Customer Focused Technology Planning:
An Overview[*]

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Introduction

Customer Focused Technology Planning (CFTP) is a planning framework designed to help firms focus their technology investments to increase their return on technology investments. The concepts behind CFTP were developed over the last twenty years in consulting assignments with several dozen corporations around the world. It has been successfully adapted to many types of companies, large and small, high and low tech, emerging and mature. Industries using the framework have included oil exploration and refining, food processing, consumer products, aerospace, chemicals and materials, pharmaceuticals, medical products, pulp and paper, computers and electronics, power distribution and telecommunications. This paper provides a brief introduction to the logic behind CFTP and the steps in a typical CFTP program.

Overview

CFTP is based on the simple idea that successful companies must achieve two objectives in concert: provide value to their shareholders by using technology to provide value to their customers.

CFTP starts with the collection of information on your objectives, skills and capabilities, the needs of your customers, the technologies available to you and others to satisfy those needs, and the capabilities and intentions of your current and potential competitors. Given the complexity and diversity of information, we find it useful to follow a relatively structured approach to integrate this information. A structured approach helps identify holes in what you know, provides a record of your assumptions, and focuses information gathering efforts. Perhaps most important, it provides managers a tool for linking the different parts of the technology investment puzzle into maps that can be used to track the logic of alternative investment options.

However, collecting data and preparing maps is not planning – planning is thinking not data manipulation. The key to good planning is the use of informed judgment, based on both your experiences and the best available information on the needs, options, and competitive implications of alternative strategies. The process of collecting and integrating the data helps refresh managers' minds about the factors affecting the investment decision, and provides a useful tool for assessing investment options – but these are only tools. People make decisions – not models.

CFTP provides managers a framework by which to assemble and assess information on the dynamic factors affecting their technology investments. Its success comes from giving managers a new *way of thinking* about technology, not in teaching them a new planning technique. The emphasis is on informed judgment, not on filling out forms or applying models.

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[*] This paper is adapted from material originally prepared for the Cal Tech executive program: "Managing Technology as a Strategic Resource."

The CFTP Process

The underlying purpose of CFTP is to provide managers a tool to help them make more informed decisions, and to do so as effectively and efficiently as possible. Specifically, it addresses the question:

> *Which technology investments will provide the competencies needed to provide, maintain, or improve product or service characteristics that are sufficiently valued by customers to establish a competitive advantage and promote your business objectives?*

It involves four basic steps:

- Develop market profiles - ***who are your customers and why are they important***?
- Create a map of technology–market interactions in selected product-market segments:
  - What product or service characteristics affect purchase/usage decisions – ***what do your customers value and why***?
  - How can technology be used to improve these characteristics – ***what is the role of technology?***
  - Profile the competition – ***can you gain an advantage?***
  - How mature are the needs, and technologies – ***where is there leverage?***
- Identify technology investment opportunities - ***what can we do?***
- Select projects and set priorities based on the business and technology strategies - ***what should we do?***

The output of the CFTP process is a map of the factors needed to understand the link between customers' needs and technology investment options. Exhibit 1 is a generic CFTP map, the logic of which should become clear as you step through the process in the sections that follow.

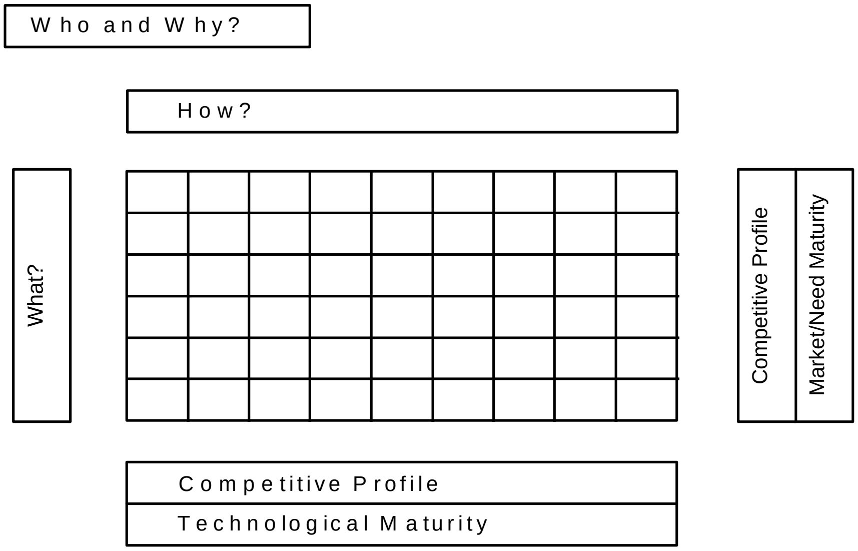

Exhibit 1. Generic CFTP Map

The basic approach is similar to the QFD technique used by many large corporations (reference, Hauser and Clauser, *The House of Quality*, Harvard Business Review, 1989*)*. Like QFD, CFTP links customer needs to product alternatives. However, while QFD is focused primarily on operations, CFTP is aimed more at the RD&E and product development functions. It helps firms decide where to invest to get the greatest return from their technology dollar. It helps managers understand the dynamic environment in which needs constantly evolve and technologies mature and are replaced by newer ones. It positions firms to anticipate shifts in market needs and technological capabilities that alter the current competitive environment.

