
Discovering Opportunities and Threats for Innovation

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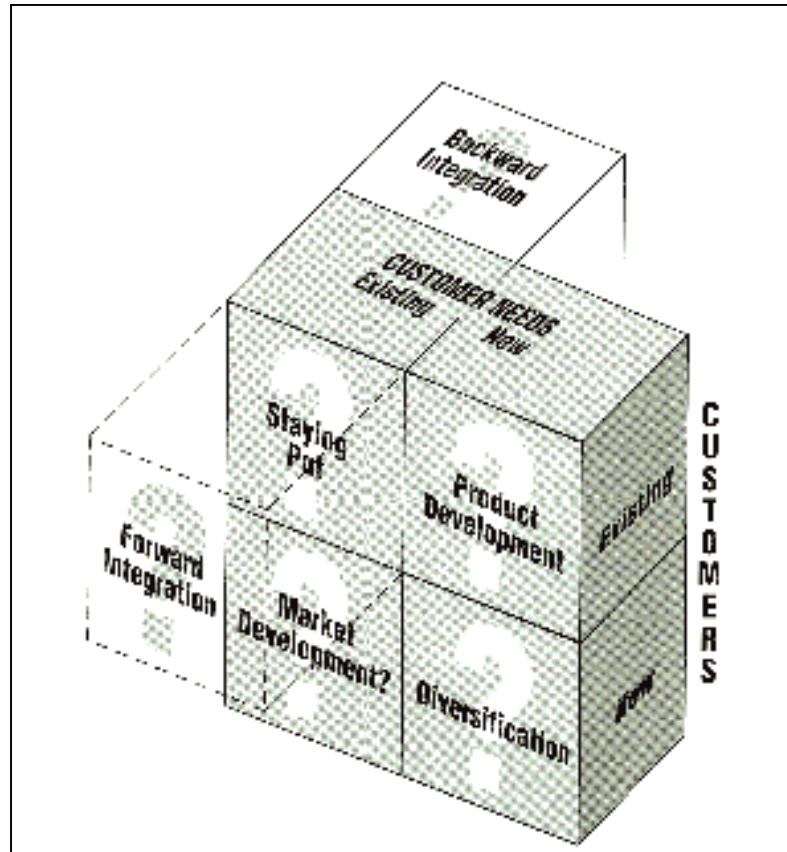
Defining a Market

A market is composed of three major elements: customers, competition, and technology. Customer needs are anticipated and filled through the use of technology by the enterprise and its competitors. A market must have, in addition to customers, competition, and technology, a time frame, geographical reference, scale, and scope. In a market, money, goods, services, and/or information are exchanged.

Markets have evolved over time. In its earliest use, market referred to a place, usually a juncture between roads where people were likely to meet. In time, markets became more specific places for exchange within towns and villages. However, in today's environment markets are no longer always tied to a concrete locale; instead the term has come more to represent a set of conditions. These conditions generally are descriptions for each of the elements mentioned above. Defining a market is not a linear process.

The methodology described in this article assumes that the enterprise has at least a vague sense of direction. It assumes that there is an ongoing purpose and that the enterprise is attempting to make decisions about whether to:

- Stay where they are
- Develop new markets
- Develop new products or services
- Diversify
- Integrate their operations either forward or backward in the supplier-customer value chain as shown below.



The process of understanding a market and discovering the opportunities and threats in a market is integrative. After developing an initial understanding of a market and a strategy, which helps the enterprise take advantage of that opportunity, it is useful to assess the consequences of that strategy on the market:

- How will it affect customer needs?
- How will competition respond?
- How will it affect the development of technology?
- After the enterprise has developed its projects, resources, and culture to produce output, which will have consequences to a market, another assessment of the market's opportunities and threats must be conducted.

Driving Forces Affecting the Market

Once an initial definition of the market is created, the next step involves taking a "world view" of the driving forces for change and how specific key forces are affecting the current structure and future development of the market. Driving forces for change can be placed in five categories.

Each category is in itself a collection of trends, events, developments, and realities. Each represents a strategic context within which we all live and operate. However, it is the interaction between these categories and their interaction with the market that creates the great force that culminates in change. And, this change creates needs.

Examples of current driving forces for change at the global level are:

- Social: The women's movement
- Political: The breakup of the U.S.S. R.
- Economic: Recession in Japan
- Demographic: The birth rate in China
- Scientific: Birth control technologies

It is important to restate that it is the interaction between these categories and in turn their influence upon the market that creates the turbulence and dynamics of the market. And it is crucial to remember that, for all the reasons stated this period in history is more turbulent than any other.

