Tools for Customer-Centered Innovation

FOUNDATIONS

Product and Technology Mapping Tools for Planning and Portfolio Decision Making

Richard E. Albright and Beebe Nelson

Chapter 15, The PDMA Toolbook 2 for New Product Development, Paul Belliveau, Abbie Griffin, Stephen Somermeyer, Eds., John Wiley & Sones, Inc., 2004

Innovare's Strategic Advisor, **Beebe Nelson** recently published with Richard Albright their chapter on product and technology mapping tools in the 2005 edition of the PDMA Toolbook 2 for Product Development.

Mapping enables innovators to visually represent their plans from high level strategic through tactical plans over the foreseeable time horizon. It is part are the process of creating shared understanding or "mental models" through the organization which improved decision-making and innovation implementation.

The chapter presents how to construct and use both strategic and tactical maps. Various strategic maps presented include event maps, technology maps, product line maps, and value chain maps. The tactical, team-based maps including experience curves, product and market architectures, and product-technology roadmaps. When mapping is fully integrated in a company's planning process the strategic and tactical maps are tied together. These provide a comprehensive picture of the market, customer, product, and technology space in which the teams execute and the company strives to be competitive.

Innovare provides Product and Technology Mapping services as well as Technology Discovery as part of our Strategic Business Research and Analysis offerings.

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PART 1: THE ROLE OF MAPPING IN NEW PRODUCT PLANNING AND STRATEGY

Fuel technology is changing. So is the cultural and regulatory environment for transportation in the United States. Our hypothetical example, Acme Motors, is a leading producer of autos. Acme's product developers are faced with questions of how they should position Acme's products. Should they join the technology leaders such as Toyota? Should they enter as fast-fuel-cell followers? Should they bet on an alternative strategy, for instance that the internal combustion engine might become so efficient that the electric/internal combustion hybrid engine, or even the internal combustion engine alone, might prove competitive with the fuel cell? As they better understand these issues, they will have to make more specific plans. Will they focus on the hybrid, or will they skip that and go directly to the fuel cell? Will they focus on being a leader in developing the efficiency of the internal combustion engine, or will they be content to play follow the leader? At the project level, what product and technology projects will be commissioned, and what will be the actual targets for the development teams?

Throughout the chapter we show the use of maps in the hypothetical case of Acme Motors and its plans for the next several generations of its passenger car product line. To succeed, Acme must take into account the evolving market, regulatory, and competitive environment, along with technology innovations and changing customer needs.

This chapter provides examples of many of the tools and maps that a product developer needs to address and unscramble questions similar to those facing Acme's developers. Some of these maps are very high level and strategic. Although they can be backed up by lots of detail, we call them "back-of-the-envelope" maps, because the logic is transparent and the amount of information is small.[1] A good place for a company to start is with these high-level maps, and we describe several of them, including an event map, a technology map, a product line map, and a value chain map. The more tactical, team-based maps can have a more complex logic and generally include much more detail. We describe how the Acme product team used a number of tactical maps, including experience curves, product and market architectures, and product-technology roadmaps. These maps expand on the mapping tools described in Wheelwright and Clark (1992) and in the first PDMA Toolbook (Meadows, 2002).

When mapping is fully integrated in a company's planning and delivery processes, the high-level and tactical maps are tied together to provide a through-line from strategy to execution (Albright, 2002). An example of a set of linked maps is shown in Figure 15-1. By the end of the chapter, you will be able to see how these maps can be constructed individually and tied together to provide a comprehensive picture of the market, customer, product, and technology space in which the teams execute and the company strives to be competitive.

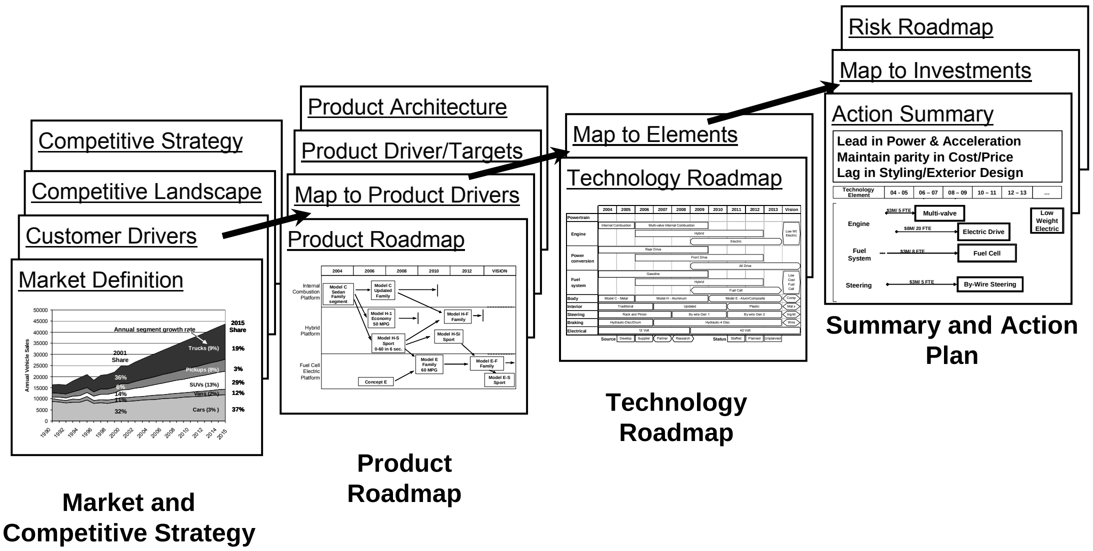


Figure 15-1. Linked maps.

The thumbnails in Figure 15-1 sketch how a company might produce individual maps of the market, of products, and of technology, and then link them together to produce an action plan for a function or a team. On the other hand, back-of-the-envelope maps by themselves are particularly good at combining roadmap information. For example, market, product, and technology information can be shown together in a map that connects specific market needs with existing or planned products and technology. One of the most useful roadmaps, the product-technology roadmap, is discussed at some length in Part 5.

This chapter also reflects on the place of mapping in strategic and project decision making. Mapping can introduce a sea change in a corporation's ability to understand its resources and link those to market needs over time. Mapping will help Acme address such questions as: How are your markets and technologies evolving? If you could take a snapshot in time, what would you see right now? Will you be in a competitive position five or ten years out? What are your fundamental technologies and product lines? Do your products and technologies support each other? Or do they conflict, overlap, or simply exist in isolation as if divided by corporate firewalls? Maps provide companies with a way of identifying their assets—including what they *have*, what they *know*, what they're *good at*, and what might be called their *social capital* (channels, brand, etc.).

The Benefits of Roadmapping

1. Roadmapping is *good planning*
2. Roadmaps incorporate an explicit element of *time*.
3. Roadmaps *link* business strategy and market data with product and technology decisions.
4. Roadmaps reveal *gaps* in product and technology plans.
5. Roadmaps *prioritize* investments.
6. Roadmapping helps set more competitive and realistic *targets*.
7. Roadmaps provide a *guide* that allows the team to recognize and act on events that require a change in direction.
8. Sharing roadmaps allows *strategic* use of technology across product lines.
9. Roadmapping *communicates* business, technology, and product plans to team members, management, customers, and suppliers.
10. Roadmapping *builds* the team.

What Are Maps and How Do They Work?

Product and technology maps provide a rich catalogue of a corporation's product and technology assets that can be sequenced on a timeline and linked with other assets. At their best, maps tie together market, technology, capability, and product/service information so that real-time decisions can be made to allocate the firm's resources and direct its efforts to meet short- and long-term goals. The essence of mapping lies in the creation of graphic presentations of information that have been built from the frequently tacit information residing in different functional areas. Maps create a syntax and a vocabulary that allow functions to communicate, and they provide evolving pictures of market-product-technology links. Good maps connect their elements to help both map makers and map readers understand the whys, whats, and hows of product and technology plans.

Mapping activities are inherently cross-functional exercises. They can be carried out by a product team, by a product management team, or by the functional heads of a strategic business unit (SBU) or a corporation. They are fractal in nature. When the data are sufficiently robust, and when the maps are well linked, maps can allow teams and managers to zoom in or zoom out to the appropriate level of complexity and detail. The information at the team level carries up to senior decision-making levels, and the strategy maps at higher business levels guide mapping structures and decisions at the team level. Mapping plays a crucial role in portfolio decision making; the maps relate information about projects, values, and assets to create a context for portfolio decisions that cannot be achieved by other tools typical of portfolio management, such as bubble charts, strategic buckets, or financial measures.

The Language of Roadmapping

The *vocabulary* of a map refers to how the elements are represented, the signs and symbols of the map. If you represent platforms as solid rectangles on map A, they should be represented the same way on map B. If "O" signifies "advanced development project" and "□" signifies "focused development project" on map A, you should use that same coding on map B. *No map branding by business units, functions, or teams!*

Map syntax refers to the rules and norms that relate the elements. It includes the map architecture. For instance, we normally read time from left (early) to right (late). Although we would think that someone who represented the time scale from right to left was simply wrong, in fact this is just a well-embedded convention. If your business can embed other conventions, so that map readers can easily compare data from one map to another, you will find maps more and more useful at strategic levels of decision making. For example, some firms show product lines as left-to-right arrows; many use the BCG grid or the S curve for life cycle. Adopt or invent useful structures, and reuse them.

The map maker uses other mapping conventions to codify and convey meaning, such as using *color* and *whitespace*. Be sure to use them judiciously, however; never use them merely decoratively; and use them consistently. Keep *labeling* to a minimum. If your syntax and vocabulary are clear, labels will be less necessary. Establish company norms around labeling, including type size/font and label placement (e.g., left of the y-axis and below the x-axis).

Maps can be developed by a few people who come together to create the core distinctions, or by teams that have maintenance of the map as an ongoing task. Maps can function as a guide to business decision makers, as an essential input to strategy, and as a planning tool for technology and product development.

In this chapter we review methods for informal mapping processes as well as methods for more formal and fine-grained processes. It's important to remember to use the right tool for the job, matching the sophistication and complexity of a map to the context of its use. A product team may require much more concrete detail to map the elements of a product platform, while an executive strategy team may find the more informal maps not only adequate but more helpful than a detailed, project-focused map. If the firm employs a consistent syntax and language, and if the maps are shared among functions and levels, then the firm will build a valuable knowledge resource over time in which the less formal maps are grounded in the maps with finer detail and the fine-grained maps can be read in the context of overall strategic importance.

There are three useful rules for successful integrated product and technology mapping:

1. *Use cross-functional teams or groups to build and maintain the maps.* The relationships among the information in a product or technology map provide market and technology *contexts* for planning and decision making. By building up the data from different areas in the corporation, the map makers can display market information in the context of technology assets and gaps, product line information in the context of market need, and so on.
2. *Iterate across groups and over time.* The first maps will be first drafts. As people in the business become more familiar with the process, they can find and integrate more detail and edit the categories of the first-draft map. Even when the mapping process has become quite mature, maps need to be maintained because the information will change over time—because of changing internal and external conditions, new information, and increased sophistication in the use of the maps.
3. *Develop a consistent syntax and vocabulary.* For maps to be a useful tool, the syntax—which displays the relationship of the parts—and the vocabulary—which identifies the elements of the map—must remain constant, or evolve to meet changing circumstances. If syntax and vocabulary change arbitrarily or are out of step, the maps will lose their utility as communication tools and map makers in one part of the organization will not be able to use information from others.