Unlike many QFD type approaches, CFTP is an inherently flexible framework, with few rigid requirements for what the forms will look like and how they are to be filled out. Its power is in its ability to adapt its planning frameworks to closely fit with a group's needs, objectives, resources, and information base.

Planning for the Planning

Before launching the CFTP planning process there are a number of questions to be resolved:

- What are the objectives? Is the primary purpose to stimulate ideas for new processes, products or services that will help improve your competitive position? Set priorities? Provide the technology input into business plans? Promote cross functional cooperation and team building? It is important that the specific objectives are understood before the process begins, and communicated to those involved.
- When do you hold formal planning exercises? It is common to plan annually, either just before or in parallel with the annual strategic and operating planning efforts. But don’t just plan because a year has passed, technological progress doesn’t follow the calendar. If there have been few changes in the forces affecting technology investments over the year, don’t waste people’s time in a major planning exercise. A simple update of the previous year’s work may be sufficient. Similarly, do not hesitate to call for a special planning effort if external or internal conditions change significantly, there are technical or competitive surprises, or you are uncomfortable with the relevance of last effort’s results.
- What help do you provide the planners? They need clear direction; access to technical, market and competitive data and intelligence; analytic frameworks; training; a facilitator; incentives, etc. Assess their needs, and plan for the support up front, before planning starts.
- Who conducts the planning and what are their roles? Among the constituencies typically active in the actual planning are the staff of formal planning groups or consultants (as facilitators, advisors, and sources of tools and analyses, not as decision makers); and cross functional teams. In most cases it is important to involve teams representing constituencies within the firm that have access to the technological, competitive, and market information needed to conduct the planning. Their interaction not only leads to better planning results, but enhances cross-functional cooperation and mutual learning.
- What other constituencies should be involved? Identify the major stakeholders inside and outside the organization. Their concerns and biases can be important in positioning the results of the planning, and they are often excellent sources of information and guidance.

Product/Market Mapping

For purposes of this overview we are assuming that the planning objectives have been set and teams formed for each of the major business areas of the firm. The teams' purpose is not to share ideas, but to share information so they can jointly develop ideas. This is a critical distinction. When different individuals are asked to come to a joint planning meeting with ideas for new products or services, they tend to be closed to other individual’s ideas and resist constructive criticisms of their own. Too often, joint planning becomes sequential monologues, with the resulting decisions more a function of pre-existing power bases than the needs of the firm. It is better to encourage individuals to come to the initial sessions with information alone, and to withhold deciding what they think should be done until the team can develop ideas as a team.

The first step for each team is to understand who the customers are and why satisfying them is important to the firm. The Product/Market Profile (Exhibit 2) is used to organize the information needed to answer these questions. Profiles would be completed by each team to provide an overview of their planning focus.