Let's bring these forces down from the macro level to the micro level, from global markets to an individual. A Hispanic American male who is 55 years old (demographic), unmarried, the single parent of small children (social), a Republican who voted for Clinton (a Democrat) (political), underemployed (economic), and the owner of a state-of-the-art personal computer with multimedia capabilities (technical) has a different set of needs in many markets than other people. Markets are made up of people who individually and collectively respond to and create driving forces for change. This is why the segmentation of a market is always along one or more of these regions of driving forces for change, and this is also why traditional market research methods, geared to the individual, are usually not useful for assessment of customer needs in the strategic time frame.

What is needed to determine the probable strategic needs of customers, capabilities of technologies, and responses of competition is a methodology to assess the impacts of the driving forces in the market. This article will describe such a methodology, which has been proven practical by use.

No method can completely predict the future except in "uninteresting" times. In times and markets where little or no change is occurring, or change has been following a predictable pattern, it is easier to predict the future. But, in that case, the enterprise's competitors can also predict the future and it is difficult to establish sustainable competitive advantage.

There is an ancient curse, "May you live in interesting times!" As difficult as life is in interesting times, it is in interesting times that change can be exploited to create or expand markets and to develop significant competitive advantage.

In interesting times, markets are chaotic. Chaos describes a state which is not random but which also does not have simple order. The future is always chaotic. There is a higher degree of order in a chaotic market than meets the eye of a casual observer. To determine the probable futures of a market, the enterprise must develop knowledge of the strong attractors, the interaction of the driving forces for change with each other and customer needs, the technological capabilities, and the competitive responses, around which the future of the market is likely to evolve.

Determination of the driving forces initially is a simple matter:

1. Develop a description of the market.
2. Establish the time frame for the analysis, i.e., five years.
3. List, by category, the driving forces for change that will influence the market you described over the time frame you have identified. Keep in mind that each category must have at least one driving force.
4. Rank each of these forces within its category (social, political, economic, demographic, and scientific).

If this is a new market for the enterprise or a market, which the enterprise does not understand, it is advisable to obtain help in determining these driving forces. Information can be obtained by secondary or primary research, calling on expert opinion, using focus groups, or by creating a facilitated team of people within the enterprise each of whom has partial knowledge.

Customer Needs

Who Are the Customers?

Enterprises have the tendency, over time, to focus on themselves, their own capabilities, and their own processes. This is especially true if the enterprise has been successful in the past. They begin to lose contact with customers and begin to trust in their own judgments. This has been exacerbated by the push to shorten the commercialization cycle. Trusting your own judgment is quicker than the messy process of staying in touch with customers. To counter these tendencies, managers are now being encouraged to stay in touch with the customer, or to "listen to the voice of the customer." Many total quality management programs have a large component of customer involvement.

These exhortations to "listen to the customer" are fine if taken in the context of the competition and technology, and the driving forces for change. But the real question is, "Who are the customers?" It does no good to ask "customers" what they want if you don't know who all the customers are.

In fact there are three different types of customers that an enterprise must contemplate. These

three types are most easily considered along the lines of whether they currently purchase from the enterprise or the enterprise's competitors. Current customers are presently customers of the enterprise, identified potential customers are presently customers of the enterprise's competitors, and unidentified potential customers are presently not customers of either the enterprise or its competitors.

As an example, for the market of fast-food hamburgers, McDonald's has Whitney as a current customer. Donna, her mother, is an identified potential customer, and her grandmother, Louise, is in the unidentified potential customer category. Louise never goes to purchase a fast-food hamburger. Donna prefers a Whataburger. Whitney, incented by the advertisements and toys, always wants to go to McDonald's.

The classification of current, identified potential and unidentified potential customers is a valuable first pass at segmenting the market. When the enterprise knows little about the market, this classification system provides a structure that is powerful in focusing its requirements generation process and its marketing efforts.

Segmentation of a market is essential to the success of any business in today's environment. The more that is known about the market, the more refined the segmentation can be and therefore the more targeted the needs and marketing approaches can be.

A simple example of segmentation is the market for faxes. A first impression may be that any business of any size already has a fax. If, however, the classification of customers is combined with a segmentation scheme based on the type of customer, some insights emerge.

Type of Customer	Customer Classification		
	Current	Identified Potential	Unidentified Potential
Large Enterprise	X	X	
Small Enterprise	X	X	X
Individual			X

In the above table, the X's represent where the primary customers are. In fact, there are some customers in all classifications and types. Most large enterprises have already purchased faxes, but there are still some small enterprises that have not purchased faxes, and individuals have just begun to purchase them for personal use.

