

THIRD EDITION

THE  
**PDMA**  
HANDBOOK

**of New Product Development**

Kenneth B. Kahn, Editor

SALLY KAY • REBECCA SLOTEGRAAF • STEVE UBAN  
Associate Editors



**pdma**

Product Development & Management Association



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# THE PDMA HANDBOOK OF NEW PRODUCT DEVELOPMENT

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THIRD EDITION

Kenneth B. Kahn, Editor

Associate Editors:

Sally Evans Kay

Rebecca J. Slotegraaf

Steve Uban



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# INTRODUCTION

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In today's world, where innovation is critical to corporate success and survival, the third edition of the *PDMA Handbook of New Product Development* provides the premier guide for the identification and execution of critical new product development (NPD) practices. The editors' intent is that readers of this *Handbook* will gain insights into how to make improved decisions when traveling through the difficult landscape typical of NPD. Modeled after the previous two editions, the third edition of *The PDMA Handbook of New Product Development* presents updated core content chapters and new chapters covering those topics deemed important to NPD practice. While the term *product* is used, the material in this *Handbook* is intended for product and/or service development situations.

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## The Intended Audience for This Book

This *Handbook* is written for people involved in the development and management of new products and services who have a keen interest in increasing their knowledge of the topic.

The following excerpt from a reader's review of the first edition on Amazon.com provides insight into who will benefit from this book:

To whom can I recommend this book? To anyone who wants to increase his or her own scope of knowledge of NPD. Especially to a person who has already gained some experience in this field and is able to compare his or her own experience to this book.

Accordingly, the overarching goal of this handbook is to help new practitioners of product development as well as those with some experience to better understand and apply critical practices in product innovation.

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## How To Use This Book

No NPD guidebook can anticipate the uncharted terrain into which a new product developer may occasionally stumble. While this *Handbook* offers concise, map-like detail about individual topics, it is also similar to a compass. As a compass, it will enable you to find your bearings no matter where in the topography you unexpectedly find yourself.

Of course, each reader of this *Handbook* will have different interests. We recommend that first-time readers skim the Contents to learn about the content of each of the *Handbook's* five sections. Once oriented, they can explore the topics that interest them or where they feel they need guidance.

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## The Book's Organization

The *Handbook* begins with Section One, which presents an overview of the nature of innovation and the NPD endeavor to prepare for this undertaking. The next three sections then follow the general flow of NPD in most firms, recognizing that this flow in practice is not compartmentalized or often linear, and that the tasks associated with one set of activities may overlap with the tasks of another set of activities. Section Two addresses topics surrounding the front end of the NPD process—the starting point. Section Three presents techniques and tools as one progresses through the NPD process. Section Four discusses the back end of the NPD process, as well as the means to achieve NPD success. The last section, Section Five, provides a view of the PDMA and its efforts to create new knowledge that closes the gap between NPD theory and practice.

The Appendix provides a description of and contact information for the Product Development & Management Association (PDMA). The New Product Development Glossary contains terms commonly used in NPD.

In summary, the *PDMA Handbook* is organized as follows:

Section I *Preparing* (page 1)

Section II *Starting* (page 115)

Section III *Progressing* (page 211)

Section IV *Achieving* (page 295)

Section V *PDMA Research* (page 385)

Appendix: About the Product Development & Management Association (PDMA) (page 427)

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We encourage readers to consider PDMA's other products. These include the PDMA website at [www.pdma.org](http://www.pdma.org), the award-winning *Journal of Product Innovation Management*, the award-winning *Visions* magazine, the *PDMA ToolBooks* (published by Wiley), New Product Development Professional Certification, and conferences and workshops. In addition, the PDMA Foundation creates and delivers actionable knowledge, such as the Comparative Performance Assessment Study for better decisions in new products management. Additional information on the PDMA is presented in the Appendix.

Finally, we appreciate the support that our publisher, John Wiley & Sons, has provided. Robert L. Argentieri and his assistants gave timely counsel and ably shepherded this multi-authored manuscript through the editorial process.

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**Steve Uban, PE, NPD**, has been a practitioner in research and new product development for almost 40 years. His new product involvement has been as a practitioner for companies such as Ecodyne, Neptune, UOP, Allied-Signal, Waste Management, Wheelabrator, U.S. Filter, Vivendi, and Weatherford. A recent product was an architectural curtain-wall product for the first reconstructed building at 7 World Trade Center in New York City. He is a former general manager of an international division of Vivendi and has spent most of his career protecting the waters of the world. He is still an active inventor in water, wastewater, industrial filtration, and infrastructure management areas and is currently working as an independent product developer for a new startup company, Informational Data Technologies, in the areas of satellite data gathering and water management. He finds great joy in creating jobs for people through new products.

Mr. Uban is a Professional Engineer and Certified New Product Development Professional and has been a member of PDMA for almost 30 years.

He was a founding board member of the Minnesota chapter and a past Vice President of New Products, and was Vice President of Publications when PDMA created their first website and first *Handbook*. He is currently Research Director for the PDMA Research Foundation and serves on the board of the PDMA Foundation.



## SECTION ONE

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# PREPARING

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*By failing to prepare, you are preparing to fail.*

—BENJAMIN FRANKLIN (1706–1790), AMERICAN INVENTOR,  
JOURNALIST, PRINTER, DIPLOMAT, AND STATESMAN







## CHAPTER ONE

---

# NEW PRODUCTS—WHAT SEPARATES THE WINNERS FROM THE LOSERS AND WHAT DRIVES SUCCESS

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Robert G. Cooper

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### 1.1 Introduction

Product innovation—the development of new and improved products and services—is crucial to the survival and prosperity of the modern corporation. According to a recent American Productivity & Quality Center (APQC) benchmarking study, new products launched in the last three years currently account for 27.3 percent of company sales, on average (Edgett, 2011), and a survey of executive opinion reveals that “enhancing innovation abilities” is now the *number one driver* of corporate growth and prosperity (a decade ago, it was “cost cutting”; Arthur D. Little, 2005). But many new products do not succeed: The same APQC study reports that just over half (53.2 percent) of businesses’ new product development projects achieve their financial objectives and only 44.4 percent are launched on time.

#### **The Quest for the Critical Success Factors**

The keys to new product success outlined in this chapter are based on numerous research studies of why new products succeed, why they fail, comparisons of winners and losers, and benchmarking

*(Continued)*

studies of best-performing businesses. Many of these investigations have been reported over the years in the PDMA journal, the *Journal of Product Innovation Management*. Some of the most revealing of these studies have been the large-sample quantitative studies of successful versus unsuccessful new products (for an excellent review, see Cooper, 2011a; Montoya-Weiss and Calantone, 1994). They began with Project SAPPHO in the early 1970s, followed by the NewProd series of studies, the Stanford Innovation Project, and, subsequently, studies in countries outside of North America and Europe (Mishra and Lee, 1996; Song and Parry, 1996). More recently, several large benchmarking studies of best practices have provided other insights into how to succeed at product innovation (American Productivity & Quality Center, 2003, Cooper, Edgett, and Kleinschmidt, 2003). This long tradition of research has enabled us to pinpoint the critical success factors—those factors that separate winners from losers—that are outlined in this chapter.

The central role of product innovation in business strategy coupled with the poor innovation performance results in many firms has resulted in a quest for the factors that drive performance and lead to product innovation success (see “The Quest for the Critical Success Factors”). Understanding why new products succeed and why some businesses are so much better than others at product innovation is central to effective new product management: It provides insights for managing new product projects (for example, are certain practices strongly linked to success?) and clues to new product selection (what are the telltale signs of a winner?). This chapter reports the findings from myriad studies of what makes new products winners and what makes some businesses more successful than others at product development.

Some success drivers distinguish *successful new products* from unsuccessful ones and thus are most relevant for managing individual new-product projects (see “Why New Products Succeed—Eight Critical Success Drivers”). Other success drivers explain why *some businesses* are more successful at product innovation than others and hence are most relevant at the business level (see “Why Businesses Excel—Nine Critical Success Drivers”).

### **Why New Products Succeed—Eight Critical Success Drivers (Cooper, 2011a)**

1. A unique superior product—a differentiated product that delivers unique benefits and a compelling value proposition to the customer or user—is the number one driver of new product profitability.
2. Building in the voice of the customer—a market-driven and customer-focused new product process—is critical to success.
3. Doing the homework and front-end loading the project is key to success: Due diligence done before product development gets underway pays off!
4. Getting sharp and early product and project definition—and avoiding scope creep and unstable specs—means higher success rates and faster to market.
5. Spiral development—build, test, obtain feedback, and revise—putting something in front of the customer early and often gets the product right.
6. The world product—a global or *glocal* product (global concept, locally tailored) targeted at international markets—is far more profitable than the product designed for to meet one-country needs.
7. A well-conceived, properly executed launch is central to new product success. And a solid marketing plan is at the heart of the launch.
8. Speed counts! There are many good ways to accelerate development projects, but not at the expense of quality of execution.

---

## **1.2 Critical Success Factors at the Project Level**

### **1.2.1 Striving for Unique Superior Products**

Delivering products with unique benefits and real value to customers and/or users separates winners from losers more often than any other single factor. Such superior products have five times the success rate, over four

times the market share, and four times the profitability of “me too,” copycat, reactive, and ho-hum products with few differentiated characteristics (American Productivity & Quality Center, 2003; Cooper, 2011a; Cooper, Edgett, and Kleinschmidt, 2003; McNally, Cavusgil, and Calantone, 2010). (Note that the *customer* buys the product, whereas the *user* uses the product; the two are not necessarily the same, although often the terms are used interchangeably.)

That differentiated, superior products are key to success should come as no surprise to product innovators. Apparently, however, this isn't obvious to everyone: Study after study shows that reactive products and “me too”

offerings are the rule rather than the exception in many businesses' new product efforts, and the majority fail to produce large profits.