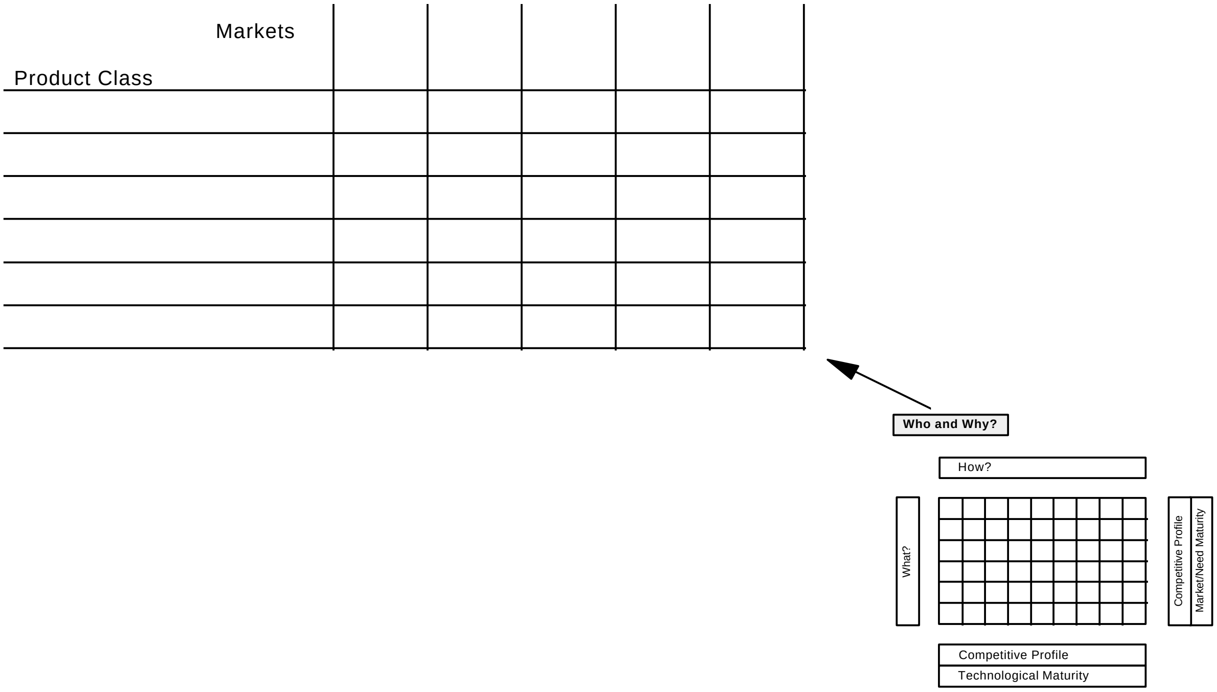

Exhibit 2. Generic Product Market Map

Guidelines for Completing Product/Market Profiles

- Use product classes, not products. Product class refers to a broad range of related products or services used to address a customer need. Product class does not necessarily deal with products per se, they may be services, advice, solutions, or prototypes – anything you provide to your customer. "Disposable liquid containment vessels" is an example of a product class. "Paper cups" is a product in that class for the fast food market. "Bag in box" is a product for the industrial fats market. By using product classes it often helps think beyond what is currently offered, and can help make connections with technology based solutions in other industries with similar needs to satisfy.

- Base market segments on decision patterns – not the structure of the marketing or sales departments, or characteristics of the product or service. The critical question is whether customers in a given market segment approach the purchase or use decision from the same perspective.

- Develop comprehensive assessments of high interest segments:
  - Company objectives - image, ROI, share, growth, harvest, etc.
  - Market characteristics - size, growth, profits, image, synergy, etc.
  - Competition - share, capabilities, intentions, etc.
- Assess non-participating segments for opportunities of technical or market extensions.
- Use available data and selectively augment based on sensitivity analysis.

This last item merits especial attention. Sensitivity analysis is important to avoid information overload; *planning should stimulate thinking, not overwhelm it*. It usually is best to do an initial analysis using only the data you have, being careful about indicating where the data is weak or you are using best guesses. After the first analysis, examine the assumptions used to support your decisions. If a variation in the assumption would lead to a different decision, the decision is *sensitive* to that data and you should take the time to validate it. Most assumptions do not affect the outcome, and by focusing only on those that do, significant time and effort can be saved.

You may need to eventually gather the data to validate the other assumptions, in order to prepare a development plan or implement your decisions. Care should be taken to conceptually separate information needed to make a decision from that needed to implement a decision. At this stage of the process, conserve resources by focusing only on details needed to support a decision. This keeps you from wasting time gathering detailed information on concepts you decide not to pursue.

Chart Detail

You will note that the product/market chart is very simplistic, as are all of the generic CFTP charts. The objective is to provide a rough framework and allow each team to adapt the chart to their needs, the types of information they have, and the purpose of the planning effort. This not only increases ownership and relevance of the resulting maps, it saves time that might otherwise be spent filling out irrelevant sections of standardized forms.

Segment Focus

The next step is to analyze a particular segment of your business: a specific product class (or related classes) in a particular market (or related markets) that is of interest because of its current or potential importance to the firm. Typically, a team will select from 4 to 7 segments for further examination. The remaining analyses are done for each of the segments selected and are designed to help understand the market, technical, and competitive dynamics in each area.

Performance Characteristics

In each selected segment, first assess the characteristics that drive the decision to use your product or service. These are simply the factors used by your customer in choosing you over a competitor, or choosing not to use your or anyone else's product. The customer could be an internal group to which you transfer a material, technology, component, or finished product; or it could be the final customer. Performance characteristics should also include factors important to interested third parties who influence the customers' buying decision, such as their purchasing department, regulators, or advocacy groups.