This type of analysis obviously provides a way to expand the market for a fax manufacturer. If they only ask questions of their current customers, the enterprise will only find out how to maintain them as current customers. This is of vital importance to the enterprise. To not maintain current customers is to lose market share to its competitors. Requirements obtained from the enterprise's current customers for faxes will more than likely be focused on the problems of current products

and services. The enterprise may also hear about some improvements required. However, it is rare that a current customer will tell the enterprise about significant changes required.

In general, it is only when competitors have begun to make inroads with the enterprise's customers that the current customer will be able to describe needs that require distinctive or breakthrough innovations. (There are always rare exceptions, and these are the best type of customers to cultivate, ones who are knowledgeable about a wide variety of direct, indirect, and structural competitors.) Ironically, then, when the enterprise has done the best job of current customer management, is the time when the enterprise learns the least from them. A strong base of highly satisfied customers who are looking to no other enterprise to meet their needs can be a problem. When the knowledge eventually becomes available to them, as it always does, and they reluctantly begin to adopt your competitor's solutions, the changeover is rapid and cataclysmic. By that time, it is too late; the enterprise has lost its leadership position.

Gathering requirements from the enterprise's competitors' customers helps. This will give the enterprise information about what it will take to get these customers to switch from the enterprise's competitors. Finally, gathering information from the class of customers labeled "unidentified potential" gives the enterprise information about what it would take to convert a person or enterprise in this class to a customer. This is likely to require at least a distinctive and possibly a breakthrough innovation.

Segmentation of a market is highly sophisticated in today's economy. It is one of the key elements of any successful marketing campaign. It is possible, with today's technology and information databases, to tailor marketing approaches down to an individual level. Called "One to One Marketing", this is an application of the "mass customization" trend. Enterprises that successfully determine the appropriate segmentation that facilitates the opportunity and threat analysis necessary for product planning and development, and marries that with "mass customization" and "one to one marketing" will create enormous wealth.

What Are Customer Needs?

The purpose of any method used by an enterprise should be to help the people in the enterprise, and therefore the enterprise itself, to make better decisions. To make better decisions, more or higher-quality information is required. Enterprises are today immersed in a sea of noise, as there is such a proliferation of sources and expansion of those sources' capability to create new information. Without structure and methods to analyze and synthesize all this information, it remains noise. With structure and methods it is possible to develop the information into data that can be used to make decisions. However, even better decisions can be made if knowledge and wisdom can be extracted. These provide the basis for the insights which not only help the enterprise make better decisions but help it determine what questions to ask. The game is not one of precision but of accuracy. It is far better in today's environment to be approximately correct than to be precisely wrong. The enterprise must focus on its effectiveness first and then turn its attention to its efficiency.

Determining Customer Needs

There are numerous techniques to determine customer needs. Some are focused on the methods of obtaining the data and some are focused on extracting better knowledge from the data. This is not a treatise on market research techniques; it would require far too much space even to list and describe them all here. What is important for our purposes is to determine which type of technique is best applied to what type of customer. Therefore, this section will focus on methods of obtaining the information rather than ways of analyzing and displaying the data.

There are four different types of techniques to determine customer needs. In common usage, these are called market research techniques, but as we define the market to be customers, competition, and technology, we will call them customer needs analysis techniques. The four types of techniques are:

- Surveillance
- Trend analysis
- Expert opinion
- Integrative techniques

Surveillance

Surveillance techniques are based on observation of customers either indirectly, by watching what is being written or said about or by them, or by direct observation of their actions. Scanning, monitoring, and tracking of print media is an excellent way to keep track of what the enterprise's current customers and identified potential customers are up to and what their needs may be. Scanning means looking at a wide variety of sources of information to pick up the "blips," the early warning signs of impending change. As with a radar scan, once these signs of change are detected the enterprise can narrow its surveillance range to the region around the area of change, switching to monitoring. If the event proves to be important, the enterprise can then switch to tracking what's being written about the particular customers or application. Surveillance techniques are particularly good for current and identified potential customers. But, as can be seen, scanning can even be useful for unidentified potential customers. The Internet, with its hundreds of millions of pages of information are extraordinarily useful for surveillance. Search engines, robots and specialty programs facilitate scanning, monitoring and tracking.

For example, a company providing training in the use of personal computer programs would want to scan the want ads to determine who is hiring people and what personal computer (PC) skills they require. Articles on growth or problems of companies provide insight into needs, and finding out what companies have recently purchased computers would be beneficial.

Direct surveillance techniques are most often used by consumer product or service businesses. Watching how people shop and make decisions, electronic means of counting visits to different types of displays, and devices to monitor television viewing habits are a few of the many direct surveillance techniques.

