33 billion worldwide by 2004.21 They f irst charted ad

spending per person in conventional media, and then compared each

medium to the Internet. Key questions and assumptions were: Will Internet

ad spending reach the level of newspapers? (No, because of the local

presence of newspapers.) How does online advertising compare to TV advertising?

(Inferior due to a lack of bandwidth.) But ad spending per person

was expected to surpass that of magazines and radio. A key assumption

was that more dollars would be drawn to the web because of new technologies

that would improve the accountability of advertising in this

medium. The total online ad-spending f igure was multiplied by a forecast

of Internet population growth, to reach the final numbers. The eff icacy of

this forecast procedure depends on having diverse sources of information

and an intense dialogue and debate about major assumptions. What gets

lost in the seemingly precise f igure that emerges is any sense of the uncertainty

surrounding the assumptions. It would be much more appropriate to

provide a range of estimates.

***Tracking Leading Indicators.*** Methodical guesswork needs to be complemented

with careful tracking of early signals of the take-off in market

demand as the product diffuses beyond the lead users and technology enthusiasts,

and the onset of aggressive competition aiming to preempt attractive

opportunities. Among the variables to watch are:

• The trajectory of the performance of the technology on key parameters

compared to target customers expectations. 146 Managing Markets

• Experience of lead users and other early adopters during market

probes.

• Customers’ perceptions of barriers to adoption and level of risk.

• Rate of competitive entry and collective investments in product availability

and market access.

• Progress in building the infrastructure and resolving issues about standards,

and complementary products.

***Diffusion Modeling.*** After a market for an emerging technology has taken

off—and the technology is now emergent—the remaining uncertainty is

over how long growth will continue. Will sales slow abruptly or continue

to expand? These are questions well suited to a diffusion model known as

the Bass model. The essence of this model is a forecast of the rate of adoption

(or initial purchases) and a forecast of the inf lection point when growth

starts to slow. These two predictions are based on estimates of the eventual

market potential, and two parameters corresponding to the propensity of

buyers to innovate or imitate.22

The underlying structure of the diffusion model is shown in Figure 6.4.

The number of new adopters per period is the same bell-shaped distribution

we discussed earlier in the chapter. This distribution peaks at T\*

which corresponds to the point of inf lection of the S-shaped curve that ref

lects cumulative adoption. Cumulative adoptions peak at a ceiling, which

is the estimated potential demand.

In practice, this model is seldom used in the earliest stages of the emergence

of a market but it is very useful for later stages. The major drawbacks

are: (1) the model cannot be estimated without a few periods of actual sales

data; (2) the forecasts are unstable when there is high uncertainty about the

potential number of adopters, because the relative advantages over existing

technologies (which are also improving) have not been established; (3) the

model assumes there are no supply restrictions. If the infrastructure is not

in place or the product is not readily available, then the excess unmet demand

will presumably generate a waiting line of potential adopters. Here

is where artful adaptation is needed. With some informed guesses about

the rate of early sales and the eventual market potential, along with estimates

of model parameters based on sales histories of analogous products

a forecast can be derived that is useful for testing the feasibility of other

forecasts using different approaches.

***Information Acceleration.*** This method literally “accelerates” potential

consumers into an all-encompassing future environment. These consumerscan experience an array of potential products and services that are simulated

on an interactive multimedia workstation. They see and hear advertisements,

product descriptions, simulated testimonials, sales presentations, and

other communications. Once they are conditioned to the future, they are

asked to choose among a variety of offerings at different price and performance

points.

This method was applied in 1995 to assess the attractiveness of a wide

array of multimedia products that were enabled by planned broadband

networks that could send enormous amounts of digitalized information

over f iber optic cables. Although the Internet had only penetrated 2 percent

of households and broadband networks were just beginning to be built,

there was already a consensus that (1) video-on-demand services would148 Managing Markets

boom, (2) in the near-term, the Internet would not achieve penetration

outside of sophisticated high-end users, and (3) video telephones would

still not become a short- to medium-term opportunity.

To test these assumptions and identify the areas of opportunity within

the broadband market, Mercer Consulting undertook an information acceleration

study with 850 randomly chosen consumers.23 These consumers

were asked how they would use the new technology—as though they were

in the richer, more “futuristic” environment of 2000 to 2005. They were

introduced to services ranging from home banking to video-on-demand to

time-shifted television and asked whether they would buy them at different

price points or stick with the ones they currently had.

The results predicted that the conventional wisdom would be wrong and

that investments based on these assumptions would be wrong. Although

the study found there was demand for video-on-demand services, and that

a consumer would pay up to $45 a month for them, this was not enough

to justify an investment of as much as $1,600 per household to upgrade the

telephone and cable networks to full two-way broadband capability. The

research also predicted that consumer online services would be a $5 billion

market by 1999 with 30 to 40 percent household penetration. Both predictions

have been verif ied by events, which increases our conf idence that

consumers can evaluate emerging technologies when they are put into a

realistic choice situation.

Conclusion: Informed Anticipation

about Markets

The disruptive character of emerging technologies makes point forecasts

and extrapolations of their eventual market prospects a futile exercise. It

could even be counterproductive if misplaced precision leads to overconfidence

and insensitivity to surprises. No single forecast can possibly absorb

all the uncertainties about customer responses, competitive activity, and

technological progress, or consider all the complex interactions, discontinuities,

threshold effects, and other nonlinearities. The best that can be

done in the early stages of the development of the technology is to demonstrate

that the market is likely to be big enough to warrant a development

project.

The proper emphasis of market assessment activities should be on learning

from market probes and anticipating the critical inf lection points ahead

of the competition. However, tracking and probing are only the f irst stepsAssessing Future Markets 149

in informed anticipation. The actual learning comes when the organization

can make sense out of the data and resolve important uncertainties. The

problem is that most managers f ind high levels of uncertainty so diff icult

to tolerate that they impose patterns where none exist. They may borrow

or create seemingly logical rules of thumb to decide issues in the absence

of discernable patterns. The result is that decisions are made on the slippery

basis of unwarranted and untested assumptions about the market opportunity

or the proper path of technological development. Two useful methods

for combating premature closure are discovery-driven planning and scenario

analysis24 as discussed in Chapter 10. Both are designed to surface and

challenge key assumptions and focus on the sources of uncertainty The

need for validation of assumptions brings the learning process full circle, by

directing specif ic market inquiries at the most critical areas of uncertainty.