To fully understand what drives the purchase or use decision, it is often necessary to consider not only product characteristics such as functionality, price, system compatibility, etc; but other factors such as your technical image, field support for your products, your ability to influence the specification, etc. A generic Performance Characteristics profile is shown on Exhibit 3

Market Segment: ____________
Product Class: ______________

Needs	Importance	Leverage	Features	Minimum Level	Desired Level	Competitive Profile
Functionality						
Acquisition Cost						
Operating Cost						
Ease-of-use						
Reliability						
Serviceability						
System Compatibility						
Subjective Factors						

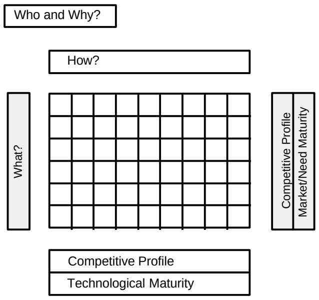

Exhibit 3. Generic Performance Characteristic Profile

Guidelines for Assessing Performance Characteristics

- Select high interest/payoff clusters for detailed assessment to save time and cost.
- List decision factors used by customers using categories on the sample chart as a starting point.
- Think broadly when defining *customer*; consider users, buyers, decision influencers, etc.
- Rank and/or rate the past, present and future importance.
- Determine how an improvement will increase the use of your product or service - its *leverage*.
- Assess the maturity of the market and the needs - maturity diminishes the impact of changes.
- Compare competitors on each characteristic - determine “best in class” through benchmarking.

Perhaps the most important consideration in this analysis deals with the concept of leverage. Leverage is related to, but different from importance. Importance is an absolute rating or ranking of all features or characteristics. The absence of an important feature will always influence the purchase or use decision. But at a certain level of performance, most characteristics reach a point where further improvement is no longer desired or valued. The characteristic is still important, but making further improvements will have little impact on customer choice., i.e., it no longer has *leverage*. At that point, less important needs emerge to drive the purchase decision.

Thus, in some contracts, the technology capabilities are important, but don't discriminate between winners and losers. If everyone considered can meet the spec, what is left are lower order considerations such as price, service, or reputation. These may not be as *important* as technical competence, but they can have more *leverage* in a particular setting.

Investments in technology need to be focused on high leverage items, not simply on high importance items. This makes the planning process challenging since leverage is more changeable than importance. In general, every time you or your competition provide greater value on a dimension, you decrease the impact or leverage of future improvements.

Customer Needs

This all sounds easy, and is, assuming you know what drives your customers' decision making process. This is one of the major challenges of a technical group, particularly if you are isolated from the customer as is often the case. The following are some techniques to determine customer needs:

- Customers themselves are probably the best source of information on their needs. Don't limit your inquiry to just your best customers, they are already generally satisfied. Instead, concentrate on your critical customers and your competitors customers. Also look at potential customers. Specifically:
    - Conduct customer visits. Be sure to plan this activity with the same rigor as other parts of a product or technology development project. Before the visit, prepare and know what you need to know and how and who will collect it. On the visit talk, listen, and observe. After the visit conduct a debriefing of all those involved to ensure that critical information is not lost.
    - Involve customers in planning, design and/or development
    - Conduct market research using your own sales force, marketing department, outside consultants, commercial databases and on-line services, etc.
    - Conduct problem research; i.e., look at their current operations and assess whether there are ways you could help them do what they do now but do so *better, faster, or cheaper.*
- Attend industry and trade shows, read industry journals, etc.
- Conduct lead user assessments with knowledgeable and innovative customers who have made important modifications or enhancements to your existing products.
- Develop industry trend assessments - find past patterns, leading firms or industries, inter-dependencies, etc. As Mark Twain once stated: *"History doesn't repeat itself, but it does rhyme."*
- Analyze competitive products to identify needs they appear to be addressing.
- Hold ideation meetings - *brainstorming, group-ware, etc.*
- Cross-functional planning can also stimulate insights into customer needs.

There are major differences between market research and problem research. Both rely on understanding customer preferences from the customers themselves, but differ in terms of the extent to which the customers can directly provide that information. For adaptation of existing products or services, your customer can often accurately tell you exactly what they value and why. Traditional *market research* using questionnaires, interviews, and focus groups, often provide all the information you need.

However, it is a greater challenge when you are considering innovative products or anticipating future or “unarticulated” customer needs. Rarely can your customers indicate their preferences for the features of non-existent products. *Problem research* is an approach that has proven useful in such cases. Simply put, based on current customer activities and forecasts of available technology, assess whether there are ways to help your customer do what they now do, but do so faster, better, or cheaper. This is usually accomplished by observing the customers while they use the existing products or services. Often it is possible, and desirable to place some of the product development team into a customer operation so that they can carry on the related tasks themselves. Sales forces can also be useful in helping develop a comprehensive model of what your customers now do so that you can develop ideas for how they may accomplish the same results with different tools or processes.

Technology Impact

The next step for each team is to identify the technology options available to provide, maintain, or improve important and leveragable characteristics. Exhibit 4 shows the generic chart that can be used to capture information on Technology Impact.