Surveillance techniques, especially the direct ones, are most useful for determining present needs of customers. The reason is obvious: it's hard to find a future customer. However, surveillance over time can establish a trend that can be used to forecast future customer needs.

Trend Analysis

This is a place where the driving forces can be used directly. Faith Popcorn has had an extensive surveillance program in effect aimed mostly at the social forces affecting the consumer market. She has identified ten trends that are important in American society today:

1. Cocooning: The need to protect oneself from the harsh, unpredictable realities of the outside world.
2. Fantasy adventure: Modern age whets our desire for roads untaken.
3. Small indulgences: Stressed-out consumers want to indulge in affordable luxury and seek ways to reward themselves.
4. Ergonomics: The sterile computer era breeds the desire to make a personal statement.
5. Cashing out: Working women and men, questioning personal career satisfaction and goals, opt for simpler living.
6. Down-aging: Nostalgic for their carefree childhood, baby boomers find comfort in familiar pursuits and products of their youth.
7. Staying alive: Awareness that good health extends longevity leads to a new way of life.
8. The vigilante consumer: The consumer manipulates marketing and the marketplace through pressure, protest, and politics.
9. 99 lives: Too fast a pace, too little time, cause societal schizophrenia and force us to assume multiple roles and adapt easily.
10. Save our society: The country rediscovers a social conscience of ethics, passion, and compassion.

Popcorn has demonstrated that the power to judge whether markets, products, and services are in tune with these trends. She states that in general practice it is important to have at least four of these trends supportive of a product or service.

Using the market-driven innovation methodology, the impacts of social trends such as those identified by Popcorn can be converted into potential customer needs, and customer need trends can be established. However, even in consumer markets, the other driving forces must be considered. For it is at the intersection of several driving forces and customer needs that significant opportunities exist.

Traditional methods of trend analysis involve the collection of historical data on customer needs for specific functions. Speed, accuracy, precision, performance, and defect levels are all examples of

customer needs on which data can be accumulated over time. Once a trend line has been established by looking at the past, a forecast of the future can be made. A great deal of caution must be exercised at this point. Forecasting the future by looking at the past is a lot like trying to drive a car by looking at where you've been. It'll work fine as long as the road is straight (i.e., the future is like the past), there are no other cars on the road (i.e., competition does nothing), and there are no animals or people who cross in front of the car (i.e., no driving forces for change).

When forecasting the future from the past, always look at all the driving forces and ask these questions: "How will this driving force impact this trend? Will it cause the rate of change in needs to accelerate? To decelerate? Or will it create entirely new needs?"

Another method of forecasting needs is by looking at early adopters. There is a generally accepted pattern of adoption of new products or ideas. Early adopters are individuals or enterprises who have advanced needs or who see the potential in new concepts long before the majority of the market. These early adopters can act as precursors to the rest of the population if the lead-lag relationship has been established for previous products or services, or if it can be inferred from the behavior of the other markets. Determination of the characteristics of early adopters is a well-refined science and art.

Expert Opinion

Expert opinion techniques constitute the bulk of customer research tools. Experts can, and in many cases must, be drawn from several categories:

Customers	Competitors	Strategic Relationships of Customers	Researchers	Opinion Leaders
Current	Direct	Customers' Customers	Academics	Politicians
Identified Potential	Indirect	Suppliers	Consultants	Lobbyists
Unidentified Potential	Structural	Others	Government Personnel Association Personnel Writers	Special Interest Groups Business Leaders Government Leaders

There are a wide variety of techniques to utilize the capabilities and knowledge of experts:

- Surveys
- Oral interviews (personal, telephone)
- Written (paper, electronic)
- Group meetings (actual, nominal, electronic, or paper)

- Publications

The keys to effective utilization of experts are the proper choice of experts to represent the broad cross section of views required in order to get a good forecast of future needs; applying nonbiased methods of posing questions and analyzing answers, and applying methods to have the experts reflect on the impact of the driving forces on needs, are also essential.

Integrative

Integrative techniques can be as simple as having the experts reflect on the trend analysis, and, considering the driving forces, determine whether the trend will continue or not. They can employ complex and highly sophisticated computer models, built for the market being studied, that include the information developed through the other techniques. These models are built upon theory and experience of the way the facts being measured can together depict a future need. It is imperative that information be obtained from a variety of different sources utilizing a variety of techniques. The results of all this research must then be analyzed and synthesized so that an adequate understanding of the customer's future needs can be established.