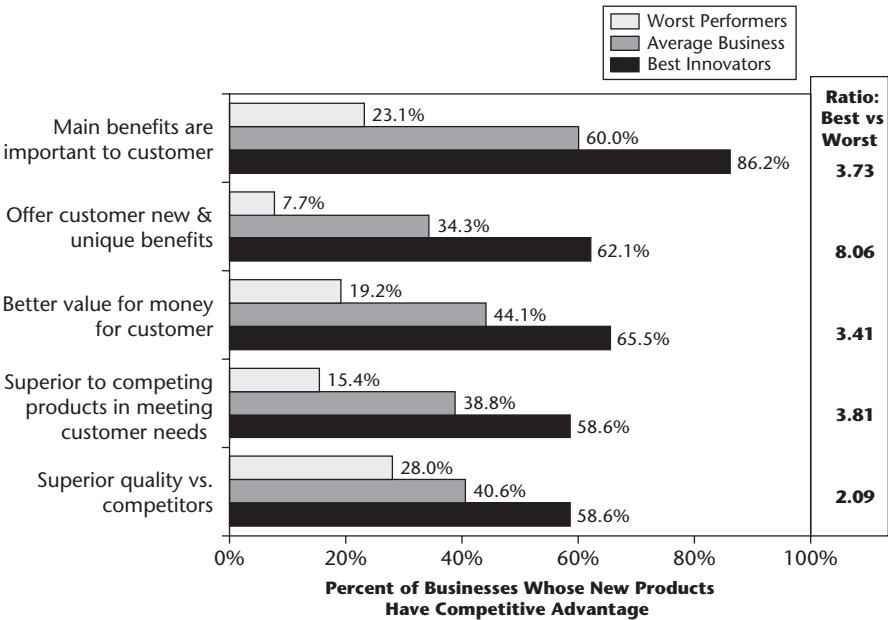
What do these superior products with unique customer or user benefits have in common? These winning products:

- Feature good value for money for the customer, reduce the customer's total costs (high value in use), and boast excellent price/performance characteristics
- Provide excellent product quality relative to competitors' products and in terms of how the user measures quality
- Are superior to competing products in terms of meeting users' needs, offer unique features not available on competitive products, or solve a problem the customer has with a competitive product
- Offer product benefits or attributes easily perceived as useful by the customer and benefits that are highly visible

*Superior and differentiated products—ones that deliver unique benefits and superior value to the customer—are the number one driver of success and new product profitability.*

Note that there are at least two elements of product advantage: As one study notes, *product meaningfulness* concerns the benefits that users receive from buying and using a new product, whereas *product superiority* captures the extent to which a new product outperforms competing products (Rijsdijk, Langerak, and Jan, 2011). Note also that “product” means not only the evident or physical product but the “extended product”—the entire bundle of benefits associated with the product, including the system supporting the product, product service and support, as well as the product's image.

**FIGURE 1.1 A UNIQUE, SUPERIOR PRODUCT IS THE NUMBER ONE DRIVER OF NEW PRODUCT SUCCESS.**



Best-performing businesses emphasize these factors in their new product efforts. The APQC benchmarking study cited above shows that the best performers are much stronger in terms of offering important benefits, a superior value proposition, and better value for the customer in their new products (Figure 1.1) (American Productivity & Quality Center, 2003; Cooper, Edgett, and Kleinschmidt, 2003). There, “best performers” were identified as businesses whose product innovation results are superior on a number of performance metrics: new product profitability, meeting sales and profit objectives, time efficiency and on-time performance, and the ability to open up new windows of opportunity.

The management implications are clear:

- First, these ingredients of a superior product (Figure 1.1) provide a useful checklist of items to assess the odds of success of a proposed new product project. They logically become top-priority issues in a project screening checklist or scoring model.

- Second, these ingredients become challenges to the project team to build into their new product design. Note that the definition of “what is unique and superior” must be based on an in-depth understanding of customer or user needs, wants, problems, likes, and dislikes. This leads to success factor 1.2.2, discussed in the next section.

But how does one create or build in product superiority? Note that superiority is derived from design, features, attributes, specifications, and even branding and positioning. The important point here is that *superiority* is defined from the customer’s or user’s standpoint, not from those of the R&D, technology, or design departments. Sometimes product superiority is the result of new technology or a technological breakthrough. But more than technology and unique features are required to make a product superior. Note that features are those things that cost the developer money. By contrast, benefits are what customers pay money for! Often the two—features and benefits—are not the same. So, in defining *unique benefits*, think of the product as a bundle of benefits for the user and a benefit as something that customers view as having value to them.

### 1.2.2 Creating Market-Driven Products and Building in the Voice of the Customer (VoC)

A thorough understanding of customers’ needs and wants, the competitive situation, and the nature of the market is an essential component of new product success. This tenet is supported by virtually every study of product success factors. Conversely, failure to adopt a strong market orientation in product innovation, unwillingness to undertake the needed market assessments, and leaving the customer out of product development spell disaster. These are the culprits found in almost every study of why new products fail.

A provocative finding of a number of studies is that not only does a strong customer focus improve success rates and profitability, but it also leads to reduced time to market (Cooper and Edgett, 2002). Contrary to myth, taking a little extra time to execute quality market analysis and market research does not add extra time; rather, it pays off, not only with higher success rates but also in terms of staying on schedule and achieving better time efficiency.

Sadly, a strong market orientation is missing in the majority of firms’ new product projects. Detailed market studies are frequently omitted (in more than 75 percent of projects, according to one investigation).

Further, marketing activities are the lowest-rated activities of the entire new product process, rated far below corresponding technological actions. Moreover, relatively few resources and little money are spent on the marketing actions (except for the launch), accounting for less than 20 percent of the total project.

The management implication is that a market focus should prevail throughout the entire new product project, with best practices such as the following (Griffin and Hauser, 1996):

- *Idea generation:* The best ideas come from customers! Market-oriented idea generation activities, such as focus groups and VoC research (ethnography, site visits) with customers to determine customers' generic needs and/or their problems, lead to superior ideas (Cooper and Dreher, 2010). Robust ideas also come from innovative users and web-based customer inputs to help craft the idea or product.
- *The design of the product:* User and customer inputs have a vital role in the design of the product—when the product's requirements and specifications are being defined. Often, market research, when done at all, is done too late—after the product design has already been decided and simply as an after-the-fact check. Note that market research must be used as an input to the design decisions and serve as a guide to the project team before they charge into the design of the new product. Best performers determine customer and user needs at the outset, starting with a user needs-and-wants study (VoC research) in tandem with a competitive product analysis (competitive benchmarking). Best practices here include in-depth personal interviews with customers and users; customer site visits (done by the entire project team); “camping out” with the customer (extended site visits or ethnography); customer panels; and large-sample quantitative market research. Even in the case of technology-driven new products (where the idea comes from a technology or laboratory source, perhaps a technology breakthrough), the likelihood of success is greatly enhanced if customer and market-place inputs are built into the project soon after its inception.
- *Before pushing ahead with development:* Best performers test the product concept with the customer by presenting a representation of the product—via models, mock-ups, protocepts, computer-aided design (CAD) drawings, and even virtual prototypes—and gauging the customer's interest, liking, and purchase intent. It's much cheaper to test and learn before development begins than to develop the product first and then begin customer testing.

- *Throughout the entire project:* Customer inputs shouldn't cease at the completion of the predevelopment market studies. Seeking customer inputs and testing concepts or designs with the user is very much an iterative process—*spiral development*, as outlined in Section 1.2.5.. By bringing the customer into the process to view facets of the product via a series of concept tests, rapid prototyping and tests, customer trials, and test markets, the developer verifies all assumptions about the winning design.

### 1.2.3 Predevelopment Work—the Homework

Homework is critical to winning. Countless studies reveal that the steps that precede the actual design and development of the product make the difference between winning and losing (Cooper, 2011a; Edgett, 2011). Successful firms spend about twice as much time and money as unsuccessful firms, as a percent of total project costs on these vital front-end activities:

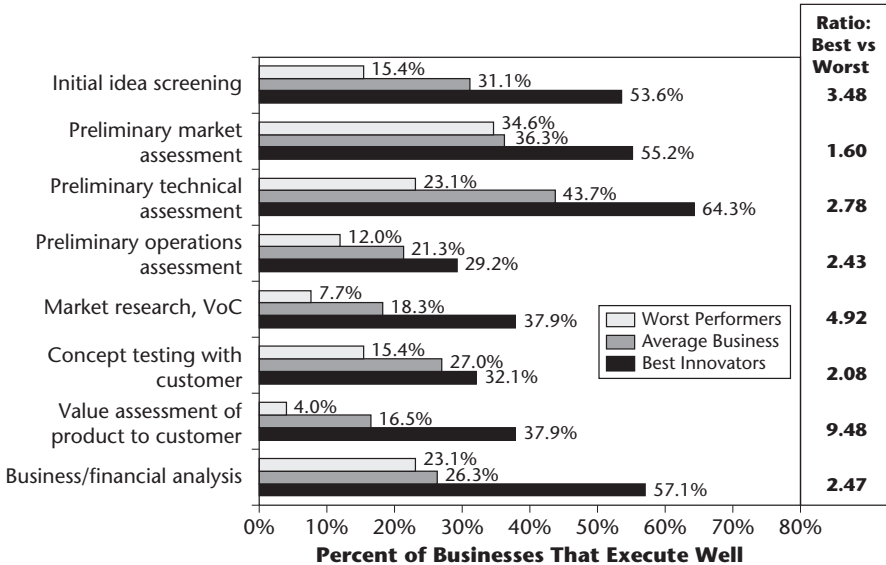
- Initial screening—the first decision to begin the project (the idea screen)
- Preliminary market assessment—the initial market study
- Preliminary technical assessment—the first and quick technical appraisal of the project
- The detailed market study, market research, and VoC research (described in Section 1.2.2)
- The business and financial analysis just before the decision to go to development (building the business case)

Another issue is the *balance* within the homework phase. Best performers strike an appropriate balance between market/business-oriented tasks and technical tasks, while worst performers tend to push ahead on the technical side and pay lip service to marketing and business issues in the early phases of the project. Figure 1.2 shows how much better best performers execute the homework activities, especially the early-stage marketing/business tasks. Surprisingly, most firms confess to serious weaknesses in the front-end or predevelopment steps of their new product process. Pitifully small amounts of time and money are devoted to these critical steps: only about 7 percent of the total project dollar cost and 16 percent of the effort.