Good map making and map using enables firms to identify and preserve their core assets and recognize key gaps in relation to product plans and market needs. Maps create a rational, discussable plan for the timing of product and technology efforts, and provide a compelling format for difficult decisions about what to keep, what to develop, what to discard, and what to outsource. Good mapping practices build consensual decision making at the team, the management, and the executive levels of the business.

PART 2: IMPLEMENTATION ALERT

Pictures drive knowledge management, decision making, planning, and follow-through. In implementing market, technology, and product mapping, it is important to recognize that the *form* in which the data are presented is an important part of their utility. This *implementation alert* is intended to alert practitioners of mapping to some subtleties that will help them get the most benefit from the practice. We recommend Edward Tufte's books on the visual display of quantitative information for much more on the subject (Tufte, 1983).

1. Data that are presented linearly, for instance, in a spreadsheet or list, invite us to think of them separately and lead to conflict over individual merit rather than comparison and investigation of the potential of combining options. Data that are presented relationally invite, even provoke, relational thinking. Furthermore, the thinking and pattern seeking is suggested by the way the data are presented: the "playing field" for interpretation (the categories of interpretation) is part of the picture. This has two important implications, one about building maps and one about using maps. The map builders set the categories within which the maps will be used or interpreted. So, for example, the map builders decide on the time frame for planning and strategic thinking. An electronic device roadmap, for instance, will typically have a short horizon, a pharmaceutical roadmap a much longer one. Target markets will be represented in the map: Who decides on the segmentation? Who selects the key customer and market needs among the many possibilities? Not every technology or product will be displayed; how will the decisions be made about selecting and grouping them for display? Map builders are pattern seekers and category builders; they provide the fundamental distinctions against which critical decisions will be made. Companies need to take seriously the building of the mapping framework, ask searching questions, and challenge the categories so that categorization becomes a part of the iterative process of developing the best and most useable maps.

   In practice, the fact that maps define the interpretative field and invite relational thinking blocks anyone's attempt to argue from one salient data point to a conclusion. For example, if a product development project has the highest expected ROI, that is part of the picture to be looked at in relationship with all the other parts and not by itself a reason to choose to do it. In this way mapping discourages decision making by political influence or position of power—and mapping can be difficult to implement in a culture where top-down decision making or executive intuition plays an overly large role.

2. Data mapped on a visual field are ideal for group inspection, discussion, and decision making. For the maps to provide support for the group's decisions, decision makers must agree that the data that are available are all the relevant data. In using roadmaps, when data gaps or distortions are found, this is cause for discussion—and for a decision to proceed or to improve the data before a decision can be made. Data in someone's hip pocket may emerge, but it must take its place on the map with the other data, not as a reason to override or to circumvent the group decisions.

Making maps is not something to be assigned to a person with nothing else to do, or to be pulled together just before a meeting or to impress a group of stakeholders. Businesses would do well to develop the art and technique of map building, and embed rules for best practice such as those found in Tufte's work. In his book *The Visual Display of Quantitative Information*, he reviews methods of relational graphics. The best, he tells us, invite causal and relational thinking, and the best foreground the data, not the method of its presentation.

PART 3: PRODUCT AND TECHNOLOGY MAPPING ON THE BACK OF THE ENVELOPE

A high-level strategy team at Acme Motors has chartered a cross-functional team—the New Technologies Team—with exploring the evolution of automobile fuel sources so that the company can address the strategic question of how it might position itself vis à vis the emerging technology. It quickly becomes apparent that the team needs to understand at a macro level the evolution of technology, of regulations, and of market drivers, and how this evolution may intersect with or be influenced by other economic, social, and technology factors. It needs to know when the technology is likely to become competitive and cost-effective and how much pressure there is likely to be to develop alternative fuels. It should also be aware of the likely changes to transportation systems, as well as other political, market, and competitive dynamics.

BACK OF THE ENVELOPE MAP 1: THE EVENT MAP—MAPPING THE STRATEGIC GEOGRAPHY. It is frequently appropriate to begin mapping with a very high level map that draws out and sorts what the team knows and also provides a map of the information gaps. We will call this the "event map," a simple grid that allows mapping of the "strategic geography." (See Gill, Nelson, Spring, 1996.) The Acme team will enlist the help of other functions, including marketing, and plot such things as their best guess about how much the cost of fossil fuel is likely to increase and how efficient internal combustion engines are likely to become. The team is also interested in how consistent the switch to SUV's will prove to be. If there is another trend, similar to the shift in the 1970s away from the gas-guzzlers to the small imports, how will that affect the overall construction of the fuel cell opportunity? What if the congestion on our highways spurs a trend toward public transportation in cities and suburban areas? Anticipating possible market trends and making informed guesses about technology evolution, the team will begin to pinpoint the potential pitfalls and opportunities, and will begin to identify where it needs more precise or sophisticated information. The team's event map of the environment surrounding Acme's passenger car development is shown in Figure 15-2.

Market	↑ use of SUVs ↑ safety concerns	Auto companies selling used cars	↑ Smaller cars? "Green" becomes significant market driver	"I'd take the train if it were a bit more convenient"	
Economics Politics Social trends	↑ traffic/ congestion ↑ energy prices ↑ Mideast unrest	Infrastructure for electric cars	↑ Government support for fuel cell development	↑ public transportation? ↓ energy prices	Highways make great parks in inner city
Regulations	Stricter emission control	Rebates encourage hybrids	CA requirements spur hybrid	Zero emissions policy in all urban areas	
Technology	IC engine at x gal/mile ↑ IC efficiency Hybrid engine	All-electric car for short trips Ford releases hybrid SUV	Every car maker has hybrid option		Will IC efficiency make fuel cell less interesting?
	2000	**2005**	**2010**	**2015**	**2020**

Event Map. Best guesses: indicate confidence, list assumptions

Best constructed by a cross-functional group over a period of time. Each mapping session should resemble "brainstorming," with group members adding thoughts and information using sticky notes or pictures. Frequent discussion breaks keep members up to speed; the knowledge gaps are recorded, and members leave with research assignments to be completed before the next session.

FIGURE 15-2 Acme's Passenger Car Environment Event Map.

The event map shows several trends that will impact one another over time. On the face of it, replacement of fossil fuel (internal combustion) engines with hydrogen fuel cells seems like an obvious move. However, the efficiency of the internal combustion engine, which has stayed pretty level for decades, has begun to increase markedly in the past several years. How economical will the fuel cell technology have to be in order to compete with an optimized internal combustion engine in 20 years? This back-of-the-envelope mapping raises questions for the next level of mapping, in which the team will have to work hard to make projections and assumptions about the relative costs/mile as precise as possible. For instance, it might be a good guess to assume that customers will continue to prefer the heavier, larger SUV-type vehicle, but before Acme targets technology development, it should also explore the impact of a possible trend to "vehicle downsizing." The team decides to launch a market research project to explore customer preferences and market trends, perhaps uncovering latent needs that might enable Acme to shape the future market.

BACK OF THE ENVELOPE MAP 2: A PRODUCT LINE MAP—IDENTIFYING PRODUCT FAMILIES. The Acme New Technologies Team realized that it needed to understand the history and current conditions surrounding Acme's product development to provide a context for the next step, which would be to map the current and future technology. The team called a meeting to discuss just what products should be included in the project scope and decided to map the company's small, midsize, and luxury cars, but not vans, SUVs, and light trucks. After about a half an hour, the team realized that most of the product differentiation among the end-user vehicles relied on size, styling/design, interiors, and added features, and that relatively little depended on the parameters in which the team was interested. The team shifted its focus to mapping the engines and the fuel technologies, and came up with a map that identified *engine families* rather than *product families.*

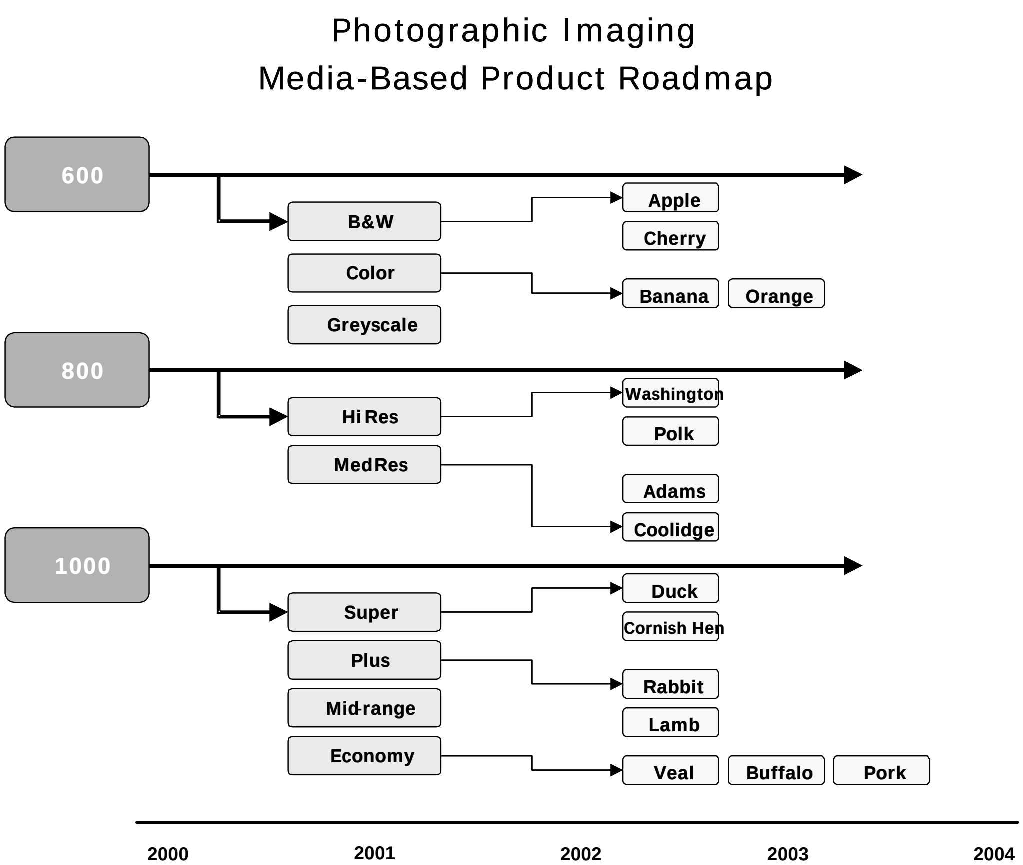


FIGURE 15-3. Imaging Product Roadmap.

CASE NOTE

The Photographic Imaging business unit at a leading photographic company realized that every time a new camera or media project was started, the tendency was to reinvent or redesign not as little as possible but as much as possible. They brought together a cross-functional group and addressed the question: What are our product platforms, and what defines a product line? Their product roadmap is shown in Figure 15-3. They began by mapping the product that the customer first decides to buy—cameras—but for the company the revenue-producing product was media, and the cameras were essentially boxes that enabled customers to use the media. Mapping the media streams as product lines brought new clarity into questions of what products to develop and when. It also highlighted the consistency of some of the product lines over time, including their "600 line," which has been a consistent seller in Asia, and encouraged the business unit to support these lines even though they were not new and interesting.