Importance of the Driving Forces

The driving forces for change are integrated in various ways into this process of customer needs forecasting. The driving forces are used to:

- Determine what questions to ask and where to look for answers
- Sensitize minds to what to scan for
- Determine the impact on trends
- Select experts and guide their considerations
- Frame integrative models

Any one piece of information obtained about customers' future needs has a high probability of being wrong. Guiding the selection of what information to develop and how to interpret that information in light of the driving forces for change improves the probability that the new piece of information will be correct. Integrating several pieces of information from different sources and with different techniques guided by the driving forces for change reduces even further the probability of error.

Determining Customer Needs (Summary)

The following steps must be used to identify and classify customer needs:

1. Identify and list the types of customers in each of the three categories (current, identified potential, unidentified potential).
2. For each type of customer in each customer category, identify current needs, then consider the impact of the driving forces on those needs.

3. For each type of customer, review all the driving forces for change.
4. For each driving force, identify the new needs that will result for that type of customer.

Technologies Impacting the Market

What is technology?

Technology is the practical application of knowledge. It manifests itself in a variety of forms:

- Methods
- Materials
- Systems

In a given market, the detailed examples of these can be classified into the three technology types – direct, supportive, and enabling. Direct technologies are those that are embedded in the product or service, and are visible to the customer, Supportive technologies are those involved in the research, development, design, manufacture, sale, and distribution of the product. Enabling technologies are those that allow improvements in the direct or supportive technologies.

Within a market, technologies exist at many levels. The choice of level of technology is the first key decision that an enterprise must make. For example, in the intelligent transportation systems (ITS) market, there is a complicated hierarchy of technologies. ITS is an emerging market that consists of "smart" cars, "smart" highways, and the communication systems that link them. Technological change could be forecasted from the top level of ITS all the way down to the metallurgy of integrated circuits, and at all the levels in between. A balance must be established between the amount of knowledge required to make a better decision and knowledge of how all the component technologies are going to behave.

The set point for the level of technologies to be forecasted is established through consideration of external and internal factors. The process of setting the level is holistic. A number of different questions must be answered. External questions to be answered are:

- What is the time frame?
- What is the market?
- Who is the customer?
- How are the needs articulated?
- What technologies are controlling the development of the market?
- How pervasive are the technologies?

With this set of questions, the enterprise is attempting to establish the level of technology that is controlling the development of the market. The enterprise must establish the level of technology that is key to fulfilling the needs of customers.

The second set of questions are related to the practicality of performing the forecast:

- What information is available?
- How much time is available to conduct the forecast?
- How much money is available?
- How many people are available?
- What are their capabilities?
- How dedicated are the people to the task?

Assessing Technological Capability

The purpose of technology forecasting in this context is to assess the capability of the technology to meet the current and forecasted future needs of the customers. This requires in all cases the translation of customer needs, quite often expressed in terms of benefits, to specifications for price, function, and form, often thought of as attributes, both at the product level. These in turn must be converted into performance criteria for the technology. For example, throughput of traffic over a city's road system may ultimately depend upon the processing speed of microprocessors in remote locations. If this is a factor controlling the development of that part of ITS, then the speed of microprocessors must be forecasted.

In making the assessment of future technological capabilities, there are three questions to be answered. Will the forecasted technological capability:

- Be sufficient to meet customer needs?
- Be insufficient to meet customer needs?
- Surpass forecasted customer needs?

If the technological capability will satisfy customer needs, the question becomes how is the enterprise going to establish sustainable competitive advantage through technology. If it appears that technological capability will fall short of satisfying customer needs, the enterprise must decide if this is a limitation of the technology or the result of the amount of effort being given to advancing the state of the art. If it is a result of the amount of effort, what effort could the enterprise put in place that would advance the technology faster than the general market, thereby giving the enterprise a significant edge? If the capability of technology appears to be in excess of what is required by its application, then the question the enterprise must answer is, "What new needs is the availability of this technology likely to create?"

The enterprise may also want to assess its own technological capability versus that of the industry. The technology forecasting techniques facilitate this type of assessment.

Forecasting Technological Capability

The necessity to forecast technological capability derives from the requirement to fulfill the future needs of the customer. Once customer needs are understood, a logical next step is to discern which of the technologies available are likely to have capabilities to meet the needs at the specified future time in question. Forecasting is, however, more than trying to precisely pinpoint a single parameter. Our colleague, Ralph C. Lenz, whom many consider to be the father of technological forecasting, is fond of quipping, "It's better to be approximately right than precisely wrong!" Joseph F. Coates eloquently states, "The burden of the work and the key to making forecasts credible has increasingly been assumed by the communications process rather than by the more abstract qualities of technical analysis."