“More homework means longer development times” is a frequently voiced complaint. This is a valid concern, but experience has shown that homework pays for itself in reduced development times as well as improved success rates.



**FIGURE 1.2 QUALITY OF EXECUTION IN THE FUZZY FRONT END IMPACTS STRONGLY ON NEW PRODUCT SUCCESS.**



- First, all the evidence points to a much higher likelihood of product failure if the homework is omitted. So, the choice is between a slightly longer project and greatly increased odds of failure.
- Second, better project definition, the result of sound homework, actually speeds up the development process. One of the major causes of time slippage is poorly defined projects as they enter the development stage: vague targets and moving goalposts.
- Third, given the inevitable product design evolution that occurs during the life of a project, the majority of these design improvements or changes should not be made as the product is moving out of development and into production. More predevelopment homework anticipates these changes and encourages their occurrence earlier in the process rather than later, when they are more costly.

The message is clear: Don't skimp on the homework! First, cutting out homework drives success rates down; second, eliminating homework to save time today will lead to wasted time tomorrow. It's a "penny wise, pound foolish" way to save time. As Toyota's new products handbook

(Morgan, 2005) recommends: *Front-end load the project*. That is, undertake a higher proportion of the project's work in the early stages and ensure that no significant project move into the development stage without the actions listed in Figure 1.2—early-stage activities that should be built into the idea-to-launch system.

#### 1.2.4 Sharp, Early, Stable, and Fact-Based Project and Product Definition

Two of the worst time wasters in a new-product project are project scope creep and unstable product specs. *Scope creep* means that the definition of the project constantly changes: The project might begin as a single-customer initiative, then be targeted at multiple users, and finally end up being a platform for a new family of products. *Unstable product specs* means that the product definition – product requirements and specifications – keeps changing throughout the development stage; thus, the technical people chase elusive development targets—moving goalposts—and take forever to get to the goal.

Securing *sharp, early, stable, and fact-based project and product definition* during the homework phase is a solution. How well the project and product are defined before the development stage begins is a major success factor, impacting positively on both profitability and reduced time to market. Some companies undertake excellent product and project definition before the door is opened to a full development program. This definition includes:

- Definition of the project's scope (e.g., domestic versus international; line extension versus new product item versus platform development)
- Specification of the target market: exactly who the intended customers or users are
- Description of the product concept and the benefits to be delivered to the user (including the value proposition)
- Delineation of the positioning strategy, including the target price
- A list of the product's features, attributes, requirements, and specifications (prioritized: "must have" and "would like to have")

Unless the five items in the definition list are clearly defined, written down, and

*Securing sharp, early, stable, and fact-based project and product definition during the homework phase is one of the strongest drivers of cycle time reduction and new product success.*

agreed to by all parties prior to entering the development stage, the odds of failure will skyrocket. Here's why:

- Building in a definition step forces more attention to the front-end or predevelopment activities, a key success driver (Section 1.2.3).
- The definition serves as a communication tool and guide. All party agreement or buy-in means that all functional areas involved in the project have a clear and consistent definition of what the product and project are and are committed to them.
- This definition also provides a clear set of objectives for the development stage of the project and for development team members: The goalposts are defined and clearly visible.

### 1.2.5 Spiral Development—Build, Test, Feedback, and Revise

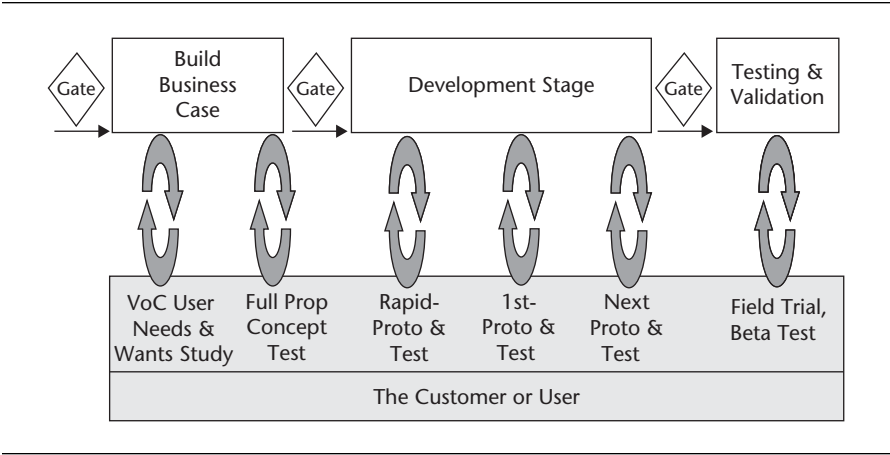
Spiral development is the way fast-paced teams handle the dynamic information process with fluid, changing information. Spiral development helps the project team get the product and product definition right, in spite of the fact that some information is fluid and some may even be unreliable when the team moves into the development stage.

Many businesses use *too rigid and linear a process* for product development. The project team diligently visits customers in the predevelopment or front-end stages and determines customer needs and requirements as best they can. Front-end work or homework is properly done; and the product specs are determined, and the product definition is fixed. So far, so good.

The development stage gets underway but proceeds in *a linear and rigid fashion*. The project team moves the project forward following a “heads-down” rather than a “heads-up” approach. Some 10 or 15 months pass, and at the end of this linear development stage, the product is ready for field trials or customer tests. Then everything goes wrong. When presented with the prototype or beta product for testing, the original intended customers now indicate that “this is not quite what we had in mind” or that “things have changed.” Or perhaps a new competitive product has been launched that alters the competitive landscape.

Smart project teams and businesses practice spiral development (based on *agile development*, as used in the information technology industry). They build in a series of *iterative steps* or *loops* whereby successive versions of the product are shown to the customer to seek feedback and verification, as shown in Figure 1.3. These loops are a series of

**FIGURE 1.3 SPIRAL DEVELOPMENT—A SERIES OF BUILD-TEST-FEEDBACK-REVISE ITERATIONS—GETS THE PRODUCT RIGHT WITH NO TIME WASTED.**



“build-test-feedback-and-revise” iterations (their iterative nature leads to the term *spiral development*):

- Build something, even if it’s only a model or representation of the product.
- Test it: get it in front of the customer or user and gauge interest, liking, preferences and purchase intent, likes and dislikes.
- Get feedback: find out the customer’s reactions firsthand and, most important, what must be fixed or changed.
- Revise: update the product definition based on this feedback, and get set for the next iteration of build-test-feedback-and-revise, but this time with a product version one step closer to the final product.

*People don’t know what they’re looking for until they see it or experience it. So, get something in front of the customer or user fast—and keep repeating these tests all the way through to formal product testing.*

**1.2.6 The World Product—a Global Orientation**

The world is the business arena today; thus, corporate growth and profitability depend on a globalization strategy married to product innovation. In global markets, product development plays a primary role in achieving a sustainable competitive advantage (Kleinschmidt, de Brentani, and Salomo 2007).

Multinational firms that take a global approach to new product development outperform those that concentrate their research spending in their home market (de Brentani and Kleinschmidt, 2004; de Brentani, Kleinschmidt, and Salomo, 2010; *The Economist*, 2008; Kleinschmidt, de Brentani, & Salomo, 2007). International products designed for and targeted at world and nearest neighbor export markets are the best-performing new products. By contrast, products designed for only the domestic or home market, and later adjusted and sold to nearest neighbor export markets, fare worse. The magnitude of the differences between international new products and domestic products is striking: two or three to one on various performance gauges.

The management implication of these and other studies is that *globalization of markets demands global new products*. To define the new products market as domestic and perhaps including a few other nearby convenient countries severely limits market opportunities. For maximum success in product innovation, the objective must be to design for the world and market to the world. Sadly, this international dimension is often overlooked or, if included, is handled late in the development process or as a side issue.

A global orientation means defining the market as an international one and designing products to meet international requirements, not just domestic ones. The result is either a *global* product (one version for the entire world) or a *glocal* product (one development effort, one product concept or platform, but perhaps *several product variants* to satisfy different international markets). Another option is *two glocal* products—for example, one designed for western or developed countries, but with different versions to suit different countries or regions; and an Asian version to sell to developing countries, but, again, tailored to suit different needs in these countries. A global orientation also means undertaking VoC research, concept testing, and product testing in multiple countries rather than just the home country and launching in multiple countries concurrently or in rapid succession; it also means relying on a global project team with team members in multiple countries (only one new product project team in five is reported to be a global development team; de Brentani, Kleinschmidt, and Salomo, 2010; Kleinschmidt, de Brentani, and Salomo, 2007).

### 1.2.7 Planning and Resourcing the Launch

Ralph Waldo Emerson once said, “Build a better mousetrap and the world will beat a path to your door.” The problem is that Emerson was a poet, not a businessman. Not only must the product be a superior one, but it must

also be launched, marketed, and supported in a proficient manner. A quality launch is strongly linked to new product profitability, and effective after-sales service is central to the successful launch of the new product (Di Benedetto, 1999; Montoya-Weiss and Calantone, 1994; Song and Parry, 1996).