What they learned from what they mapped may have been obvious in the sense that there was no new information. But before the mapping project, it was not unusual to find that a new camera project would require unexpected changes to media, raising project complexity and cost and introducing all kinds of supply chain and distribution/logistics problems. With the product line map, these questions could be identified ahead of time. Product line mapping supported portfolio decisions—which lines to support, eliminate, or bolster—as well as decisions at the level of the individual project.

The first decision the team had to make was what would form the basic categorization for product line and platform mapping. The fact that media was the revenue driver won out, but there was in fact much more attention at the time on hardware, in particular a very new and different small-format camera. The team also chose to map products back in time, and the historical view brought older successful lines more clearly into view. If mapping had begun closer to the present, they might have missed the important point that the 600 line had been

Getting started with product and technology mapping can seem overwhelming. There is too much information, and too many information gaps as well. Good mapping requires time, and it takes resources from other planning and development efforts. The best way to start mapping in your company is to begin with a question you need to answer or a decision that you need to make. This will give you guidance on how to structure the data, what data needs to be included, and who should be involved.

The team now wants to get a better picture of the technology that is currently available. At some point it will want to look at competitors' technology, and technology trends, but for now, it simply wants to begin an inventory of the relevant technology assets of the company, whether historical, current, or planned. This will give the team a good baseline for deciding on likely areas for investigating in order to fill out the strategic picture.

CASE NOTE

A manufacturer of heating and air-conditioning products simply wanted to create an inventory of its technology assets and to begin to discover how those capabilities were focused on market and product needs. It was driven by the common concern that the innovation needed by one project might be already “on the shelf” of the project in the next building. Technology projects in this company were assigned based on the needs of product development projects, including those that might have long-range implications. The technology group seldom sat together to explore how the different projects might overlap or support each other. Since technology projects had been launched and subsequently identified with business or product issues, the function did not have its own technology categories, so the manufacturer’s first question was this: What are the basic categories for our technology projects?

The facilitator suggested using a bottom-up, or inductive, way of defining its technology categories. First planners wrote all the technology projects on sticky notes and assembled them in rough logical order. These projects were then broken down into technology elements—called “technology building blocks”—which they then assembled using an affinity map. (See Burchill and Brodie, 1997.) What they ended up with was a map of projects organized so that they could see overlaps, relationships, and synergies. This map is shown in Figure 15-4.

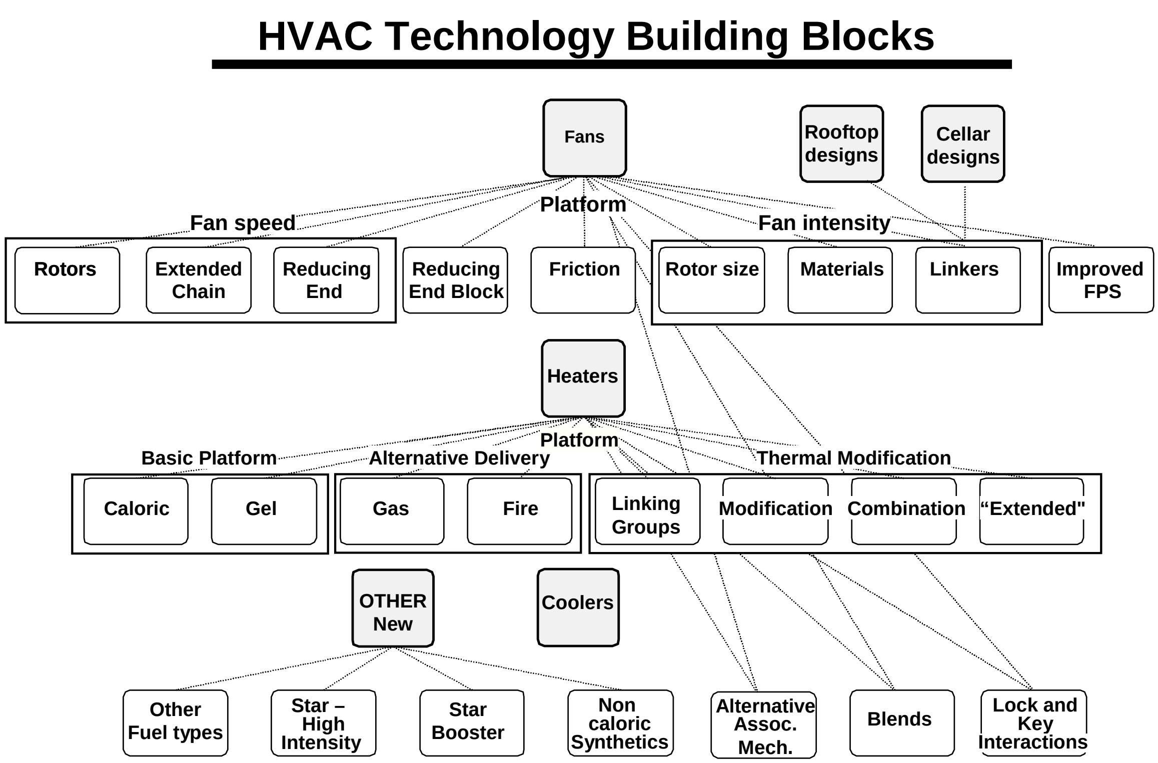


FIGURE 15-4. Technology project map.

The team's next question had to do with how the engine, and the fuel technology, fit into the overall supplier-to-customer value chain. For this mapping exercise, the team brought together a cross-functional group including sales, marketing, procurement, manufacturing, contract manufacturing, distribution, and service. Focusing on the passenger car engine, the team used informal process mapping to locate the contributors along the value chain, including suppliers of raw materials and engine parts, engine assembly and installation, and engine use, maintenance, and repair.

CASE NOTE

A chemical formulator wanted to explore how its product fit into a larger value chain. It divided the space, from raw materials to retailers and distributors, and used the graphic analysis to uncover where it could add the most value. The resulting map is shown in Figure 15-5 (Taytelbaum, 2000). This fairly quick cross-functional mapping exercise helped the company recognize that where it traditionally added value gave it limited opportunity to leverage its core competencies. It began to explore how its competencies could address more attractive and profitable issues further down the value chain.

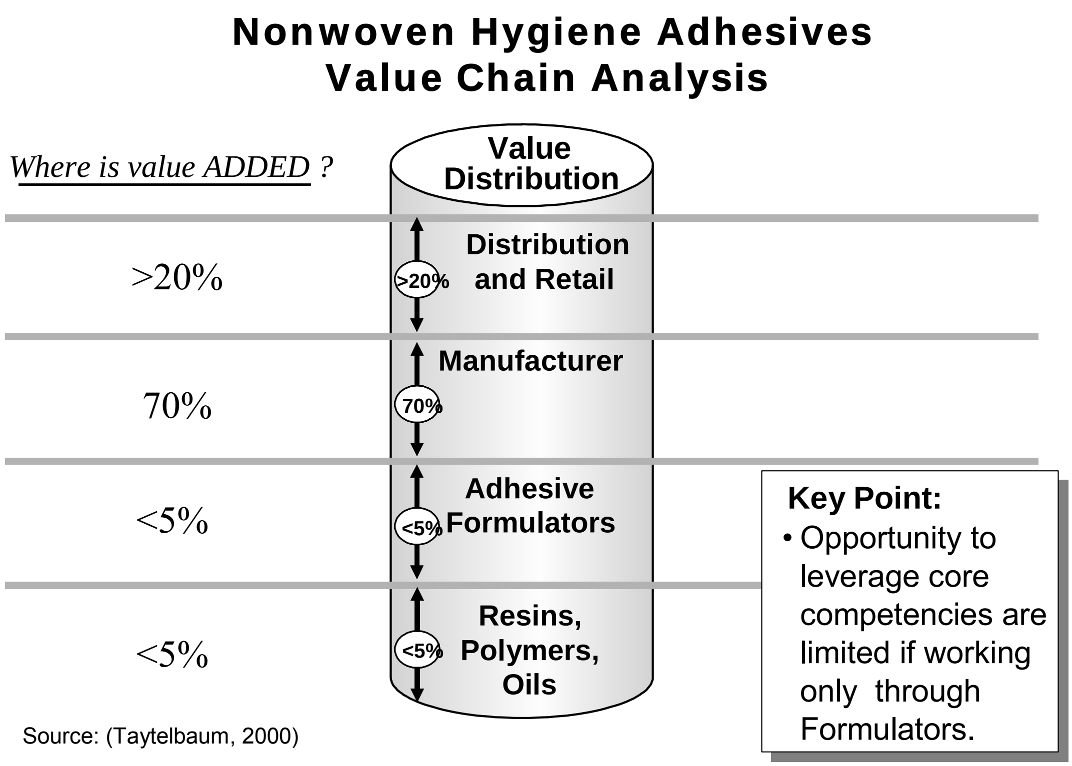


FIGURE 15-5. Chemical Formulator Value Chain Analysis

In all of these examples, a small group came together to map issues of key strategic importance. They worked with limited information and created the categories that would help them think through the issues. In some cases, they met over time to make their initial hunches more precise and to develop more information.

These back-of-the-envelope maps can be used in companies with a relatively low level of process maturity, but companies that make the best use of mapping then go on to implement mapping across businesses, product lines, and functions, making the mapping exercise a cross-company endeavor that is used at both the project and the portfolio level. Before detailing the tools and methods for the more mature and sophisticated uses of mapping, we will discuss the relationship of a company's process maturity to the choice of mapping tools.

PART 4: IMPLEMENTATION ALERT

Planning tends to follow the structure of an organization. This section describes the four key dimensions of mapping and how maps must fit an organization and match its planning maturity. The barriers between functional units or business units are an important factor in determining what type of planning will be done and what types of maps may be created and maintained.

Mapping is most easily done within the bounds of a structure where relationships are solid and well defined, and it can be impeded by the barriers created by organization structure. Most organizations are structured in a matrix of functions (marketing, research and development, manufacturing, etc.) and businesses (such as product lines or profit centers). Figure 15-6 shows a simple view of planning in the matrix organization of a corporation, with functional organizations laid out horizontally and product lines or businesses vertically. Four basic dimensions of planning and mapping are shown: (1) planning within functions, (2) planning over time, (3) planning across functions, and (4) planning across product lines.