For today's environment, technology forecasting should be defined as the process of discovering and communicating probable technical capabilities in order to make better decisions and prevent surprises. Forget the academic exercises and concentrate on discovering the direction, rate, and nature of the changes taking place in the technologies in question. The tools available for accomplishing these tasks fall into four general categories of techniques: surveillance, trend analysis, expert opinion, and integrative. These are the same categories described above in our discussion of customer needs analysis. Now, their application is focused instead on the issues of technological capability. The techniques within the four are aimed at discerning the probable capabilities at the three levels of technology (direct, supportive, and enabling). The types of techniques used and the efforts employed to forecast are dependent on a series of both internal and external factors as previously discussed. The main reasons for conducting the forecast are to make better decisions, and to prevent surprises.

For forecasting purposes the surveillance category is made up of three technique areas: scanning, monitoring, and tracking. Scanning is the process of looking broadly for events and trends that may imply an impact (threat or opportunity) upon the technical arena of particular interest. The activity is not unfocused, nor is it undirected; rather it is purposeful in effort to skim and detect. An individual who can discipline himself or herself to follow a scanning process can review great volumes of material in very short periods of time. Once potential information or data is detected, monitoring is used.

Monitoring is the process of specifically, and with a defined purpose, following the technological developments in a particular area. Monitoring may be done by an individual or as a team or group effort. Not only are information and data gathered, they are analyzed for meaning and impact and the results communicated in some meaningful way. It is virtually impossible to develop a forecast without using monitoring techniques.

Tracking is the process of carefully and purposefully following a greatly narrowed range of technological development. The frequency of activity is greatly increased in a technological tracking mode. The results of this activity are of immediate value and can be used for both operational and strategic decisions.

Trend analysis as a category consists of many, mostly quantitative, techniques. We identify six techniques that have proven to be the more useful overall in business environments. They are

precursor developments, trend extrapolation, the Pearl curve, the learning curve, substitution, and multiple substitution.

Forecasting using **precursor developments** can be done when a lead/lag relationship can be established between two technical areas. This is usually done by observation over a period of years, and establishing causal connections between the technical areas

Trend extrapolation involves plotting key parameters of technical progress against time. From the results, regular development patterns can be discerned. An initial assumption can be made that the patterns, which are rooted in past developments, can be extended into the future for some period of time. In a large number of technical areas, it has been found that if progress is plotted versus time, the trace is linear on a semilog graph. This would represent a constant percentage rate of change

The **Pearl curve**, named for the American demographer Raymond Pearl, who used it in demographic forecasting, is one example from a family of growth models. These techniques are often used to describe technological change patterns that resemble organic growth. The slope of the Pearl curve is a function of both the distance to go to the upper limit for growth and the distance already covered.

The **learning curve** is a production-driven performance technique. Its basic premise is that as the number of units produced doubles, the labor-hours per unit decrease by a constant factor.

Substitution analysis is used to forecast the rate at which one technology will replace another. The traditional approach involves the application of the Fisher-Pry model. This model predicts characteristics loosely analogous to those of biological system growth. Many examples now exist for technology substitution.

Multiple substitution represents an increasingly common situation in which either more than one new technology is substituted for an old one or a single new technology is actually replacing more than one old technology.

The **expert opinion** forecasting category can be divided into three technique areas: interviews, surveys, and groups. In today's needs-driven environment the use of expert opinion for forecasting is imperative.

Interviews can be conducted under two basic conditions-structured and unstructured. Each type has advantages and disadvantages associated with it. However, given the value of people's time, structured interviews are optimal.

Surveys are conducted under many different formats and for many different reasons. They can vary from public opinion surveys administered by enterprises such as Gallup to market research surveys done by the likes of Good Housekeeping, Gentlemen's Quarterly, Working Woman, or Money magazines. In large part what differs in a survey focused on technology development rather than market research or public opinion is the types of questions asked and who is included in the survey universe. One particular type of survey, the Delphi, can be adapted very well to the rigors of obtaining both quantitative and qualitative data.

There are also a myriad of **group techniques** which can be directed to gaining technological information for forecasting purposes. These group techniques may range from the familiar focus group to the highly structured and inclusive morphological analysis.

The **integrative category** of forecasting techniques consists of four technique areas: opportunity analysis, scenarios, cross-impact analysis, and mathematical models.

Scenarios generally present in a narrative form the descriptions of multiple forecasts. They can provide a common context and a vehicle for presentation of very complex concepts and information.

Cross-impact approaches are designed to capture interactions between events or trends and to represent them formally in a cross interaction model. Mathematical complexities, such as probabilities, can be deftly handled in a cross-impact matrix. With the advent of PCs and spreadsheet software the need to construct expensive models has diminished significantly.