The message is this: Don't assume that good products sell themselves, and don't treat the launch as an afterthought. Even though the launch is the last step in the project, never underestimate its importance. A well-integrated and properly targeted launch does not occur by accident, however; it is the result of a *fine-tuned marketing plan*, properly backed and resourced and proficiently executed. There are five requirements for an effective market launch plan:

1. The development of the market launch plan is an *integral part of the new product process*. It is as central to the new product process as the development of the product itself.
2. The development of the market launch plan *must begin early* in the new product project. It should not be left as an afterthought to be undertaken as the product nears commercialization.
3. A market launch plan is only as good as the *market intelligence* upon which it is based. Market studies designed to yield information crucial to marketing planning should be built into the new product project.
4. The launch must be properly resourced—in terms of both people and dollars. Too often, an otherwise great new product fails to achieve its sales goals simply because of a underresourced launch.
5. Those who will execute the launch—the sales force, technical support people, other front-line personnel—should be engaged in the development of the market launch plan and therefore should be members of the project team. This ensures valuable input and insight into the design of the launch effort, availability of resources when needed, and buy-in by those who must execute the launch—elements critical to a successful launch (Hultink and Atuahene-Gima, 2000).

### 1.2.8 Speed—But Not at the Expense of Quality of Execution

Speed is a competitive weapon. Speed yields competitive advantage—the first on the market; it means less likelihood that the market or competitive situation has changed; and it results in a quicker realization of profits. So, the goal of reducing the development cycle time is admirable. A word of caution here, however: Speed is only an interim objective; the ultimate goal is profitability. While studies reveal that speed and profitability are connected,

the relationship is anything but one to one! Further, there is a dark side to the emphasis on speed: Often the methods used to reduce development time yield precisely the opposite effect, and in many cases are very costly – they are at odds with sound management practices (Cooper and Edgett, 2002; Crawford, 1992). The objective remains successful products, not a series of fast failures! Additionally, overemphasis on speed has led to trivialization of product development in some firms— too many product modifications and line extensions and not enough real new products (Cooper, 2005).

Some sound principles that project teams embrace in order to reduce time to market include:

- Doing the front-end homework and developing early and stable product and project definitions based on facts rather than hearsay and speculation (success drivers discussed in Sections 1.2.3 and 1.2.4); this saves time downstream.
- Building in quality of execution at every stage of the project. The best way to save time is by avoiding having to cycle back and do it a second time.
- Employing effective cross-functional teams: “Rip apart a badly developed project and you will unfailingly find 75 percent of slippage attributable to: ‘siloeing,’ or sending memos up and down vertical organizational “silos” or “stovepipes” for decisions; and sequential problem solving” (Peters, 1988).
- Using *parallel processing*: The relay race, sequential, or series approach to product development is antiquated and inappropriate for today’s fast-paced projects.
- Using *spiral development*, as described in Figure 1.3. These build-test-feedback-revise iterations begin with the concept test in Stage 2 (see Figure 1.7) and end with the full field trials (beta tests) in Stage 4.
- Prioritizing and focusing – doing fewer projects but higher-value ones. By concentrating resources on the truly deserving projects, not only will the work be done better, it will be done faster.

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## 1.3 Critical Success Factors at the Business Level

Why are some businesses so much more successful at product innovation than others? Huge differences in product development productivity exist between the best and worst firms, according to a major global study (Arthur D. Little, 2005). The top 25 percent of firms have *12 times as much productivity*

in new product development as the bottom, realizing a huge \$39 in new product sales per R&D dollar spent, while the bottom 25 percent of firms achieve only \$3.3 in new product sales. In this section, we continue to explore the theme “drivers of success,” but *this time focused on the business* rather than the project as the unit of analysis. In short, we consider *what distinguishes the most successful businesses* when it comes to innovation performance (see the box “Why Businesses Excel—Nine Critical Success Drivers” for a summary of the nine critical success drivers at the business level).

### **Why Businesses Excel—Nine Critical Success Drivers (Cooper, 2011a)**

1. Businesses with superlative performance in new-product development have a product innovation and technology strategy to focus the business on the best arenas, and to provide direction for ideation, roadmapping, and resource allocation.
2. Successful businesses focus: They do fewer development projects, better projects, and the right mix of projects. They achieve this by adopting a systematic portfolio management method and by building tough Go/Kill decision points into their new product idea-to-launch system.
3. Leveraging core competencies is vital to success; *step-out* development projects, which take the business into new areas (new markets or new technologies), tend to fail. However, collaborative development and open innovation can mitigate some risks here.
4. Projects aimed at attractive markets do better; thus, certain key elements of market attractiveness—market size, growth, and the competitive situation—are important project selection criteria.
5. The resources must be in place; there is no free lunch in product innovation.
6. The right organizational structure, design, and teams are major drivers of product innovation success.
7. Businesses that excel at product innovation have the right climate and culture that supports and fosters innovative activity.
8. Top management support doesn’t guarantee success, but it certainly helps. However, many executives get it wrong.
9. Companies that follow a multistage, disciplined stage-and-gate idea-to-launch system fare much better than an ad hoc approach or no system at all.



### 1.3.1 A Product Innovation and Technology Strategy for the Business

We live in turbulent times. Technology advances at an ever-increasing pace; customer and market needs are constantly changing; competition moves at lightning speed; and globalization brings new players and opportunities into the game. More than ever, businesses need *a product innovation and technology strategy* to help chart the way (Cooper, 2011b, American Productivity & Quality Center, 2003; Cooper, Edgett, and Kleinschmidt, 2003; Song, X.M., Im, S., van der Bij, H. and Song, L.Z., 2011).

Having a new product strategy for the business is clearly linked to positive performance (American Productivity & Quality Center, 2003; Cooper, Edgett, and Kleinschmidt, 2003). The ingredients of such a strategy with the strongest positive impact on performance include the following (Cooper and Edgett, 2010):

1. *Clearly defined product innovation goals and objectives:* Best practice suggests that a business should clearly define its long-term goals for product innovation—for example, deciding what percentage of the business's sales, profits, or growth will come from new products over the next three or five years.
2. *The role of product innovation in achieving the overall businesses goals:* Strategists recommend that the product innovation goals of the business be linked to the overall business goals so that the role of product innovation in achieving business goals is clearly articulated.
3. *Strategic arenas defined—areas of strategic focus on which to concentrate new product efforts:* Focus is the key to an effective innovation strategy. The goal is to select strategic arenas that are rich with opportunities for innovation—those that will generate the business's future engines of growth (Cooper, 2011b). The great majority of businesses do designate strategic arenas—markets, product areas, industry sectors or technologies—in order to help focus their product development efforts, although evidence suggests that many business are focused on *the wrong arenas*—on traditional and sterile areas that fail to yield the opportunities and development portfolios needed (Cooper, 2005).
4. *Strategic buckets employed:* Studies of portfolio management methods reveal that earmarking buckets of resources—funds or person-days—targeted at different project types or different strategic arenas helps to ensure strategic alignment and the right mix and balance of development projects (Cooper, Edgett, and Kleinschmidt, 2002a). Best performers utilize strategic buckets two and a half times more often than worst performers.

5. *Product roadmap in place*: A product roadmap is an effective way to map out a series of development initiatives over time in an attack plan, often five to seven years into the future. A *roadmap* is simply a management group's view of how to get to where they want to be or achieve their desired objective (Albright and Kappel, 2003; McMillan, 2003), and it provides *placemarks* for specific future development projects. Roadmaps are used by best performers twice as often as by worst performers.
6. *Long-term commitment*: Does the business have a long-term view of its new product efforts? Or is product development largely a short-term effort, with an absence of longer-term projects? Many businesses are deficient here; only 38.1 percent of them have a long-term new product strategy. By contrast, the majority of best performers have such a strategy.

### 1.3.2 Focus and Sharp Project Selection Decisions—Portfolio Management

Most companies suffer from too many projects, often the wrong projects, and not enough resources to mount an effective or timely effort for each (Cooper, 2011b, Cooper and Edgett, 2002, 2006). This stems from a lack of adequate project evaluation and prioritization, with negative results:

- First, scarce and valuable resources are wasted on poor projects.
- Second, the truly meritorious projects don't receive the resources they need. The result is that the good projects, starved for resources, move at a crawl, or just don't get done.

The desire to weed out bad projects, coupled with the need to focus limited resources on the best projects, means that tough Go or Kill and prioritization decisions must be made. This results in sharper focus, higher success rates, and shorter times to market. Project evaluations, however, are consistently cited as being poorly handled or nonexistent: Decisions involve the wrong people from the wrong functional areas (no functional alignment); no consistent criteria are used to screen or rank projects; or there is simply no will to kill projects at all—projects are allowed to develop a life of their own.