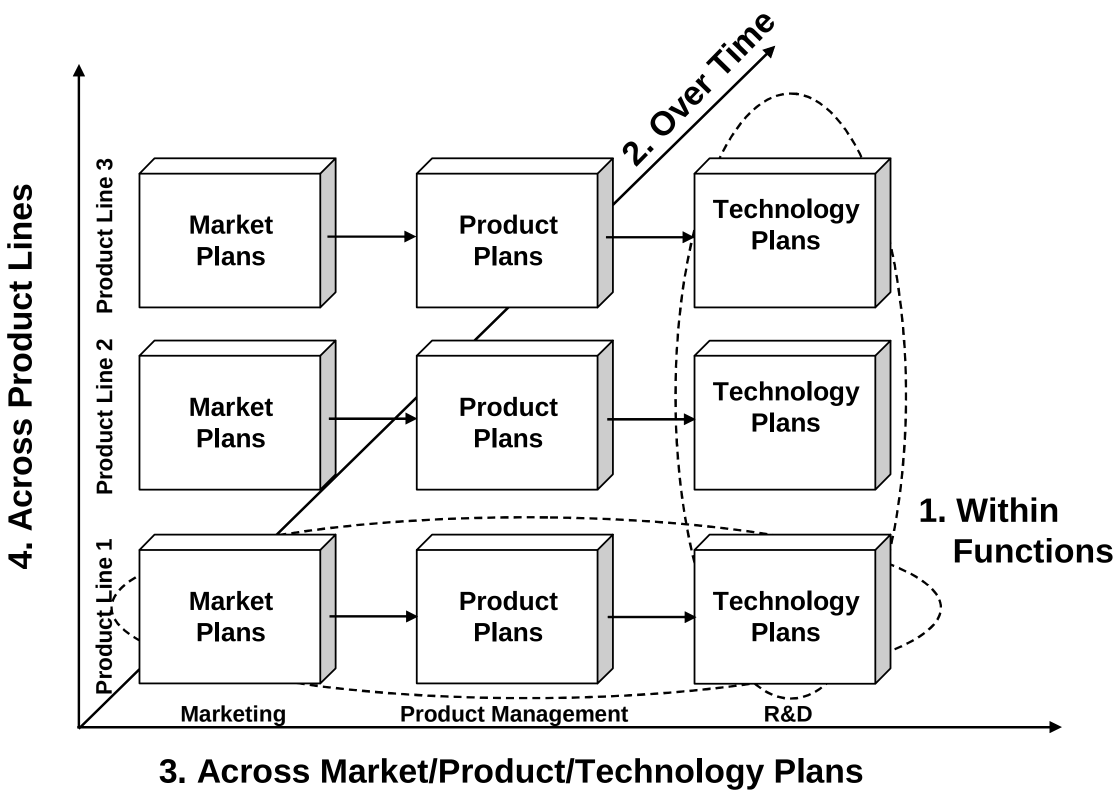


FIGURE 15-6. The four dimensions of mapping.

Within each business unit or product line, marketing, product management, and research and development organizations typically have functional responsibility for planning and execution in their respective areas. Each functional group creates its own plan over time; product line plans may then be constructed from functional plans for the market, for the product, and for technology to implement the product. Within each function, maps may be created and used to show the evolution over time of some aspect of the plan—for example, how the market will grow over time, or the cost targets that the product must meet over time. Also within functions, architectural maps may be made—for example, how the market is segmented, how the product is constructed of components or subsystems, or how the product is expected to evolve against the life cycle S curve. These maps of architecture across time, created for functions and product lines, represent the most basic level of mapping sophistication.

At the next level of sophistication, consistent with an organization that has implemented cross-functional product teams and phase/gate processes, maps may show the linkages across the functions—for example, how customer needs determine key product characteristics and how key product characteristics determine the most important technologies for success in the marketplace. For example, a product-technology roadmap integrates architecture, time, and functional and/or business linkages to provide a powerful product line planning story. These roadmaps help a team agree and align around a plan, provide a framework to tell the team's story to others, set priorities for development and market actions, and help guide the team during the development process. These types of maps flow across the horizontal dimension (as in the dashed horizontal oval), linking the functional elements and incorporating time. For example, the product-technology roadmap of Figure 15-1 mirrors the functional elements (market/strategy, product, and technology) that contribute to the plan.

Finally, in organizations with a well-developed portfolio management process, maps may be made to show the connections across product lines. For example, maps may show where two or more product lines are addressing common market segments, where there are key technologies whose development may be shared among product lines, or where technologies needed by one development project may be found already developed in another product line. These maps link plans in the vertical dimension (as in the vertical dashed oval), linking functions and groups of functions across product lines or business units. Maps at this level promote rich discussion in portfolio decision making.

To summarize, the four dimensions of mapping capture information within functions, over time, across functions, and across product lines. The complexity of the mapping process increases as more of these dimensions are incorporated. It is important to match the sophistication of your maps to the maturity and sophistication of the surrounding processes, such as the strategic planning, marketing, portfolio management, phase/gate, and life cycle management processes. The objective of developing and using maps is to aid decision making in the organization's processes, and a map should use the information available but should not imply greater precision than is found in the data or provide more information than is appropriate for the decisions being made.

The maturity of product development and management planning and mapping may be measured by the degree of integration of functions, product management and development, and management across product lines (including portfolio management processes). The levels of maturity are shown in Figure 15.7. At the first level of maturity, limited planning exists within functions, with virtually no cross-functional planning. Integration takes place on an ad hoc, informal basis. At this level, mapping is useful to a limited extent within functions, and the time basis for plans and maps is often ill-defined or not considered. At maturity level 2, architectures are defined and planned within functions, along with some thinking about evolution over time. Integration across functions is managed, but it depends on individuals rather than systematic planning. Architecture maps within functions begin to take on characteristics that enable planning for significant product evolution. At maturity level 3, planning and mapping consistently consider evolution over time, and some systematic integration across functions is performed. Maps at level 3 firmly include a sense of evolution and begin to bridge the functions in an informal way. At maturity level 4, plans are well integrated over functions, producing integrated market, product, and technology plans within product lines or business units. Maps take on the full product-technology roadmap of Figure 15-1. Finally, at the most mature level, 5, plans are integrated across product lines and business units. At this level, mapping in standard formats allows systematic comparison of all aspects of plans and provides a foundation for portfolio management.

A team should manage the level of detail of its maps to be consistent with the maturity of the planning process or the level of detail required in decision making. Early in planning stages, maps should be high level, sketching the level of knowledge available. As development and planning proceed, maps can become more detailed. For decision making involving many portfolio elements (projects, products, etc.), maps should fit the decisions that are needed. For example, in a corporate product portfolio process, maps should focus on decision criteria such as value creation, fit with strategy, and balance of the portfolio, rather than on detailed feature evolution or target setting. As we have already stressed, a good corporate approach is to layer maps within a common structure, so that decision makers can start at a high, broad level of information, drilling down for greater detail as needed.

Mapping Maturity	Within Functions	Over Time	Across Functions	Across Product Lines
1. Limited Planning within functions. Initial, ad hoc integration.	◒	○	○	○
2. Architectures within functions, but not integrated. Managed, integration depends on individuals.	●	◒	○	○
3. Planned evolution over time, some integration. Defined.	●	●	◒	○
4. Product plans with integrated market, product, technology plans over time. Quantitatively managed.	●	●	●	◒
5. Integrated plans across product lines, driving portfolio decisions. Optimizing.	●	●	●	●

FIGURE 15-7. Mapping and product development maturity.

PART 5: OPENING THE ENVELOPE

As the portfolio and management processes in an organization become more mature, they can use and support more sophisticated mapping tools that may be used together to create an integrated product and technology roadmap. Several tools and methods are described in this section, using Acme Motors to illustrate.

Acme's back-of-the-envelope maps (Part 3) laid out critical events in a possible evolution of the industry and the next several generations of vehicles. Senior management has studied the strategic and tactical implications of this work and has assigned to a new product team the challenge of developing and incorporating new technologies in Acme's new passenger vehicles. The team will need to incorporate new architectures and designs for powertrains, fuel sources, steering, braking, body systems, and more. At the same time the team must keep an eye on competitors and competing technologies to be sure that Acme's cars are competitive and differentiated. The team must also develop its passenger car line in conjunction with its other product lines, gaining efficiency from collaboration and sharing across the lines. (*Note:* Acme's team can begin the planning process developing maps for each functional area; but Acme's planning processes are quite mature, so the cross-functional team is able to develop an integrated roadmap.)

Based on information and decisions from the back-of-the-envelope maps, Acme's strategy board has defined the following vision for their passenger car product line: "Acme Motors will develop and market an efficient and competitive fuel-cell-powered vehicle, with attractive styling and well-integrated and efficient subsystems for passenger comfort and safety." This vision is a number of years and multiple product generations away, and Acme's passenger car product line will likely have to evolve through multiple powertrain configurations and related subsystem changes to arrive at a competitive, efficient, and cost-effective vehicle. All of these product and technology evolutions must be coordinated to produce a total package that will achieve the vision while remaining competitive over time. As the team progresses in developing its maps and plans, it will keep the strategic maps updated so that senior management and the entire organization can continue to be included in this strategically important and risky venture.

Because of the very large scope of its charter, the team has decided to create the following maps to guide its work: (1) maps of functional architectures, (2) maps that set targets or objectives over time, (3) maps that link market drivers to product drivers and technology drivers, (4) maps that show product or technology evolution, (5) maps that link architecture, targets, and plans over time to make an integrated product line and technology strategy, and (6) maps across product lines to identify key technologies that can be shared or potential points for collaboration. Maps 1, 2, and 4 may be drawn up first by functional subteams and then linked together as maps 3 and 5 are created by the cross-functional team. Finally, this team can integrate its work with other product teams to create map 6.

(1) Maps of Functional Architectures

These maps define how all the parts of the product or service fit together and interact. They can be as simple as the component layout of a product or as complex as the interactions among product subsystems. The old adage "a picture is worth a thousand words" applies here in that the picture can quickly and effectively define the relationships of the parts and give a reader a rapid understanding of the parts of the problem.

An architecture can take a pictorial form, showing the assembly of the physical product, perhaps in a cutaway view, or it can take a logical form, showing a hierarchical assembly structure or a layered block diagram of the product. Physical products are often best architected by a picture or a subsystem/component layout. Many software and service products can be best shown in a layered view, indicating how modules or functions are connected or exchange information. The architecture for process-produced products, such as many chemicals, includes the manufacturing process steps. The key determining factor in constructing an architecture is that it should include all the major components that determine the value of the product.

Product planning needs to understand market architecture as well. Luke Hohmann distinguishes between "tarchitecture," or the technical architecture, and "marchitecture," which "embodies the complete business model, including the licensing and selling models, value propositions, technical details relevant to the customer, data sheets, competitive differentiation, brand elements, [and] the mental model marketing is attempting to create for the customer"(Hohmann, 2003; p. 51).

The first map created by Acme's cross-functional planning team is an architecture that defines the subsystems, or technology elements, of the passenger car product line (see Figure 15-8A). A cutaway view shows the engine compartment and powertrain components in greater detail. In this first-level view of the car, it is difficult to show many components; a more detailed view might include several subdiagrams showing details for each subsystem. For example, the powertrain diagram would show fuel source, engine, power conversion, and emissions subsystems.

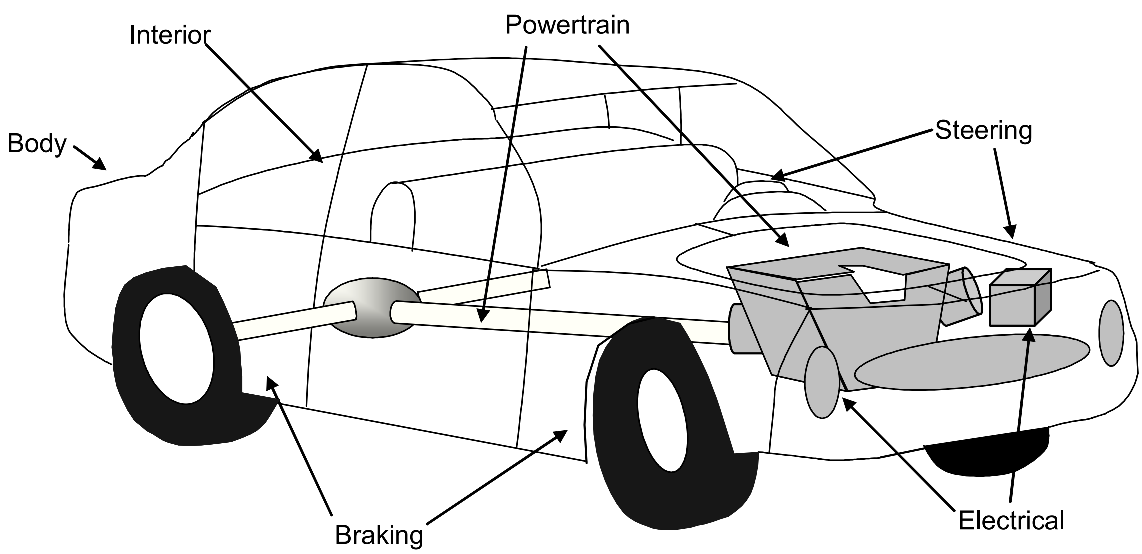


FIGURE 15-8A. Cutaway view of Acme's product architecture.