A **mathematical model** uses equations to represent the system in which events occur. It requires significant time and effort to initiate and construct, and maintaining the model with current data is a necessary yet onerous, task. The value of large mathematical models solely for technological forecasting is negligible in the current environment.

All these categories are useful and important to forecasting technological change. The forecaster must continuously update any and all projections as well as assess the impacts that the driving forces for change will have on the development rate and direction of technology.

Determining Technological Capability (Summary)

The following steps must be followed to determine the technological capability to meet the needs identified earlier:

1. Define the three types of technology (direct, supportive, and enabling) for this market.
2. Determine a comprehensive set of examples of each of the three types of technologies.
3. From this list, identify the few key technologies that control the development of the products and systems to meet customer needs.
4. For each of the key technologies identified in each of the three types of technology, determine its current and future capability to meet the needs of the three categories of customers. This step can be as quantitative as you want it to be. Technology-forecasting techniques are often essential in the determination of technological capability over the time frame of the analysis. Match the technology forecasting technique to the application.
5. For each technology, determine the strength of the technological capability against the needs of the market.

Competition

What Is the Competition?

Customers provide the "pull" in the market. Their needs attract competition, vying to provide solutions to those needs. Technology developed by the set of competitors satisfies those needs but also can create new needs through advanced capability. Technology therefore can be the "push" of the market. Competition is the "clash" in the market as competitors each seek superior positions.

There are three different types of competition:

- Direct
- Indirect
- Structural

Direct competitors attempt to satisfy the same need in the same manner. Indirect competitors attempt to satisfy the same need but in different ways. Structural competitors attempt to do away with the need.

For example, consider the airline industry. The airline companies are moving goods and people from place to place. American Airlines, Delta, and Continental are all direct competitors. Indirect competitors are numerous. Examples of indirect competition are bus companies, trains, ships, and cars. A structural competitor to the airline industry is telecommunications and computers. Videoconferences, faxes, phones, and electronic mail are attempting to do away with the need for face-to-face meetings. In one profoundly large blunder, an airline company held a national meeting of its management team to address its strategic plan for its future via teleconferencing to save time and money.

Enterprises often have considerable knowledge of their direct competitors. But in many cases, even with a lot of information on direct competitors, they lack the understanding of the competitor's strategy which is key to understanding that competitor's response to future needs. Rarely do enterprises study and understand their indirect competitors, and almost never do they consider structural competition. This is a significant failing, for there is considerable wisdom to be gained by examining these two areas of competition.

IBM's failure in the 1960's to understand the power of semiconductor integrated circuitry to produce microprocessors and the impact they would have on computer systems is a significant contemporary example. IBM did not understand the indirect competition of PCs and workstations with its central processor strategy. The Pullman Company, which produced and staffed quality sleeping accommodations on passenger trains, did not understand the structural competition of air travel. And RCA, one of the early developers of transistor technology, failed to comprehend their impact on vacuum tubes, and therefore the power of indirect competitors like Texas Instruments.

The pharmaceutical companies that commercialized the polio vaccines were structural competitors of iron lung manufacturers. In the 1930s, the manufacturers of cooked canned foods were

structural competitors of the ice delivery services for iceboxes. Later, the mechanical refrigerator companies were indirect competitors of icebox companies. Currently, the marketers of irradiated and aseptically packaged uncooked foods are structural competitors for the makers of refrigerators.

Dick Davis, a futurist for Whirlpool who foresaw the impact of wrinkle-free fabrics, a structural competitor to irons, and who helped Whirlpool capitalize on that change said, "No company ever gets struck by the future in the forehead. They get it in the temple!" Enterprises do a reasonable, although sometimes myopic, job of understanding their direct competition, but they frequently fall short of identifying, understanding, and integrating into the enterprise the impacts of indirect and structural competitors.

Competitive Response

The process of understanding the competitive response to the strategic needs discovered earlier in this chapter begins with the definition of the three categories of competitors. Then specific competitors are listed and ranked in order of current importance to the enterprise. Sometimes it is not possible, or practical, to list specific indirect or structural competitors. In this case, identify classes of these types of competitors and describe them.

The next steps involve the development of an understanding of the competitor's current strategy. This is followed by an assessment of each competitor's response to the forecasted needs. The techniques for understanding competitors' strategies and their likely response to future needs can be categorized in the same way as needs forecasting and technology-forecasting techniques: surveillance, trend analysis, expert opinion, and integrative techniques.

This is also not a treatise on competitive analysis. Our purpose here is to give an overview of the techniques, and, more important, show how to integrate them into an overall opportunity and threat analysis.