What some companies have done is to redesign their idea-to-launch systems: They have created a *funneling process*,

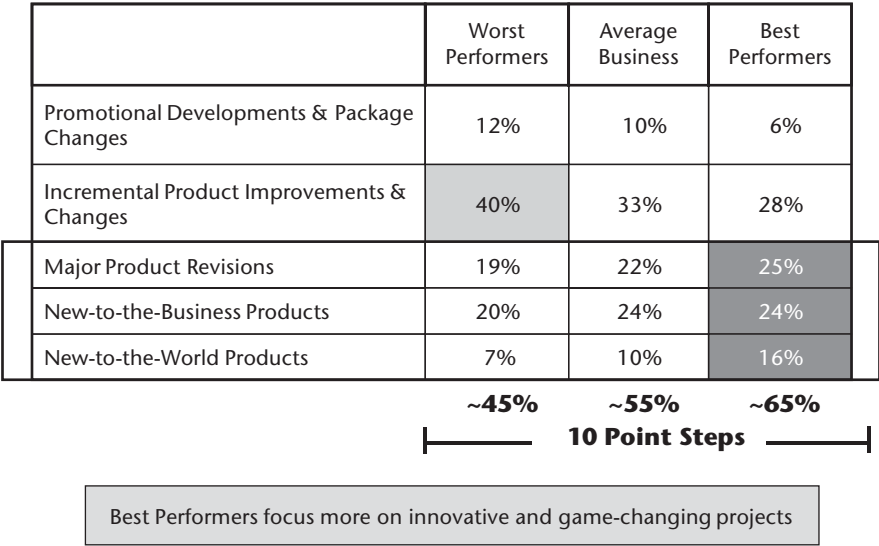
*Introduce tough gates with teeth and learn to “drown some puppies.” The result is better focus—fewer but better development initiatives.*

which successively weeds out the poor projects; and they have built in decision points in the form of tough *gates*. At gate reviews, senior management rigorously scrutinizes projects, and makes Go or Kill and prioritization decisions. The use of visible Go/Kill criteria at gates improves decision effectiveness. Fortunately, certain project characteristics have been identified that consistently separate winners from losers; these characteristics should be used as criteria for project selection and prioritization. A list of criteria in a *scorecard format*—a scoring model—can be used at gate reviews to rate the project. These criteria include some of the important success drivers cited in this chapter (Cooper and Edgett, 2006; Cooper, Edgett, and Kleinschmidt, 2002a, 2002b):

1. *Strategic*: How well the project aligns with the business's strategy and how strategically important it is
2. *Competitive and product advantage*: Whether the product is differentiated, offers unique benefits, and offers a compelling value proposition to the user
3. *Market attractiveness*: How large and growing the market is its long-term potential, and whether the competitive situation is positive (not intense, few and weak competitors)
4. *Leverage*: Whether the project leverages the business's core competencies, such as marketing, technology and manufacturing
5. *Technical feasibility*: The likelihood of being able to develop and manufacture the product: is this new science and a technically complex project or a technology repackaging?
6. *Risk and return*: The financial prospects for the project (e.g., net present value [NPV], internal rate of return [IRR], and payback period) versus the risk

Selecting projects and choosing winning new product initiatives is only part of the task, however. Others are selecting the right *mix and balance* of projects in the development portfolio, seeking strategic alignment in the portfolio, and ensuring that the business's spending on product innovation mirrors its strategic priorities. Many businesses have moved to more formal *portfolio management systems* to help allocate resources effectively and prioritize new product projects (Cooper, Edgett, and Kleinschmidt, 2002a, 2002b). Note that the best-performing businesses have more aggressive development portfolios and undertake a higher proportion of more innovative new product projects, while the worst-performing ones have a very timid new product project portfolio (see the breakdown in Figure 1.4).

**FIGURE 1.4 THE BREAKDOWN OF PROJECTS BY PROJECT TYPE SHOWS THE DIFFERENT PORTFOLIOS FOR BEST VERSUS WORST PERFORMERS IN PRODUCT INNOVATION.**



1.3.3 Leveraging Core Competencies—Synergy and Familiarity

“Attack from a position of strength” may be an old adage, but it certainly applies to the launch of new products. Where synergy with the base business is lacking, new products fare poorly on average.

*Synergy* or *leverage* is a familiar term, but exactly what does it translate into in the context of new products? Synergy means having a strong fit between the needs of the new product project and the resources, competencies, and experience of the firm in terms of

- R&D or technology resources (for example, ideally the new product should leverage the business’s existing technology competencies)
- Marketing, selling (sales force), and distribution (channel) resources
- Brand, image, and marketing communications and promotional assets
- Manufacturing or operations capabilities and resources
- Technical support and customer service resources
- Market research and market intelligence resources
- Management capabilities

These seven synergy or leverage ingredients become obvious checklist items in a scoring model to prioritize new product projects. If the leverage

score is low, then there must be other compelling reasons to proceed with the project. Leverage is not essential, but it certainly improves the odds of winning.

*Familiarity* is a parallel concept. Some new product projects take the company into unfamiliar territory: a product category new to the firm; new customers and unfamiliar needs served; unfamiliar technology; new sales force, channels, and servicing requirements; or an unfamiliar manufacturing process. And the business often pays the price: Step-out projects have a higher failure rate due to lack of experience, knowledge, skills, and resources.

The encouraging news is that the negative impact here is not as strong as for most success factors. New and unfamiliar territory certainly results in lower success rates and profitability on average, but the success rates are not dramatically lower. The message is this: Sometimes it is necessary to venture into new and unfamiliar markets, technologies, or manufacturing processes and areas where leverage may be limited (e.g., some key skills or resources are missing). Success rates will suffer. However, strategies such as *collaborative development* and *open innovation* help the developer acquire the necessary resources, skills, and knowledge for such step-out projects (Campbell and Cooper, 1999; Chesbrough, 2006; Docherty, 2006). For example, through *open innovation*, the developer obtains resources and knowledge from sources external to the company: ideas for new products; intellectual property and outsourced development work; marketing and launch resources; and even licensed products ready to launch.

### 1.3.4 Targeting Attractive Markets

Market attractiveness is an important strategic variable and plays a role in notable strategy models, such as Porter's "five forces" model and the two-dimensional GE-McKinsey map or business portfolio grid. In the case of new products, market attractiveness is also important: New products targeted at more attractive markets are more successful (Cooper, 2011a; Montoya-Weiss and Calantone, 1994; Song and Parry, 1996); thus, market attractiveness should be considered in project selection and scoring models.

There are two dimensions to market attractiveness:

1. *Market potential*: positive market environments, namely, large and growing markets—where a strong customer need exists for such products, where the purchase is an important one for the customer, and where profit margins earned by others are high
2. *Competitive situation*: negative markets characterized by intense competition; competition on the basis of price; high quality, and strong competitive products; and competitors whose sales force, channel system, and support service are strongly rated

The message is this: Both elements of market attractiveness—market potential and competitive situation—impact new product fortunes, and both should be considered as criteria in any scoring model for project selection and prioritization.

### 1.3.5 The Necessary Resources

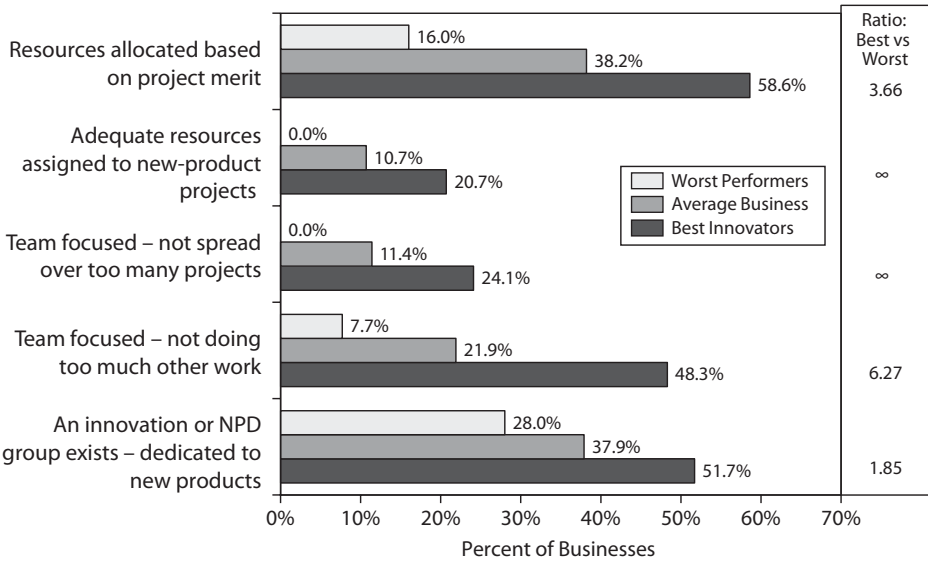
Too many projects suffer from a lack of time and financial commitment. The results are predictable: much higher failure rates (American Productivity & Quality Center, 2003; Cooper, Edgett, and Kleinschmidt, 2003). As the competitive situation has toughened, companies have responded with restructuring and doing more with less. And so, resources are limited or cut back (Cooper and Edgett, 2003). Another reason for failure is trying to do too many projects with the limited resources available—the inability to say “no” to would-be development projects or to kill bad ones. The *resource crunch* takes its toll and is the root cause for much of what ails product development: a lack of VoC and market input; inadequate front-end homework; ineffective launches; and overemphasis on simple, fast projects.

Best-practice companies commit the necessary resources to new products much more often than do most firms (American Productivity & Quality Center, 2003; Cooper, Edgett, and Kleinschmidt, 2003). While new product resources are in short supply across the board—with less than 30 percent of businesses indicating that they have sufficient resources in four key functional areas—the best performers appear to be much better resourced than most firms. Equally important, as shown in Figure 1.5, these resources are focused and dedicated, with project team members not working on too many projects or doing other tasks. Indeed, about half of the best performers have a *ring-fenced product innovation group* that does nothing but work on new products (this is a *dedicated* cross-functional group—technology, marketing, and even sales and operations—whose full-time job is to work on new product projects). Finally, resources must be available early in the project in order to undertake the essential front-end homework and early-stage market research outlined above.