Market Segment: ____________
Product Class: ______________

Features	Design	Material	Process	Competitive Profile
Architecture Use characteristics Interface specs Physical parameters Target cost Appearance Service				
Maturity (E,G,M) Importance (B,K,P,E) Competitive Profile				

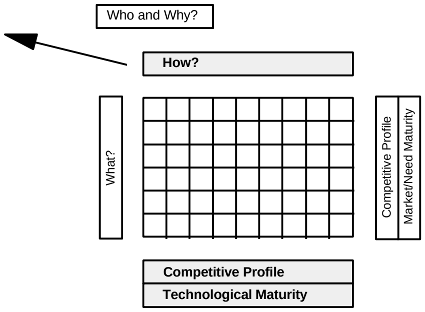

Exhibit 4. Generic Technology Impact Profile

Guidelines for Assessing Technology Impact

- Identify technologies that do or might affect important leverage characteristics.
- Rank or rate the potential for the technology to maintain or improve characteristics of importance.
- Estimate relative maturity and anticipate potential for obsolescence or substitution.
- Determine the competitive impact of technology:
  - base - necessary and available to all
  - key - source of competitive advantage
  - pacing - technology expected to be future key
  - exploratory - early stage with unclear potential
- Use benchmarking to compare competitors and identify “best in class”, investment level, experience, strengths, etc.

The importance of understanding technology maturity cannot be underestimated. The types of management challenges you face change significantly depending on whether technology is in its emerging, growing, or maturing stage. An important task of the CFTP teams is to understand the relative maturity of their most important technologies and to develop forecasts of substitute technologies.

Although it is possible to construct s-curves for the technologies being looked at, it usually is not worth the effort. It is more important that the team develop a *sense* of how mature the technology is, and to then explore the management implications. (Reference Exhibit 5).

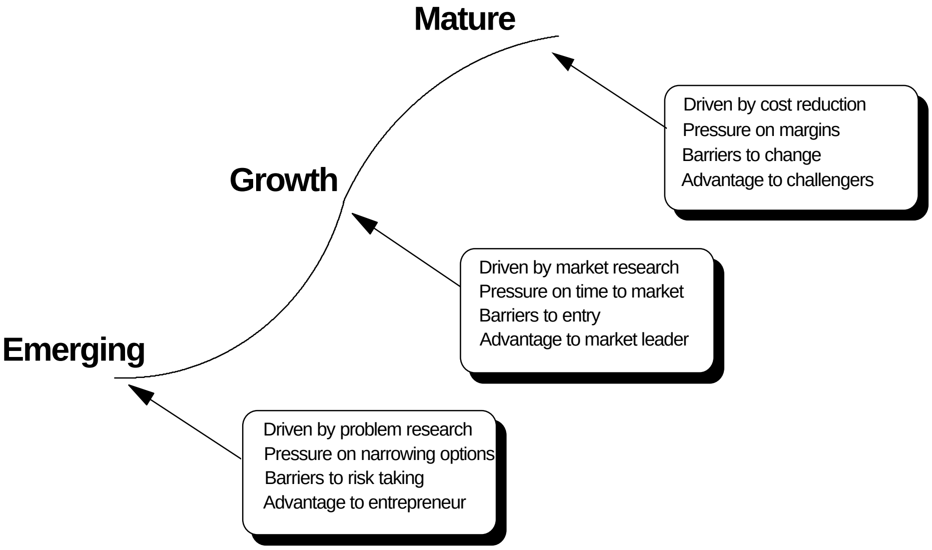
Mature
Growth
Emerging
Driven by cost reduction
Pressure on margins
Barriers to change
Advantage to challengers
Driven by market research
Pressure on time to market
Barriers to entry
Advantage to market leader
Driven by problem research
Pressure on narrowing options
Barriers to risk taking
Advantage to entrepreneur

Exhibit 5. Management Implications of Technology Maturity

Resistance to new technology is common, and often it is necessary to get an outside perspective to ensure that those with vested interests in the old technology do not ignore its maturing. However, such resistance is not always bad. Great breakthroughs can happen in seemingly mature technologies when its supporters are confronted with a competing technology. Resistance can lead to a burst of creativity and energy that pushes the old technology well past what observers regarded as its natural limits. Critics can also help direct investments in the new technology by identifying serious shortcomings not recognized by its supporters. Resistance should not be eliminated, it should be managed.

The relative maturity of the technology is only part of the technological intelligence needed. Where is the competition relative to you? What new technologies are out there that are attempting to replace the current technology base? When the technology matures will there be new technology take its place? Or will technology become less important as competitors’ capabilities equalize? Failure to anticipate these forces can lead to serious mistakes. Exhibit 6 graphically illustrates the key technology intelligence questions.