Another, hierarchical, architecture view for Acme's passenger car is shown in Figure 15-8B. The subsystems are grouped and defined in increasing detail. While the figure shows two layers, the team will go on to develop several more layers for detailed discussion and analysis. This architectural structure allows each subsystem to be evaluated, performance criteria to be defined, performance targets set, and the design process structured. The architecture keeps the team focused on the key marketing and design problems, and helps the team organize its thinking about how the subsystems of the product fit together.

An issue with architectures is how broad they should be—what they should include. For all the issues related to getting a car to market successfully to be understood, Acme's passenger car architecture will likely need to go beyond the physical product to include the fueling infrastructure—as it changes from gasoline to alternative fuels such as hydrogen or methanol. It might also be extended to include marketing programs and servicing infrastructure. Acme's passenger car product line team has decided to develop a " tarchitecture" for its initial plan for development of the car. In subsequent planning steps the team will build a "marchitecture" with a broader scope, including marketing and distribution issues, fueling and maintenance infrastructure, supply chain issues, and regulatory issues.

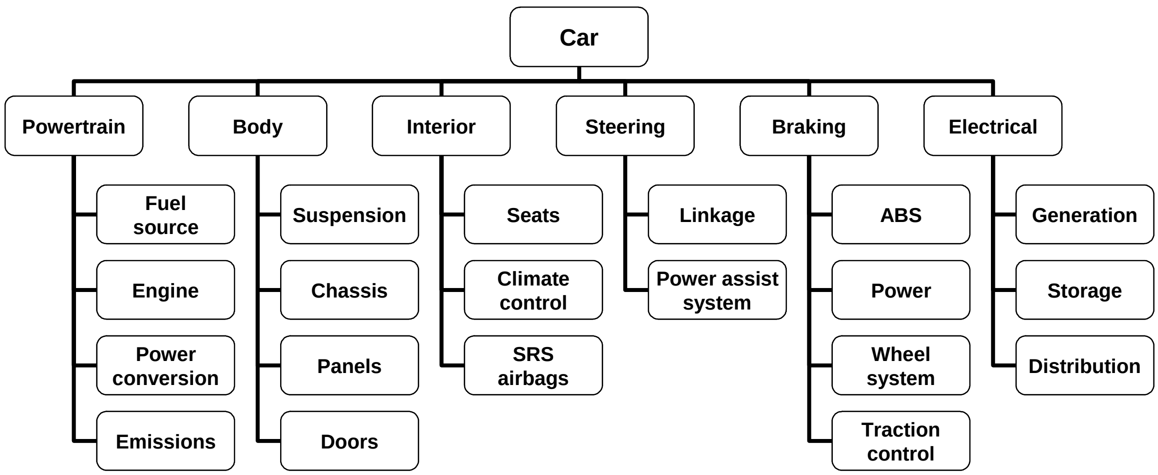


FIGURE 15-8B. Hierarchical passenger car architecture.

The architecture diagrams in Figures 15-8A and Figure 15-8B are static views. For many products where there is a single dominant architecture—for example, vehicles with traditional, internal combustion engine powertrains—this may be sufficient. However, many system architectures evolve, introducing the time dimension. The Acme team's ultimate target is a radically different fuel-cell-powered, electric drive architecture. The team has also determined that an evolutionary approach is needed to reach the target, and they have defined an architectural evolution of the powertrain subsystem, shown in Figure 15-8C. In the case of Acme's passenger car, the company plans to evolve the powertrain from a gasoline-powered engine rear wheel drive configuration to a hybrid gasoline-electric front wheel drive model to a fuel-cell-powered all wheel electric drive system. The hybrid phase, to be introduced in 2006, will enable learning and development of electric motor technology to progress while fuel cell costs are reduced to the point where they will be competitive with internal combustion technology. Finally, the fuel cell electric powertrain will be introduced in 2009, after which the other architectures will be phased out.

Maps may also be used to describe the evolution of plans in other functional areas. For example, the team may map market segmentation, market size, and customer needs prioritization. Figure 15-9 shows the evolution of the market for light vehicles in the United States (Hellman and Heavenrich, 2001). Acme's marketing department has projected the historical market forward to help the team size its expectations and future production forecasts. Acme's marketing department has placed the targeted market segment for passenger cars in the context of the overall market for light vehicles and has forecast market segment sizes by projecting from the market growth of the late 1990s using "best-fit curves." The marketing department projects the car segment to grow at about 3 percent per year, while several segments grow at faster rates: up to 29 percent per year for SUVs. The forecast shows that the car segment declines from about 36 percent of the market in 2001 to under 20 percent by 2015.

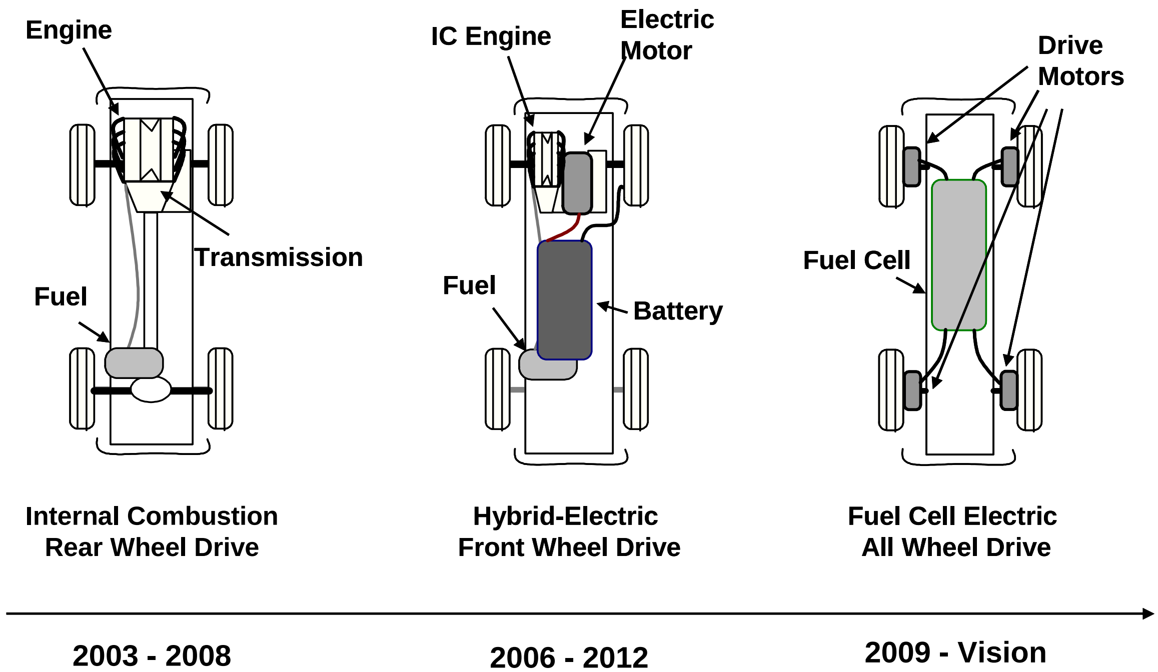


FIGURE 15-8C. Architectural Evolution.

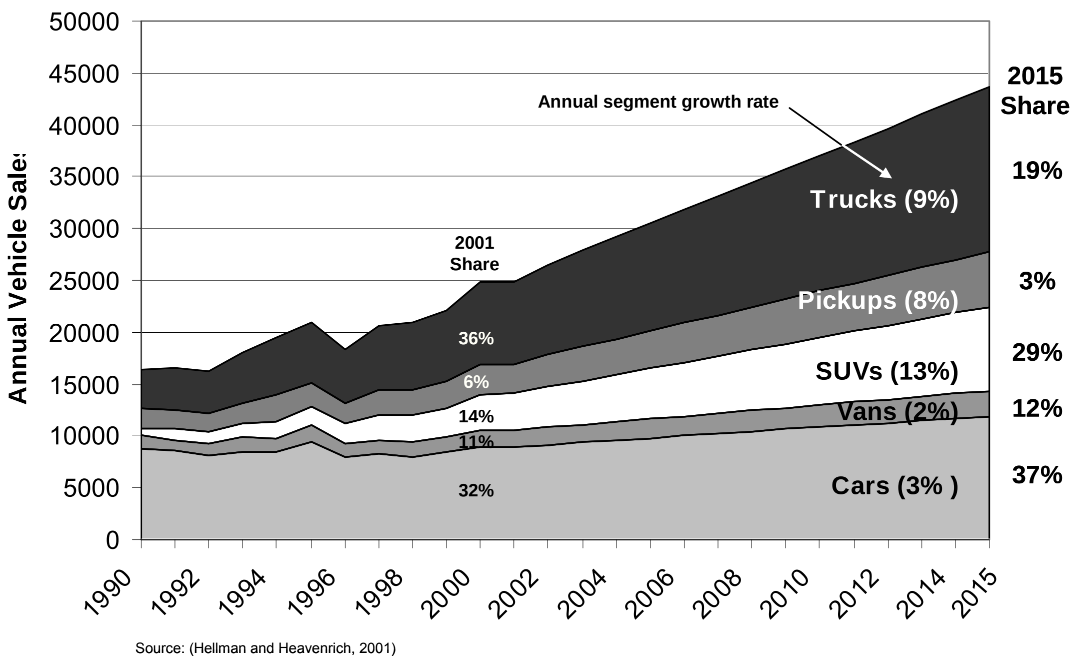
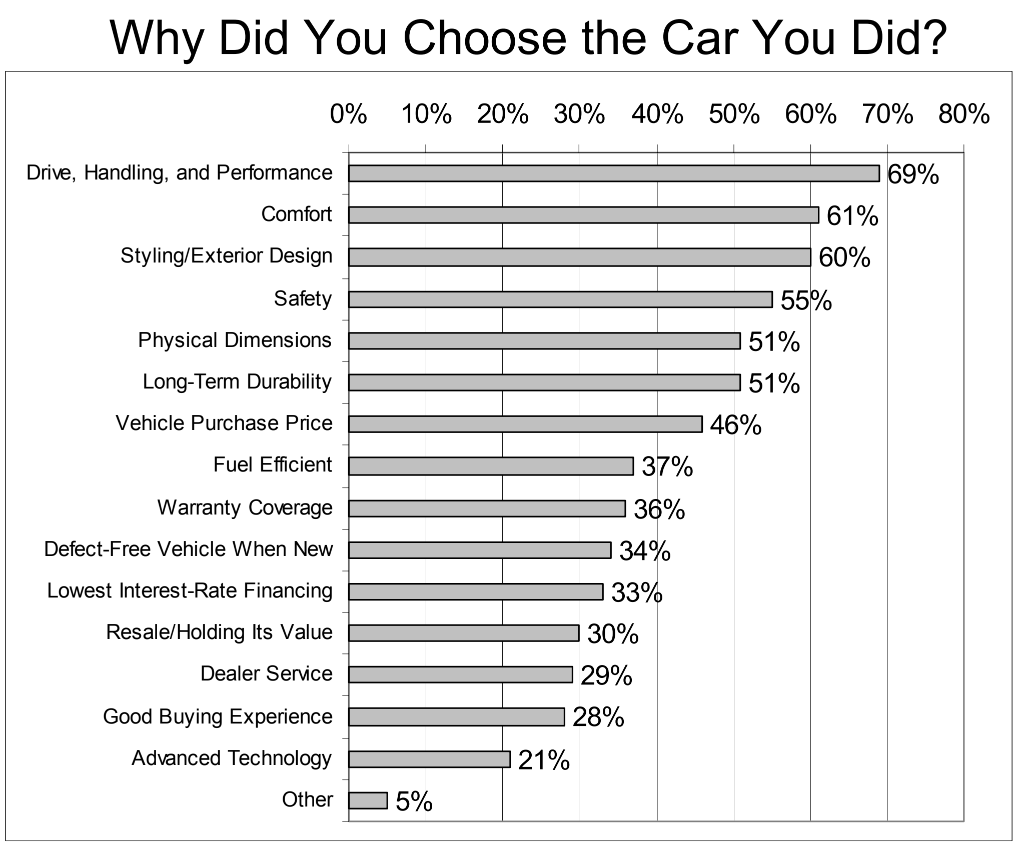