### 1.3.6 The Way Project Teams Are Organized

Product innovation is very much a team effort. Do a postmortem on any bungled new product project, and invariably you’ll find each functional area doing its own piece of the project, with very little communication between players and functions (a fiefdom mentality) and no real

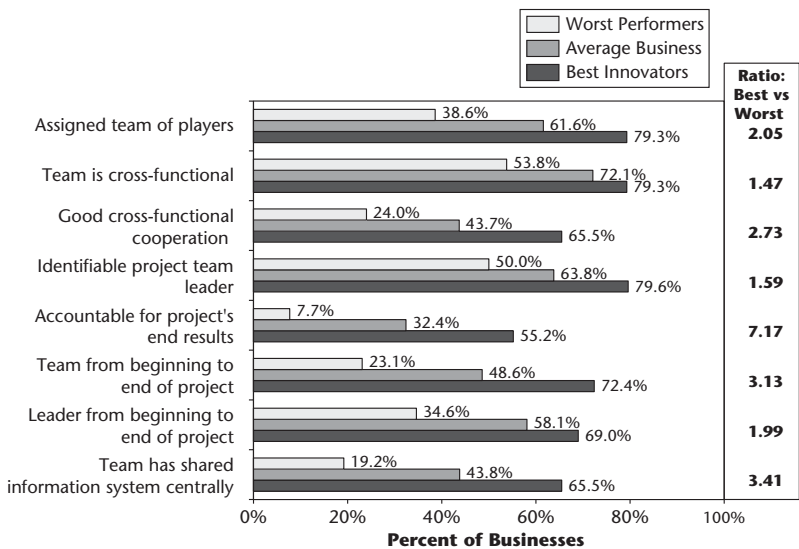
**FIGURE 1.5 PROJECT TEAM FOCUS AND DEDICATED RESOURCES HAVE A STRONG IMPACT ON PERFORMANCE.**



commitment of players to the project. Many studies concur that the way the project team is organized and functions strongly influences project outcomes (Cooper, 2011a; Cooper, 2011b; Nakata and Im, 2010). Best performers organize their new product project teams as follows (Figure 1.6; American Productivity & Quality Center, 2003; Cooper, Edgett, and Kleinschmidt, 2003; Edgett, 2011):

- There is a clearly assigned project team for each significant new product project—people who are part of the project and do work for it (only 61.5 percent of businesses have clearly assigned teams, with the best-performing businesses outdoing the worst by 2:1). And most important, the project team is cross-functional, with team members from technology, sales, marketing, operations, and so on—a practice now embraced by the great majority of businesses. Here, team members are not just representatives of their function, but rather *true members of the project team*, shedding their functional loyalties and working together to a common goal.

**FIGURE 1.6 THE WAY DEVELOPMENT PROJECT TEAMS ARE ORGANIZED STRONGLY IMPACTS ON PRODUCT INNOVATION PERFORMANCE.**



- The project team remains on the project from beginning to end, not just for a short period or a single phase. Almost half of businesses use this team approach, and it is particularly evident among the best performers.
- There is a clearly identified project leader—a person who is in charge and responsible for driving the project. And the project leader is responsible for the project from idea to launch; he or she carries the project right through the process, and not just one or a few stages. Worst-performing businesses are weak here.
- A central shared-information system for project team members is in place—a system that permits sharing of project information and allows several team members to work concurrently on the same document, even across functions, locations, and countries.
- Project teams are accountable for their project’s end result—for example, ensuring that projects meet profit/revenue targets and time targets. Team accountability is a pivotal best practice, separating the best from the worst performers by 7:1!

Product development must be run as a multidisciplinary, cross-functional effort. While the ingredients of good organizational design should be familiar, surprisingly many businesses have yet to get the message.



### 1.3.7 The Right Environment—Climate and Culture

A second organizational success ingredient is a positive climate for innovation. Such a climate has many facets and includes an environment where (Cooper, 2011b; American Productivity & Quality Center, 2003; Cooper, Edgett, and Kleinschmidt, 2003; Edgett, 2011)

- Intrepreneurs (internal entrepreneurs) and risk-taking behavior are supported and encouraged
- Senior management is not afraid to invest in the occasional risky project
- New product successes are rewarded and recognized (and failures are not punished)
- Team efforts are recognized rather than individuals
- Senior managers refrain from micromanaging projects and second-guessing the project team members
- Project review meetings are open (the entire project team participates)

Most businesses are quite weak on almost all of the elements of a positive climate described in the preceding list, with typically less than one-third of businesses employing these practices (but best performers do!) (American Productivity & Quality Center, 2003; Cooper, Edgett, and Kleinschmidt, 2003; Edgett, 2011). Some other practices that also drive performance, but are rarely seen except in a handful of very innovative firms, include making resources and time available for creative people to work on their own projects (e.g., via free *scouting time*, *Friday projects*, or bootstrapping funds); allowing the occasional unofficial project to proceed under the radar; setting up *skunk works* projects—teams operating outside the official company bureaucracy; and having an idea submission scheme in place (whereby employees are encouraged to submit new product ideas and are rewarded or recognized for good new product ideas).

*A positive climate and culture that supports product innovation is one of the strongest discriminators between best and worst performers.*

### 1.3.8 Top Management Support

Top management support is a necessary ingredient for successful product innovation. Top management's main role is to *set the stage* for product innovation, to be a behind-the-scenes facilitator and much less an actor

front and center (Cooper, 2011b; American Productivity & Quality Center, 2003; Cooper, Edgett, and Kleinschmidt, 2003; Edgett, 2011).

In best-performing businesses, senior management makes a long-term commitment to product innovation as a source of growth. It develops a vision, objectives, and a strategy for product innovation. And it makes available the necessary resources for product development and ensures that they aren't diverted to more immediate needs in times of shortage. In addition, management commits to a disciplined idea-to-launch system to drive products to market.

Most important, senior management is engaged in the new product process, reviewing projects, making timely and firm Go/Kill decisions, and if Go, making resource commitments to project teams. And management empowers project teams and supports committed champions by acting as mentors, facilitators, "godfathers," or sponsors of project leaders and teams.

### 1.3.9 A Multistage, Disciplined Idea-to-Launch System

A systematic idea-to-launch methodology – such as a Stage-Gate® system<sup>1</sup>— is the solution that many companies have adopted in order to overcome the deficiencies that plague their new product efforts (Cooper, 2011a; Edgett, 2011; Griffin, 1997; Lynn, Skov, and Abel, 1999; Menke, 1997). Stage-Gate systems are simply roadmaps or play books for driving new products from idea to launch successfully and efficiently. The 2010 APQC benchmarking study reveals that 88 percent of U.S. businesses employ such a process, and it identified the stage-and-gate process

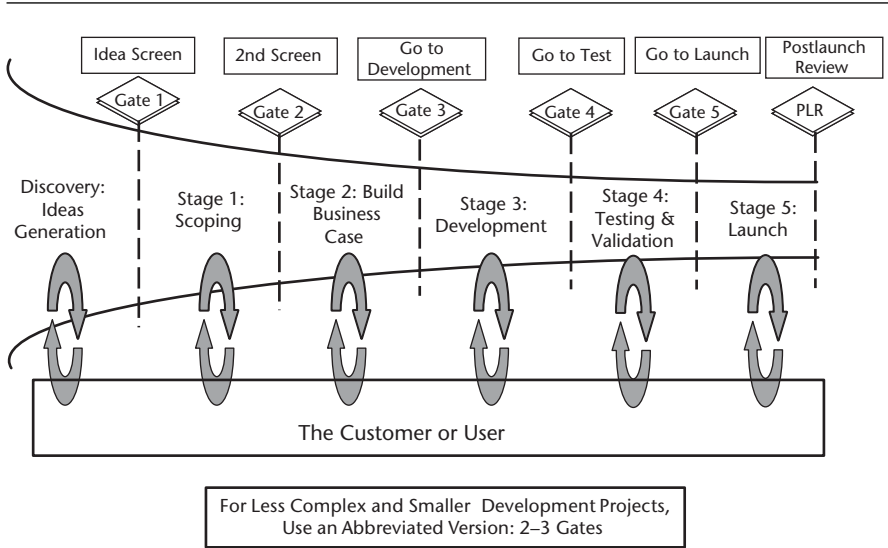
*Leading companies have adopted a Stage-Gate system, a method developed by the author, to accelerate new product projects from idea to launch.*

as one of the strongest best practices, employed by almost every best-performing business (Cooper and Edgett, 2012). And the payoffs of such processes have been frequently reported: improved teamwork; less recycling and rework; improved success rates; earlier detection of failures; a better launch; and even shorter cycle times (reduced by about 30 percent).

The goal of a robust idea-to-launch system is to combine the best practices outlined in this chapter into a single methodology or model so that these success drivers or practices happen by design, not by accident.

<sup>1</sup>Stage-Gate® is a registered trademark of Stage-Gate International Inc. in the United States; see [www.stage-gate.com](http://www.stage-gate.com).

**FIGURE 1.7 THIS FIVE-STAGE IDEA-TO-LAUNCH STAGE-GATE SYSTEM IS FOR MAJOR PRODUCT DEVELOPMENT PROJECTS.**



Used with permission from Cooper (2011a), Chapter 4.

A typical idea-to-launch system is shown in Figure 1.7 for *major projects*, which breaks the innovation process into five stages (Cooper, 2011a). Each stage consists of a set of concurrent, cross-functional, proven, and prescribed activities to be undertaken by the cross-functional team. Best practices, such as solid front-end homework, sharp fact-based product definition, spiral development, and VoC are built into the various stages by design. Required deliverables are defined for the end of each stage—expectations are thus clear.

Here are the stages:

*Discovery:* the ideation stage, which involves prework designed to discover and uncover opportunities and generate ideas. Multiple sources of ideas should be accessed, although some sources and methods are more popular or more effective than others (Cooper and Edgett, 2008).

*Stage 1. Scoping:* a quick investigation and sculpting of the project. This first and inexpensive homework stage has the objective of determining the project’s technical and marketplace merits. Stage 1 involves desk research or detective work—little or no primary

research is done here. Prescribed activities include preliminary market, technical, and business assessments (see Figure 1.2).

*Stage 2. Build the Business Case:* the detailed homework and up-front investigation work. This second homework stage includes actions such as a detailed market analysis, user needs and wants studies to build in VoC, competitive benchmarking, concept testing, detailed technical assessment, source of supply assessment, and a detailed financial and business analysis. The result is a *business case*—a defined product, a business justification, and a detailed plan of action for the next stages.

*Stage 3. Development:* the actual design and development of the new product. Stage 3 witnesses the implementation of the development plan and the physical development of the product. Lab tests, in-house tests, or alpha tests ensure that the product meets the requirements under controlled conditions. The deliverable at the end of Stage 3 is an in-house-tested (alpha-tested) prototype of the product, partially tested with the customer.