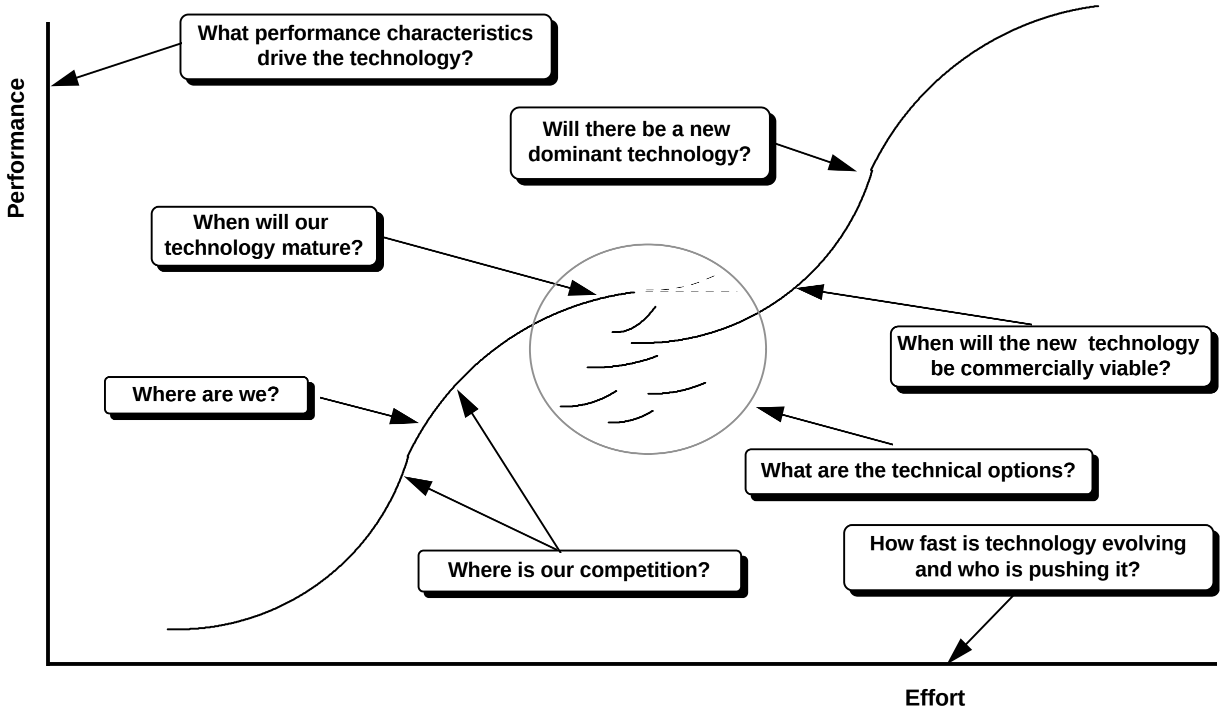
What performance characteristics drive the technology?
Will there be a new dominant technology?
When will our technology mature?
When will the new technology be commercially viable?
Where are we?
What are the technical options?
Where is our competition?
How fast is technology evolving and who is pushing it?
Performance
Effort

Exhibit 6. Key technology Intelligence Questions

This information needs to be gathered from a number of different sources. Exhibit 7 identifies several techniques for tracking technology. They are organized in terms of their Character (personal versus impersonal) and their Proximity (directly from the developer versus from a secondary source). No one technique is right for all situations, each has its advantages as well as disadvantages. Firms need to consider them all, being sensitive to the purpose of the intelligence gathering, and the time and resources available.

The impersonal techniques are probably the most common, since the information is relatively easy and inexpensive to collect. However, such information cannot be tailored to specific needs, and is often not current.

		Proximity	
		Primary	**Secondary**
Character	**Personal**	**Personal networks** **Sponsored research** **Visits** **Trade Shows** **Venture capitalists** **Universities** **Entrepreneurial firms** . . .	**Gatekeepers** **Consultants** **Editors** **Expert panels** **Suppliers/vendors** **Analysts** **Retired executives** . . .
	Impersonal	**Patents** **Patent citations** **Literature searches** **Reverse engineering** **Marketing material** **Annual reports, 10Ks** **Ads for staff** . . .	**Industry surveys** **Trade journals** **Associations** **Government records** **UN reports** **Local newspapers** **Buyers guides** . . .

Exhibit 7. Techniques for gathering Technology Intelligence

Probably the most reliable and timely way to gather technical intelligence is with the personal techniques. However, these can be time consuming, particularly if you don't have trained staff, and must be handled carefully to avoid accusations of industrial espionage and exposure of the true interest of the inquiring firm. For these reasons, professional information consultants, are often commissioned to do the intelligence gathering. Such secondary sources can also be useful in filtering out extraneous information, although some firms prefer to gather the information themselves to avoid losing details filtered out by experts.