Many of the technology-forecasting techniques can be and are applied to competitive analysis. It's just that their focus is shifted from the technology to the competitors. Some of the customer needs analysis and forecasting techniques are also applicable here. Three of the techniques unique to competitive analysis are:

- Benchmarking
- Reverse engineering
- Executive analysis

Benchmarking has been made very popular because of the stress on quality and the focus on "best" practices. Benchmarking is a way to obtain and share information about processes used within enterprises. Reverse engineering, buying a competitor's product and analyzing its components and its design, and inferring processes can give concise, direct information about a competitor's current capability. An analysis of executives' personalities can add information on the competitor's likely response to change.

Assessing Competitive Response (Summary)

The following steps must be used to identify the competitive response to the needs identified in the previous section:

1. Define the types of competition (direct, indirect, and structural) for this market.
2. Identify the types of competition and list as many specific examples as reasonable in each of the three categories.
3. For each competitor type identified, determine the competitive response to the needs. It is helpful here to reconsider all the needs each time an innovation response is determined.
4. For each response determined, identify the strength of the response. Use the same five-point scale as was used in the determination of customer needs.

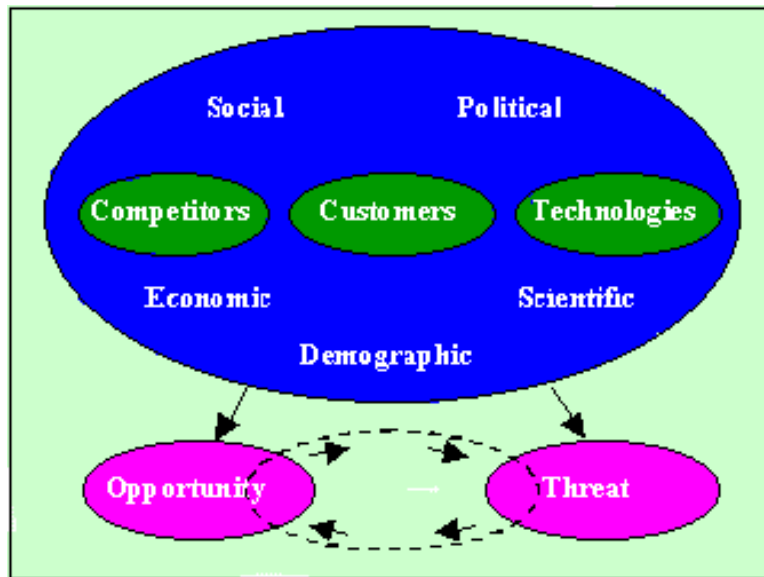
Additional Insights on Technology

At this point it is useful to revisit the assessment of technology. Often, the direct technologies considered are all those used by the direct competitors. Add to the technology list those that are associated with the indirect and structural competitors. Select those that are key to development of your enterprise's competitors' ability to meet the needs of customers. Use technology-forecasting techniques to ascertain if the enterprise's indirect competitors are going to be able to replace the enterprise's products or whether the enterprise's structural competitors are going to be able to do away with the need for those products.

Synthesizing Market Opportunity or Threat

The synthesizing of customer needs, technological capability, and competitive response into a view of the opportunity and threat in a market provides significant insight. However, the enterprise should not lose sight of the details of the analysis or the insights that have been developed by the process it has gone through to get to this point. It is useful throughout this synthesis process to keep a "trail" from the synthesized statement to the details that made it up. For while the synthesis is helpful in creating a strategy and comparing the opportunity and threat to the enterprise culture, it is from the details that project focus is determined.

The elements that determine opportunities and threats in a market for an enterprise are shown schematically below. Customer needs, technological capabilities and competitive responses to those needs and capabilities all interact on each other. These three elements are set in a milieu of driving forces for change that act on each of the three elements of the market as well as each other. The result is a chaotic swirl of opportunities and threats that must be teased out.



The steps taken next depend upon the use of the knowledge gained from the analysis. If the goal is develop specific product or technological development plans, it may be better to use a cross impact type of approach and work with linear lists, weighed or prioritized. If the goal is to develop strategies for the market, it may be better to develop scenarios that the teams developing the strategies can respond to. This is an integrative approach that relies upon synthesis of all the information garnered in the analysis. The goal of this process is to determine nodes or attractors around which multiple scenarios can be written. We have found it very useful to search for four different scenarios. This avoids the problem, in a three scenario approach, of having most people select a middle scenario. It also avoids the problem of having people have to make a decision between two, often polar, scenarios that may divide the effort. Four scenarios provide a rich context for people to think about the alternative futures. We have found that that thinking and the resulting discussions create more wisdom for the enterprise.

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