*Stage 4. Testing and Validation:* the verification and validation of the proposed new product, its marketing and production. This stage tests and validates the entire viability of the project: the product itself via customer tests, beta tests, or field trials; the operations process via trial or limited production runs or operations trials; customer acceptance by way of a test market, simulated test market, or trial sell; and the financial justification required prior to full launch.

*Stage 5. Launch:* full commercialization of the product—the beginning of full operations and commercial launch and selling. The postlaunch plan—monitoring and fixing—is implemented, along with early elements of the life cycle plan (new variants and releases; continuous improvements).

Some 12–18 months after launch, the Post Launch Review occurs. The performance of the project versus expectations is assessed (team accountability is a key review issue), along with reasons why and lessons learned; the project team is disbanded and recognized; and the project is terminated.

Preceding each stage in Figure 1.7 is a gate. These gates are the *quality control checkpoints* in the system: Are we doing the right project, and are we doing the project right? At each gate, the project team meets with senior management, the *gatekeepers*, to seek approval and resources for

their project. The gates thus open the door for the project to proceed to the next stage and also commit the necessary resources—people and funds—to the project and team to move forward.

Each Go/Kill gate specifies deliverables (what the project team must deliver to that gate review); criteria for Go (e.g., a scorecard outlined above in Section 1.3.2) upon which the Go/Kill and prioritization decisions are based; and outputs (an action plan for the next stage and resources approved).

Since Stage-Gate was first introduced, it has undergone many changes and improvements, and some firms have even deployed their *third-generation version* of the system. New practices built into Stage-Gate include (Cooper, 2008)

- Adapting the process for *open innovation*—for the inclusion of ideas, intellectual property, R&D work, and even fully developed products from outside the firm (Crawford, 1992; Docherty, 2006; Grönlund, Rönneberg, and Frishammar, 2010)
- Making the process scalable—for example, Lite and XPress versions of Stage-Gate for lower-risk and smaller projects; and even different versions of Stage-Gate to handle different types of development projects, such as Stage-Gate-TD for technology platform developments (Cooper, 2011a)
- Creating a leaner idea-to-launch system—removing all waste and factoring in continuous improvement—by utilizing principles borrowed from lean manufacturing
- Making the Stage-Gate system part of the total *Product Life Cycle Management System*—from idea to product exit many years later (Cooper, 2011a)
- Building in tough gates—gates with teeth—to focus scarce development resources on the highest-value-to-the-corporation projects, culling out the weaker projects (Cooper, 2009)
- Making the system more adaptive and agile—for example, by using spiral development, and accelerating the process via concurrent activities (overlapping activities) and even overlapping stages—moving forward with partial information (Cooper, 2008)
- Automating the idea-to-launch system via new software products that handle everything from idea management to the development process and even resource management.<sup>2</sup>

<sup>2</sup>Some software products have been evaluated; see [www.stage-gate.com](http://www.stage-gate.com).

## 1.4 Summary

Generating a continuous stream of new product successes is an elusive goal. But the quest goes on, because the goal is so important to business success. This chapter has provided an overview of some of the key drivers of new product performance, and hence insights into how to win in developing and launching new products.

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## CHAPTER TWO

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# AN INNOVATION MANAGEMENT FRAMEWORK: A MODEL FOR MANAGERS WHO WANT TO GROW THEIR BUSINESSES

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Paul Mugge and Stephen K. Markham

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### 2.1 Introduction

When asked in IBM's yearly survey, the majority of CEOs cite "growth through new products and services" as their number one strategic objective. The globalization of markets has created a highly competitive arena where survival depends on a continuous stream of successful new products. Barriers to competition have fallen precipitously as regulations have eased and markets have become more global. After three decades of cost cutting and restructuring in response to a formidable set of global competitors, firms are turning their attention to growth. Their CEOs realize that the winners will be those companies that distinguish their products and services, that is, that create a competitive advantage.

According to the Product Development and Management Association (PDMA), successful high-technology companies have found that more than 50 percent of their current sales are coming from new products (Barzack, Griffin and Kahn2009). In the case of the most successful, this figure is over 60 percent. The next round of competitive positioning will be based on innovation, and a company's innovation capabilities will determine its future growth potential. This is creating a special challenge for senior management. Only innovation increases the size of

the pie, which means that its mastery is vital to a company's long-term well-being. Unfortunately, many managers may be better at, and even more comfortable with, controlling costs than creating products that fuel top-line growth.

Companies have invested considerable resources and energy in becoming leaner and more nimble. The quest for productivity, quality, and speed has spawned a remarkable number of management tools and techniques: total quality management (TQM), reengineering, outsourcing, Six Sigma, and so on. However, many of the companies that have applied these techniques are frustrated by their inability to translate gains into sustainable, profitable growth. The products and services of these firms are indistinguishable. Bit by bit, these management tools have actually taken them away from viable competitive positions.

To get ahead of the pack, managers at leading companies are asking fundamental questions of themselves: How can they move beyond producing only incremental innovations and create more radical innovations? Which emerging technologies have the greatest potential to be disruptive and generate breakthrough results? What adjacent market segments could they enter to leverage existing platforms? What is the resulting risk of these actions? Managers are also asking which internal capabilities they need to be successful innovators and which business operations are critical to conceiving of, producing, delivering, and supporting their products and services.

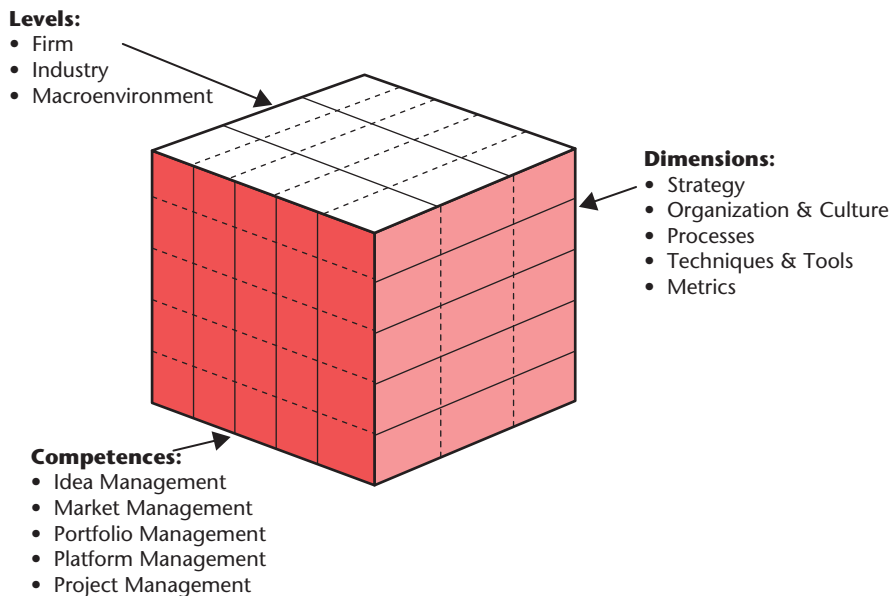
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## 2.2 The Innovation Management Framework

The Innovation Management (IM) Framework is offered to help new product development managers identify those activities required to be a successful innovator. The IM Framework (Figure 2.1) describes a systematic way to think about managing innovation. It demystifies innovation management by breaking it down into elements that can be learned, practiced, measured, and ultimately improved—that is, managed.

The IM Framework was developed from an exhaustive meta-analytical study of 25 years of technology management research sponsored by the Center for Innovation Management Studies (CIMS). Over those years, CIMS sponsored research at 65 different universities and with 110 companies. Each study was categorized, and the categories were then sorted into three aspects that make up the model in Figure 2.1. These aspects include competencies, dimensions, and levels.

FIGURE 2.1 INNOVATION MANAGEMENT FRAMEWORK.



### 2.2.1 Competencies

Based on the meta-analysis of the innovation management research, the IM Framework identifies five organizational competencies that successful innovation companies possess: Idea Management, Market Management, Portfolio Management, Platform Management, and Project Management. A company must be proficient in all five competencies to reliably and repeatedly produce differentiated products and services.

Competencies are not processes. Innovation processes can vary greatly based on the size and maturity of the firm, the industry that firm operates in, and so on. IM competencies, by contrast, are the basic capabilities of innovation. They represent the inclination, aptitude, and practice of the organization in achieving specific IM objectives, such as managing ideas, markets, portfolios, and so on. Proficiency in IM competencies is essential to any innovation process (see Section 2.3). Moreover, organizations can learn and master IM competencies, and it is management’s job to ensure that they do.

## 2.2.2 Dimensions

To assist managers in this task, the IM Framework breaks down each competence into five dimensions: Strategy, Organization and Culture, Processes, Techniques and Tools, and Metrics. A critical insight from the meta-analysis is that the dimensions “cross-cut” each IM competence and represent the management activities needed to build strong, durable innovation management capabilities. Taken together, IM competences and dimensions provide a complete and integrated system for helping organizations realize results from innovation.

## 2.2.3 Levels

The primary purpose of the IM Framework is to help managers build strong and competitive innovation capabilities in their firms. For many of these managers, just keeping up with the day-to-day demands of customers, suppliers, channel partners, and creditors can be a full-time job. Yet, events take place outside the boundaries of the firm that also determine the course of innovation, such as the acts of standard bodies, the policies of governments, and the actions of new industry entrants. Successful innovation organizations look beyond their boundaries and pay attention to their environment. The last part of the IM Framework deals with the unique innovation challenges and activities found at three levels of the environment: the firm, the industry, and the macroenvironment.

Taken together, competencies, dimensions, and levels form a cube. Section 2.3 presents the categorization of topics found in the CIMS studies. Categorizing the research not only provides an overview of the innovation management research, it also supplies managers with a logical structure with straightforward tools and techniques to manage innovation. It provides managers with a straightforward means to identify gaps or weaknesses in their organization and to develop roadmaps for improvement.