FIGURE 15-9. Market segmentation/structure.

Historically, the market has been highly variable from year to year, driven by economic conditions and also by changing tastes of the public, so substantial debate may ensue among members of the planning team about the future of the overall market and of the growth or decline of the passenger car segment. That debate might include discussion of whether forecast growth is too conservative or too optimistic, whether the growth in the various segments will remain at current rates, or whether economic or social conditions might bring about a shift in consumer preferences for cars versus SUVs or pickup trucks. The team might even call into question whether its focus on the car segment is the right one. It may also decide to create several scenarios, each with its own map, using different assumptions about growth and consumer preferences.

Market maps may also identify the important customer needs for a product line. Acme's marketing department has identified two significant customer subsegments in the passenger car market: the family sedan segment and the performance segment. The segments have similar needs, but with differing priorities. The marketing department has obtained independent research on customer's buying decision priorities, and this information is shown in Figure 15-10. The figure lists the key customer drivers, ordered by the frequency with which they are cited by survey respondents (McManus, 2003). Drive, handling, and performance are cited as important by nearly 70 percent of potential buyers, followed by comfort, design, and safety. The list of customer drivers will be used by the team to focus their product line development. Note that the highest-priority drivers focus on the car itself, while dealer service and good buying experience are further down the list, confirming the team's decision to concentrate first on creating a roadmap for the car itself and later on the larger "marchitecture."



Source: J. D. Power and Associates, Feature Contenting Report, 2002 (McManus, 2003)

FIGURE 15-10. Customer drivers.

(2) Maps That Set Targets or Objectives Over Time

Mapping over time is especially important for product line development. A key element of nearly every product line strategy is pricing and costing, and industry learning and experience curves can help set bounds and competitive targets. The Acme team must set price and cost targets for its passenger car line over the planning horizon to 2015. To make these projections, the Acme team uses an experience curve of the historical average car selling price/horsepower versus the cumulative U.S. industry production of passenger cars since 1975, shown in Figure 15-11. This experience curve, created by Acme's product managers using government data and market surveys, helps the team determine price and cost targets in the context of industry competition (Davis and Diegel, 2002, Hellman and Heavenrich, 2001, Ward's Communications, 2002). To help set targets for vehicle pricing, product managers have extrapolated the historical data using the industry learning rate and the marketing department's assumptions about market production.

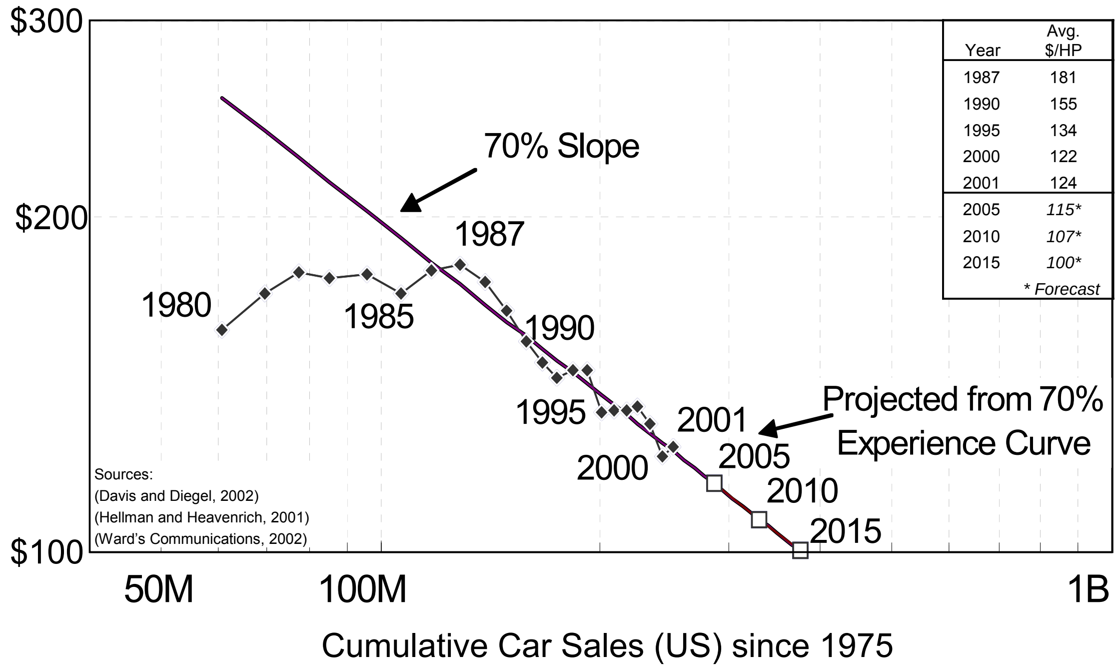


FIGURE 15-11. Price/Power Experience Curve for Passenger Cars.

As it introduces alternative powertrain architectures, Acme's team must make sure that the new configurations are competitive with the moving target of internal combustion engine technology. The experience curve shows that the 1980s were a period of little learning or reduction in price per horsepower. Then, during the 1990s, industry learning moved ahead at a rapid pace, reducing the price per horsepower, most likely due to the introduction of computer-controlled multivalve, fuel-injected engine technology and increased global competition. This learning changed the industry experience curve to a 70 percent slope, where a cumulative doubling of volume results in prices (and costs) declining to 70 percent of what they were. If this experience is extrapolated assuming industry production at levels similar to the past few years, the industry average price per horsepower will decline from about $124/horsepower in 2001 to about $100/horsepower in 2015.

An experience curve captures many forces that will impact prices and costs. It reflects the advance of technology innovation, conditions of industry competitiveness and culture (of sharing and exchanging learning), and the drivers of market demand. Forecasts using the slope of the experience curve are based on a number of assumptions that can be varied to study their impacts on targeting. For example, expected future market demand affects targets by determining how far along the forecast path the market will be.

The experience curve may also be used to evaluate the viability of competing technologies—to understand which technologies are most likely to win out over competition from a cost perspective. If the cost of a new competing technology declines at a steeper slope than the existing dominant technology, experience curves help forecast at what point the new technology will overtake the existing technology in the market. For example, the experience curve for price per horsepower tells Acme where it must set its cost targets for new powertrain technologies in order to be competitive in the future. In 2003, for example, the cost of a fuel cell alone was estimated to be about $1,300/horsepower.[2] If the price of the entire car is expected to be about $100/horsepower in 2015, auto manufacturers must reduce the fuel cell cost to the range of $20 to $30/horsepower by 2015 in order to be competitive. This sets a high bar for management's vision. The team will have to set aggressive performance targets for all subsystems, thereby setting the stage for competitive targets for the highest-priority product drivers, the key performance characteristics of the company's product line. It also signals a priority for Acme's research organization to focus on fuel cell cost reduction.

Maps described so far have largely been focused on one function in the product development chain. Maps across functions create a more complete product line story by connecting and integrating the functions.

(3) Maps That Link Market Drivers to Product Drivers and Technology Drivers

Linking functional plans together is a powerful way to focus development on the most important features serving the highest-priority needs. This linkage connects the most important product features to the architectural elements that will implement those features. Linking maps makes sure that product development priorities are focused on the things that are important to the customer and that will provide differentiation. Figure 15-12 is a map developed by Acme's cross-functional product team to show a part of the linkage of customer drivers to product drivers to technology elements of the architecture for Acme's passenger car product line. Customer drivers might be called the "know-whys" for the product line—the customers' priorities tell the Acme team why they should take a particular development course or introduce certain features. The product drivers are the "know-whats," identifying key product features. And the technology elements are the "know-hows" for the product line, showing how technologies can realize the product vision. The connections among drivers help the development team trace their designs and decisions back to fundamental customer needs. The linkages can also help establish priorities and timelines. For example, the technology elements with the greatest number of links to the high-priority product drivers will often become the focus of implementation. To develop the linking map, the team starts with the customer drivers, the key product performance dimensions, and the architectural elements; makes connections; and then prioritizes the drivers in each category. The Acme team finds that product drivers of power, acceleration, frame stiffness, suspension characteristics, and steering are the keys to the most important customer driver for handling and performance. The team's analysis proceeds until it has determined a small number of key drivers for which performance targets will be set. The team also determines the characteristics in which Acme will seek to lead competitors, perform at parity with the industry average, or lag the industry. Finally, the team links the product drivers to the elements of the architecture, indicating where in the architecture of the product new technologies must be introduced in order to meet performance targets. The Acme team determines that the powertrain is the key area of the architecture, and labels the powertrain as its attack technology, the area on which it will concentrate.