Adding Detail

Gather and assess new information by exception, not as a matter of course. As mentioned earlier, begin with what you know and organize it at fairly general levels. At various points of the planning process it will become clear that additional information or another level of detail is needed to fully understand either what is driving the business or what options you have for enhancing your position. Whenever necessary, develop supporting charts that break down important dimensions into smaller levels of analysis. (Exhibit 8)

Thus, the initial analysis may compare major technical options such as the use of a VAX platform as opposed to a Sun or HP workstation. Once you decide that HP appears the best choice, you may want to break the HP option into the various configurations of processor, peripherals, and so forth. Expand each cell or cluster of cells to provide the detail needed to clarify options and support decisions.

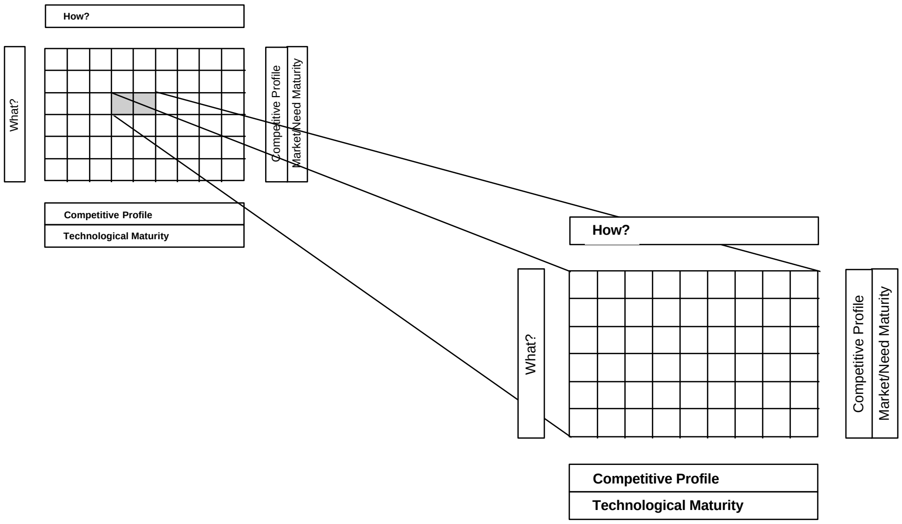

Exhibit 8. Provide Detail as Needed

You may want to add new charts or sections of charts to incorporate variables that will help the team collect and assess information needed to address such items as design characteristics, quality standards, product specification, core technologies, or selling and marketing points. Keep in mind, the charts are tools to help organize your thinking. If information is important for the decisions being considered, incorporate it. If not, leave it out.

Checking Interactions

The various performance characteristics and technologies affecting your business do not act in isolation from each other. It is important to check whether investments designed to improve selected characteristics will have a negative impact on other characteristics. (Ref. Exhibit 9) A negative impact does not preclude going forward, but you may want to modify your approach to minimize the downside effects. Make sure that any detrimental impact is flagged and considered in the "cost" of the improvement. Pay particular attention to previously satisfied needs or optimal processes, these are often overlooked when focusing on highly leveragable items. Make sure that any detrimental impact is flagged and considered in the "cost" of the improvement. Seek out changes that have positive interactions, providing benefits along multiple dimensions. An apparently modest project may provide a multitude of modest enhancements and greater total benefit than a major enhancement that has little impact elsewhere.