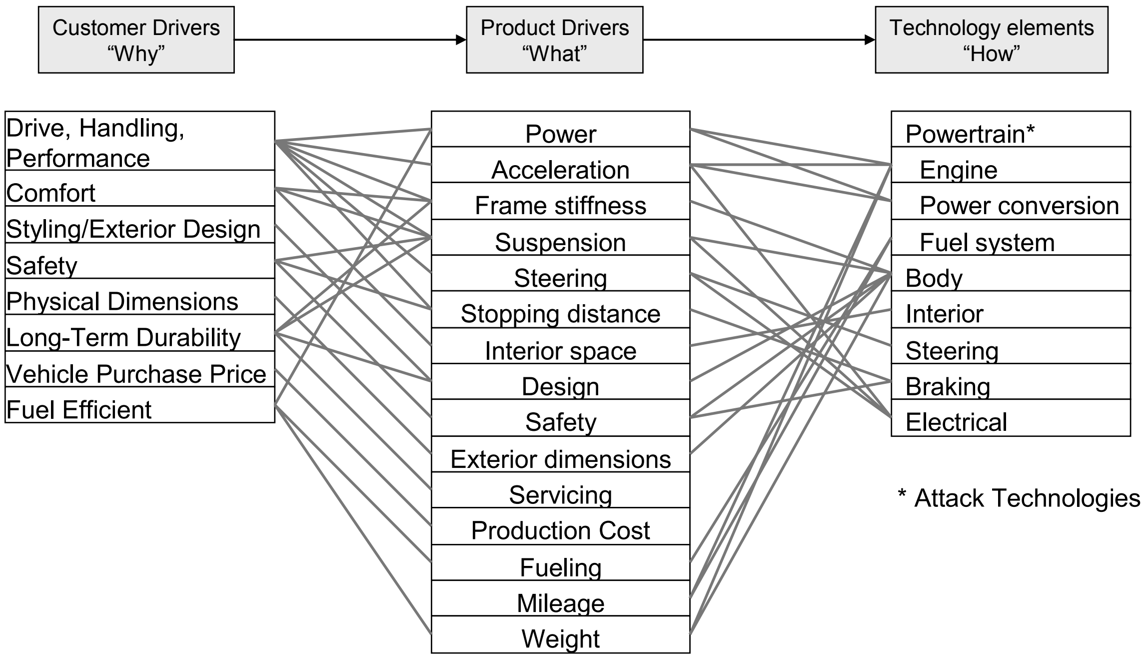


FIGURE 15-12. Driver mapping for cars.

(4) Maps That Show Product or Technology Evolution

The next set of maps that the Acme team develops involves the display of product or technology evolution over time. Maps of this type are often called roadmaps, because they indicate a direction for product and technology development and document the decisions the team has made to pursue one of many possible routes.

Maps may be used to show the evolution of the product line over time. The "product roadmap" shows how the product line evolves and branches to introduce new models or releases and when certain models or platforms are to be discontinued. This is a key output of the cross-functional team, and Figure 15-13 shows a product roadmap developed for Acme's passenger car product line. The roadmap shows the introduction of new platforms serving specific segments and branches to include new models targeted at specific segments. As the market evolves, Acme's product line will develop to include models targeted at the family and performance segments of the market. The current internal combustion engine, rear-wheel-drive platform will be renewed for the 2004 model year with a new body, the Model C, aimed at the family sedan segment. This platform will be updated once for the 2006 model year and then discontinued. Development will focus initially on a hybrid-electric platform, using the body components of the Model C to produce a no-frills model with high gas mileage that appeals to buyers looking for an economy sedan—the Model H-1. Late in 2006, the sporty Model H-S will be introduced, with fast acceleration (0 to 60 miles per hour in 6 seconds). The H-S will use the same body and other components as the H-1. Meanwhile, research will continue on a fuel cell-electric platform, with a concept car due in 2006. If the concept car meets market appeal and technical targets, the Model E will be introduced in 2009. The Model E will be the basis of the continuing product line with family and sport variations, and is indicated as the “vision.” To consolidate the product line, the Model C will be phased out in 2010, and the Model H platform will be discontinued in 2012.

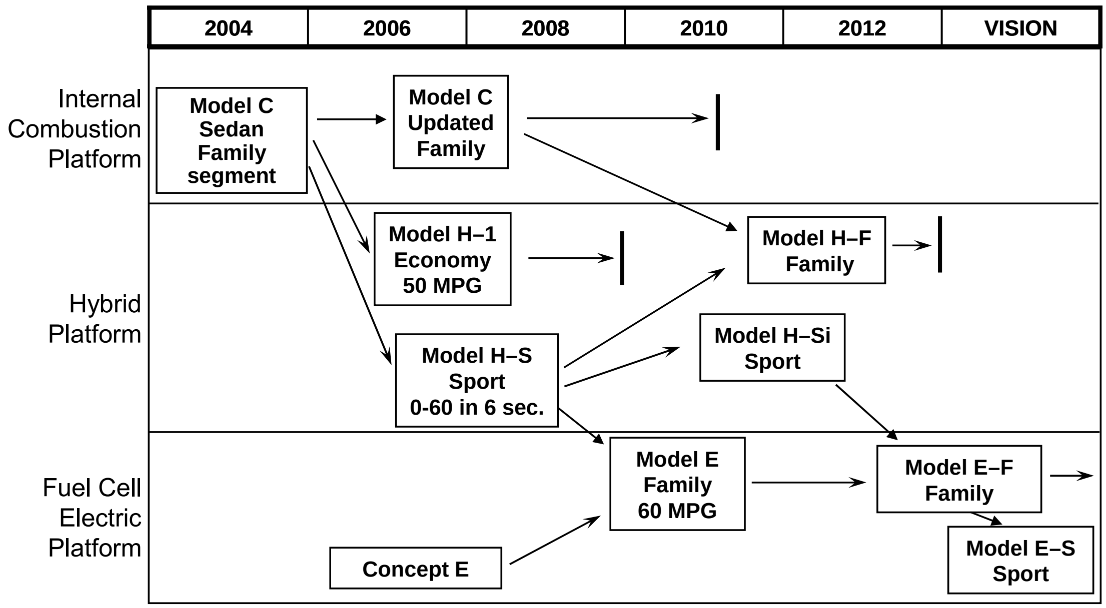


Figure 15-13. Acme’s passenger car product roadmap.

The product roadmap shows the current plan for the product line. Events will undoubtedly cause these plans to change, so the roadmap must be a living document, revisited periodically (yearly or twice yearly, for example) or when there are major changes in the marketplace. For example, if the Chinese market were to suddenly open up, a model to meet the needs of this market might be added to the roadmap.

Acme’s product roadmap includes a vision at the end of the time frame. This allows the team to describe the ultimate goal for the product line. In Acme’s case, the fuel cell-electric platform will be the ultimate destination of the product line.

Acme’s product roadmap is organized by powertrain platform. In alternative formulations, a critical dimension of product performance may be added. In the computer industry for example, roadmaps for successive generations of computers often use clock speed or some other measure of processing throughput versus time to show the expected evolution. In a market-driven company, the product roadmap might be organized by market segment to highlight the key differentiating features provided by marketing campaigns.

With the product roadmap in hand and key product drivers and targets set, the Acme team is ready to develop its “technology roadmap,” building a picture of the technologies that will be used over time in the product line. The technology roadmap is organized by the product architecture and helps make sure the right technologies, resources, and competencies will be ready when they are needed. A technology roadmap for Acme’s passenger vehicle product line is shown in Figure 15-14. The team constructs the technology roadmap from alternatives presented by the R&D organization, and the roadmap is developed to be consistent with the product roadmap.

Acme's passenger car roadmap shows the evolution of technologies to match the platform introduction shown in the product roadmap. Each row in the roadmap shows an element of the architecture, and the bars in each row identify the technologies that will be used during specified years of the plan. The current internal combustion engine design is used from 2004 through 2005, and an upgraded multivalve engine is used from 2006 until the Model C's production is discontinued in 2009. A hybrid engine is used in the Model H from 2006 through 2012, and electric drive is used in the Model E from 2009 through 2013. Each line of the technology roadmap includes space for a vision. For the engine, Acme's vision is to develop a very low weight electric drive system. The source of each technology is indicated on the roadmap by the shape of its bar (color may also be used). The internal combustion and hybrid engines will be developed by Acme's R&D organization, while the electric drive motors will be developed with a partner. The low-weight electric motor of the vision will be a project of Acme's research organization. The status of each technology is indicated by the thickness of the outline of its bar. The development of the internal combustion engine is staffed, the development of the hybrid engine is not yet staffed but it is planned, and the development of the electric drive motors is not yet planned.

Additional rows of the technology roadmap show the evolution of key technology elements of Acme's passenger car product line. The technology roadmap in Figure 15-14 shows the first level of technology detail. Each row may be expanded into many items or components as the team develops greater detail. In the end, the technology roadmap may extend to several pages of information. The technology roadmap will be a living document, revisited by the planning team periodically or as priorities and plans change.

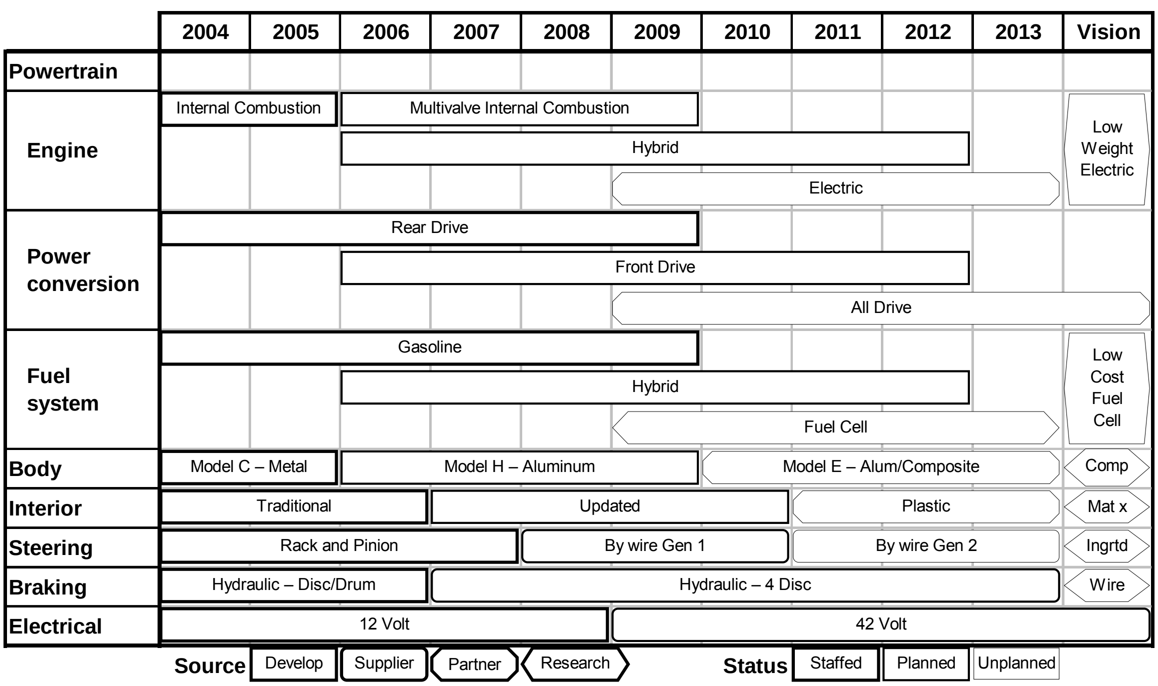


FIGURE 15-14. Acme's passenger car technology roadmap.

(5) Maps That Integrate Architecture, Time, and Linkages to Make a Product Line Story

The power of mapping becomes evident when functional maps are linked and integrated with each other to form a complete view of the product line evolution: the product-technology roadmap. Figure 15-15 shows an overview of the Acme team's complete product-technology roadmap. The figure shows thumbnail images of the maps described previously, along with several additional maps that complete the product line roadmap.

Acme's integrated product-technology roadmap is composed of four sections: market and competitive strategy, product definition and evolution, technology plans, and action plans. The arrows linking the parts together indicate the links formed by the driver maps. The market and competitive strategy section of the product technology roadmap includes a description of the market (including segmentation, growth, and key issues); a definition and prioritization of customer and market drivers; a competitive landscape that outlines the strengths, weaknesses, and strategies of competitors; and a statement of Acme's competitive market strategy defining how Acme plans to win in the marketplace. The second section of the integrated roadmap (product definition) includes the product roadmap, the product architecture, product drivers and targets, and a mapping of customer drivers to product drivers. The third section includes a mapping of product drivers to technology elements and the technology roadmap.

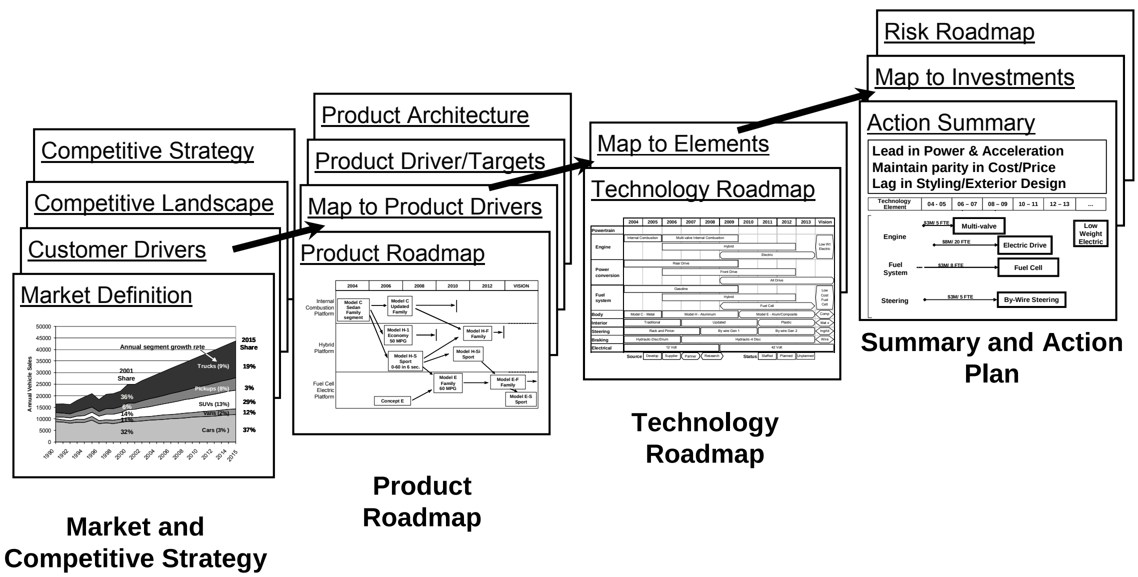


Figure 15-15. Putting it all together – Acme's passenger car product-technology roadmap

The first three parts of the product-technology roadmap lay out the team's plan for the product line. This information is brought to action in the fourth section, the summary and action plan. This section of the roadmap identifies key technology developments or acquisitions that must take place to realize the plan. The action plan also summarizes the key decisions of the team. Acme's team has decided to lead competitors in power and acceleration, maintain cost and price parity, and lag in styling/exterior design. To achieve the lead in power and acceleration, Acme will concentrate on engine design, incorporating multivalve technology in its internal combustion engine and then focusing on fuel cell and electric motor technologies, which can yield high torque for fast acceleration. Acme will seek to maintain cost/price parity, using the industry experience curve to target its price points. Acme's styling has never been leading-edge, and Acme's team has decided to cede leadership to other manufacturers in this area, planning to make up for Acme's pedestrian styling with driving excitement. In turn, based on these decisions, the Acme team has identified several key development projects that must be undertaken. Based on when these key technologies must be ready for use, the team has indicated when development must begin and provided a rough idea of resources (budget and staffing) that will be required. In this way, the action summary presents a plan for key actions.

The summary may also include a technology investment map that identifies all the planned technologies by their competitive impact. This map helps manage the technology portfolio by identifying each technology by its competitive potential (base, differentiating, or disruptive) and source (development, partnering, or acquisition). The objective of this mapping is to make sure that Acme's technology investment portfolio is achieving the right mix of base and differentiating technologies and that development resources are appropriately allocated. Often, portfolio managers find that resources are heavily devoted to base technologies (widespread and well-developed), rather than to differentiating and disruptive technologies. Maps help identify the right balance.

Finally, the summary may include a risk roadmap. A risk roadmap charts signals of game-changing events to watch for, those things that will require a change of plans. It is often derived from the event map developed in the early stages of planning, and it identifies key events or conditions for the team to monitor during the development period. Categories of risk may include market, technical, schedule, economic, political, resource, and other areas. The team will review and update the risk roadmap in their periodic review sessions as product developments progress.

(6) Maps Across Product Lines

The final application of maps described here crosses product lines to promote a rich product and technology portfolio process. Using its product-technology roadmap, Acme's passenger car product line team can compare its strategies, product driver targets, and technology needs with the roadmaps of Acme's other product teams. With a set of roadmaps in common markets or using common technologies, a cross-roadmap analysis can identify areas where development can be shared, technologies can be reused, or collaboration can benefit the corporation. A particularly effective framework for a cross-roadmap analysis uses a matrix of architectural elements versus market segments.

Figure 15-15 shows Acme's cross-roadmapping analysis, identifying common technologies across its several product lines, including passenger cars, vans, SUVs, pickups, and trucks. The product lines are listed across the page, while the architectural elements are listed vertically. In a cross-roadmap review, each product line team describes its plan and its key technology needs. These are then compared for commonality and summarized on the matrix, organized by the architectural elements. Each of the product lines, except for the truck line, need multivalve engine technology, so this development may be shared across several product lines. On the other hand, only the passenger car and van product lines have a need for front-wheel-drive technology. These two teams may collaborate to develop this technology. Several of the product lines have similar, but slightly different, needs for fuel cell technology, and they have each been asking Acme's small fuel cell research team for help. With the recognition of needs across several product lines, Acme's chief technology officer may give the research team a charter to develop fuel cells that can meet several units' needs.

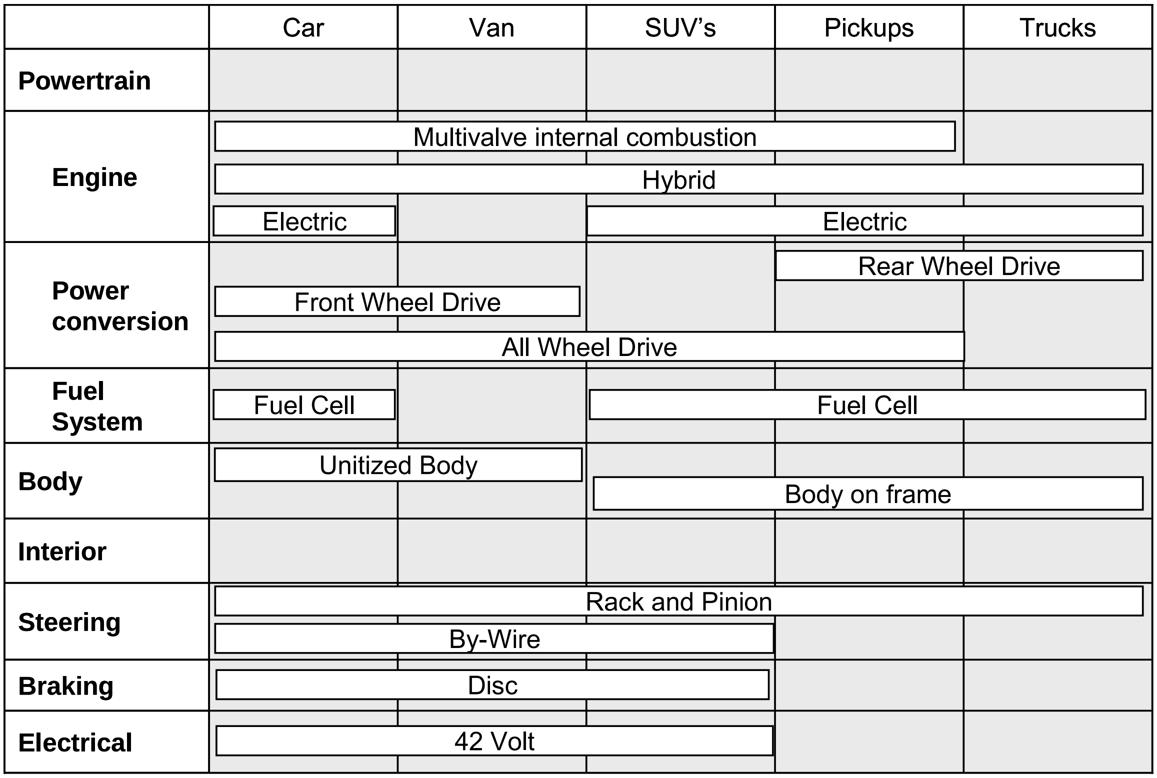


FIGURE 15-15. Acme's technology cross-roadmap framework.

Roadmaps are used for many purposes in corporations. The origin of roadmap is usually attributed to Motorola Corporation in the 1980s (Williard and McClees, 1989). Roadmaps have come to see many applications within corporations (Albright et al., 2003), as well as for industry planning and technology foresight (Kostoff and Schaller, 2001).

Roadmaps may be used as nested sources of information. A view at the top level of a roadmap gives a concise, graphical summary of plans for upper management review, or for communicating product strategy and directions to customers. Probed to greater depth, the roadmap reveals detailed information that guides the product development team, the life cycle management team, suppliers, and other stakeholders. Roadmaps can be key sources for product portfolio management, providing a common format for information that the portfolio management team can use to assess trade-offs. Key success factors for roadmapping include processes for getting started, dealing with sharing and secrecy, identifying situations for which roadmapping is a good fit (and those that are not), finding the right time horizon, making roadmaps compelling (Kappel, 2001), and measuring the value created by roadmapping (Albright, 2003).

EPILOGUE: OVERCOMING THE CORPORATE LEARNING DISABILITY

Maps in planning and portfolio management are graphic presentations of information that quickly and effectively communicate plans, objectives, and expected results. But just as important as the story the finished maps tell are the benefits of learning to the map makers as they construct, debate, and redefine their maps in the planning process. Maps give teams a way to identify knowledge gaps, set targets, and document results of research. They also easily communicate the work at the team level to the executive level, so strategic decisions can be made that reach across projects, markets, businesses, and time frames.

Peter Senge speculated over a decade ago that most—perhaps all—companies have "learning disabilities" (Senge, 1990: pp. 17–18). The practices of product and technology mapping provide a way for corporations to document intellectual property, describe the gaps between what they have and what they need to meet market needs, and turn this knowledge into a portfolio of product and technology development projects. Maps facilitate communication across the system boundaries that so often block learning and knowledge.

The important thing to remember about mapping is that you can begin implementation at a very modest level and continue to build on existing maps year after year. And another equally important thing to remember about mapping is that it does require attention and resources—it can be done part-time, but not in your spare time.

NOTES

1. Hohmann (2003) calls these "lo-fi" maps. Although the form of what we are calling "back-of-the-envelope" maps may remain high level, the depth of data and information that supports them can become very sophisticated over time.
2. The estimated cost of an automotive fuel cell in 2003 was about $1,000/kilowatt. A kilowatt is equivalent to 1.341 horsepower.

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