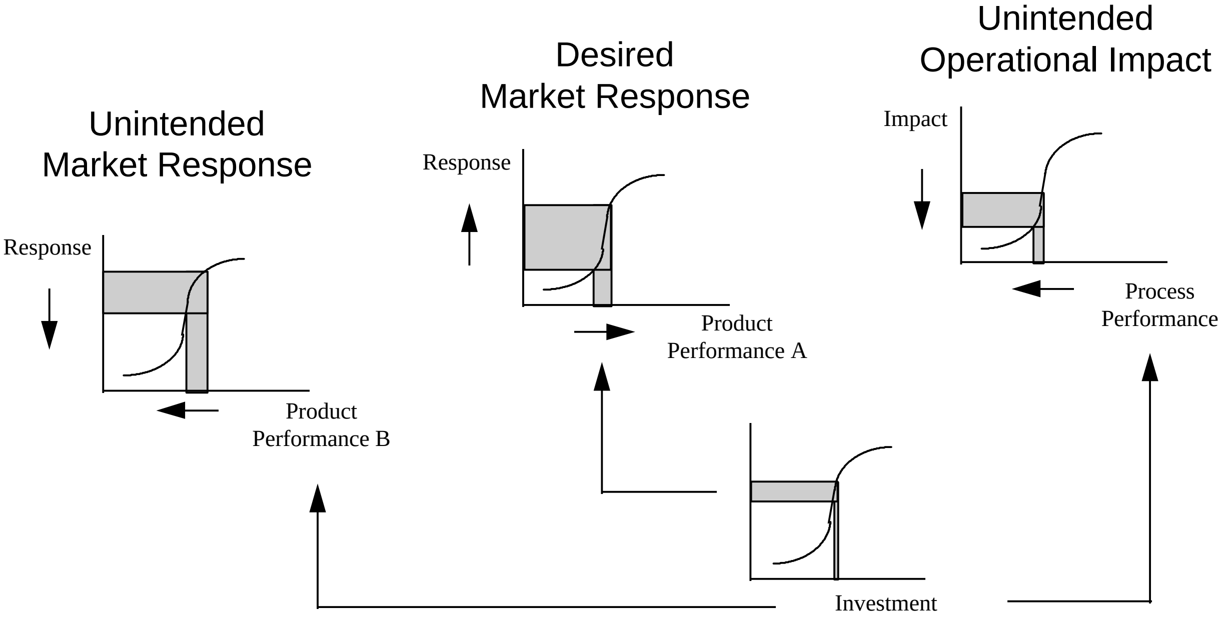

Exhibit 9. Test for Possible Interactions

Communicating Results

At this point in the process there may be four or five teams, each of whom have assessed six or more segments, resulting in several dozen separate analyses. The amount of information to be used to make investment decisions can be overwhelming, particularly to those to whom you might be presenting your conclusions. It is important to capture the key dynamics and relationships in a format that helps the teams quickly, yet thoroughly, identify options and work through the rationale, options, and likely competitive impact of each. Exhibit 9 provides an example of a completed CFTP Map. Appendix 1 contains additional information on the interpretation of the CFTP map.

While the map contains a lot of information, it represents but a fraction of the analyses a team is likely to have done. The detail is kept as back-up to allow the team to focus on the major relationships and dynamics needed to understand why a particular investment makes sense. In the map below, for example, the team might point out that their company (CI), has a real problem with its flavor (it is number 3), which is the most important characteristic, improvements in which will have a moderate impact in the marketplace (leverage). Two technologies have a big impact on flavor, fats and flavorings. In the first it has moderate capability compared to others, but in flavors, it is definitely weak. It can be argued that if to improve their market position (now at 10% share), they will need to develop or acquire flavoring technology and launch projects to enhance the flavor of their products.

			Ingredient Technologies				Process Technologies		Competitors		
Performance Characteristic	Importance	Leverage	Sweetners	Fats and substitutes	Shelf life enhancers	Flavorings	Formulation	Mixing	CI	A	B
Flavor	1	M	+	++	+	++	+	+	3	2	1
Appearance	2	L	+	+	++	o	++	+	3	2	1
Fat Content	3	H	o	++	o	o	o	o	2	1	2
Texture/ Mouthfeel	4	H	+	++	+	++	+	+	2	1	3
Price	5	M	o	+	+	+	++	++	3	2	1
Calories	6	L	++	+	o	o	o	o	1	1	1
	Competitor Profile	Constar Inc.	●	⊙	⊙	○	○	⊙	10% share		
		A	⊙	●	●	●	⊙	●	30% share		
		B	⊙	⊙	●	●	●	⊙	40% share		
	Relative Maturity		G	E	G	G	M	G			

Importance: Rank order, **1** is most important
Leverage: **H** = high **M** = medium **L** = low (refers to customer reaction to performance improvements)
Technology Impact: **++** = technology influences greatly (positive or negative) **+** = moderate impact **o** = low impact
Competitors **1** = best **2** = second best **3** = third best; ties indicate equal performance
Competitive profile ● = strong capability/high investment ⊙ = moderate capability/investment ○ = low capability/investment
Relative maturity **E** = Emerging technology **G** = Growing technology **M** = Mature technology

Exhibit 9. Representative CFTP Map

Planning Begins

It is at this point that systematic data gathering hands off to insight and informed judgment. Using the maps as tools and mental crutches (there is a lot of information to keep straight), the planners identify potential development projects. We find it useful to think of four types of generic investment opportunities covering investments in both long and short term technical and product enhancements. Each team identifies several projects, together with the reasons why the project makes sense, the risks of doing and not doing it, the costs, alternatives, impact on the competitive environment, etc. Teams often make recommendations about other things as well, such as the need for additional information, or access to new technologies.

The end result of this phase of the CFTP process is a mapping of the competitive, market, and technological environment and the identification of a large number of investment opportunities. The next phase requires that managers assess the options and decide which to pursue, based on their business, market, and technology strategies, and the available internal and external resources. These activities build on the CFTP mapping effort, but the emphasis goes from data gathering and reflection to the use of informed judgment to make decisions about the makeup of the technology portfolio.

Summary

CFTP does not tell you in what products or technologies to invest, nor does it identify options for you and tell you how to weigh them. It merely structures and focuses the information needed to stimulate innovative ideas, clarifies the impact of technology investments on your customers and on your business, and helps you effectively and efficiently make technology investment decisions that benefit both.