Each dimension and competence has been operationalized to form the Innovation Management Maturity Assessment (IMMA). The IMMA asks respondents to assess their level of maturity for each competence and dimension on a 1 to 5 scale where 1 = ad hoc, 2 = defined, 3 = managed, 4 = leveraged, and 5 = optimized. The results are displayed on a 5x5 grid with areas of maturity identified in a heat map. See <http://cims.ncsu.edu/index.php/assessments/imma> for a working model and further description of the tool.

## 2.3 The IM Framework Structure

In this section we present the essential competences, or capabilities, leading organizations possess that enable them to recognize new opportunities, select appropriate technologies, and design and efficiently develop new and attractive solutions. The five IM competencies represent the inclination, aptitude, and practice of organizations to produce truly differentiated offerings, that is, to successfully innovate. Mastering these competences is vital to the growth and long-term health of the organization. After discussing the competences, we present the dimensions and then the levels of innovation management.

### 2.3.1 Competencies

**2.3.1.1 Idea Management** *Activities include: Boundary Spanning, Technology Scouting and Evaluation, Applied Research, Collaboration with Early Adopters/Scientific Centers, and so on.*

Idea Management begins to answer the question of competitive advantage by simultaneously examining technology and market factors. Ideas about possible market opportunities made feasible by new technologies are often the point where innovation begins. In an all-out race to gain an advantage over their competitors, managers of leading companies personally go to

great lengths to make sure that the climate of the organization for ideation is optimum. They personally sit on review boards, offer monetary incentives, and free employees from their day-to-day routine—all in an effort to glean ideas that ultimately have commercial value.

To systematize Idea Management, these firms often divide their R&D portfolio and management attention into multiple *horizons* to make sure that they have the investments and talents aimed at the early identification and maturation of new, promising technologies.

Some studies address how to manage innovation through the *fuzzy front end*, that is, when information regarding the market application of new technologies is scant, causing forecasting headlights to dim (Koen, Ajamian, Burkart, Clamen, Davidson, D'Amoe, Elkins, Herald, Incorvia, Johnson, Karol, Seibert, Slavejko, and Wagner, 2001). A relatively few models for managing nascent technologies through this period are

*Idea Management is the ability of a firm to effectively identify, assimilate, and qualify information regarding new technologies or ideas that can lead to highly differentiated, breakthrough products and services.*

available (Markham, Baumer, Aiman-Smith, Kingon, and Zapata, 2000). For some technologies—and budding entrepreneurs—this can be the “valley of death” (Markham, Aiman-Smith, Ward and Kingon, 2010).

For example, the race to leverage nanotechnologies will place even more demand on a firm’s Idea Management capabilities. These technologies are barely emerging and are largely in the domain of science.

In their seminal report, the Chemical Industry Technology Partnership (2003) predicted that many of these technologies may be 20 years away from broad commercial use. Nevertheless, the allure of what potentially can be created with nanotechnologies is so great that companies around the world are building Idea Management capabilities.

**2.3.1.2 Market Management** *Activities include: Determining Customer Buying Preferences, Market Segmentation, Creating Market Attack Plans, Pricing, Advertising and Promotional Activities, Account Management, and so on.*

The long-term competitiveness of any company depends ultimately on the acceptance and attractiveness of its product and service offerings in the marketplace. A differentiated offering is pivotal for profits, improving the market position, creating new standards, and creating new niche markets.

Market Management provides a “market-understanding” framework that allows the organization to focus on profitable markets, customers, and business opportunities to pursue. It relies on developing insight—through research and fact-based analysis of market data—that identifies and anticipates potential market opportunities related to the organizations’ strategic direction. Market information, however, exists in many forms.

*Market Management selects market opportunities and plans offerings in response to them that represent the greatest value to both the organization and its customers.*

A comprehensive Market Management capability defines the types of information, the owners of this information, and how this information will be used in defining and analyzing market characteristics. It requires segmenting macro markets in a manner that provides insight into how to define product characteristics or features that promise to provide a competitive advantage in existing or new markets. Lastly, the capability needs to spell out exactly how the attractiveness of potential market segments will be described and prioritized to support investment decisions in these segments.

**2.3.1.3 Portfolio Management** *Activities include: Risk/Reward Assessment, Real Option Analysis, Periodic Portfolio Review, Project Evaluation and Selection, and Pipeline Loading.*

Portfolio Management is fundamental to creating true business value. The investment choices made today determine the business value realized in the future. Often a firm's portfolio of projects is crammed with too many "me-too" projects, which steal valuable resources and divert management attention from those few good

projects that will really differentiate the firm in the marketplace. Having a portfolio of high-value projects that is properly balanced and is directly tied to the business strategy is essential to optimizing the value realized.

While Project Management is dynamic and milestone driven, Portfolio Management tends to be more stable, with much longer, more strategic objectives. It is not, however, a static process. What many firms call Portfolio Management is in fact a misnomer. In these companies, Portfolio Management is often relegated to a once-a-year "project prioritization" event, usually to feed the annual budgeting cycle.

Leading firms realize that effective Portfolio Management is much more than this; it is a continuous process of allocating resources to best achieve the firm's business objectives. These firms constantly strive to balance the portfolio, determining the optimal investment mix between risk and return, maintenance versus growth, and short-term versus long-term gains. Portfolio Management keeps a firm's portfolio fresh and responsive to market and strategy shifts.

**2.3.1.4 Platform Management** *Activities include: Reference Platforms, Architecture Review Process, Modular Design, Parts/Subsystem Rationalization, and Integrated Design/Sourcing Decisions.*

Platform Management is the ability to simultaneously design and plan a line, or family of products or services, from a set of common building blocks. Single-product development approaches lack efficiency in that they fail to exploit the benefits of commonality among different products and product lines. A platform design approach provides multiple benefits by

*Portfolio Management allows a firm to manage a set of investment projects that are aligned with the business strategy, balanced, and generate the greatest economic return.*

*Platform Management establishes the platform strategy, reference architecture, set of modular subsystems, and development plan for an entire product or service line.*

- Lowering total costs (R&D, production, inventory, maintenance, etc.) due to the need for fewer part numbers and the ability to achieve higher parts reuse

- Reducing product development risks and expense by using proven building blocks
- Increasing market share through reduced cycle times and faster time to market

Platform Management is inextricably linked to Market Management. It involves understanding the market attractiveness for niche-specific platforms where product differentiation is a key and leveraging horizontal platforms where adjacent market segments could be exploited.

**2.3.1.5 Project Management** *Activities include: A Structured Project Development Process, Stage-gate Reviews, Fact-based Go/Kill Decisions, Integrated Financial Management, and Lifecycle Planning.*

It is important to do Project Management well; otherwise, the flow of development projects to their successful completion, launch, and realization of objectives may be impeded. Thus, a chief concern of senior management is to make sure that nothing constricts the flow of the project pipeline. Having too many projects

imposes high demands on critical resources, which extends lead times and requires frequent and unscheduled management interventions.

It is important that managers not meddle with projects but limit their intervention to well-defined checkpoints. Their focus should be on provisioning projects with adequate resources—both human and capital. They should empower project teams to *run their project like a business*. Managers should make decisions only on the basis of facts and kill marginal projects as early as possible to keep the number of remaining projects matched to the firm's development capacity. Clearly, effective Portfolio Management is necessary to drive effective Project Management.

Finally, the product evolves as it progresses through its lifecycle and eventually is replaced by a newer product. This must also factor into the planning because it requires resources and careful decision making to determine when the product should be retired and/or replaced and how. Lifecycle decisions are much more than the last phase of development—or the problems and tasks an organization encounters in the field. Leading companies plan for the full lifecycle of a product from its conception to its withdrawal from service. They also consider not only the financial impact of full life cycle management but also how it impacts

*Project Management reliably and predictably guides projects through their phases of development so that they deliver the economic and strategic values originally intended for them.*



the firm's promise of brand value and ultimately its reputation in the marketplace.

## 2.3.2 Dimensions

The meta-analysis of the literature reveals much more than the essential competences of Idea, Market, Portfolio, Platform and Project management. The framework demonstrates that each competence must be managed in multiple dimensions. Taken together, these dimensions provide managers with a prescription for improving their organization's innovation management proficiency.

**2.3.2.1 Strategy** *Activities include: Targeted Business Arenas/Markets, Barriers to Entry, Value Proposition, Strategic Control Points, Strengths, Opportunities, Weaknesses, and Threats (SWOT) Analyses, Benchmarking and Competitive Evaluation, and so on.*

The core of any business strategy—connecting a company's internal processes to improved outcomes with customers—is the *value proposition* delivered to the customer (Kaplan and Norton, 2001). The value proposition describes the unique mix of product, price, service, relationship, and image that the provider offers its customers.

A clearly stated value proposition provides the ultimate target for focusing a business's strategy.

Business strategies tell the story of the organization by answering the following questions:

- What is our market position?
- How will we sustain/grow this position?
- What makes our products and services different from those of our competitors?
- How do we measure success?
- What organizational capabilities do we need to acquire/develop to be successful?

The value proposition must also lay out the innovation strategy in support of the business strategy, for indeed the two are intertwined. For example:

- What percentage of revenue is to come from new products and services?
- Are we to be first to market or a fast follower?
- Will we even do R&D internally or will we form alliances?

*Strategy defines the specific goals of the organization and exactly how the organization will achieve them. Strategy is only valuable when it creates change in the marketplace.*

Good strategies are long on detail and short on vision. Good strategies start with massive amounts of quantitative analysis: hard analysis that is blended with wisdom, insight, and risk taking.<sup>1</sup>

**2.3.2.2 Organization and Culture** *Activities include: Authority Relationships, Human Resources, Skills Acquisition and Development (Organization); Organization's Basic Beliefs, Values, and Behaviors; Leadership, Motivation, and Rewards (Culture).*

Culture isn't one aspect of the game; it is the game. In the end, an organization is nothing more than the collective ability of its people to create value (Gerstner, 2002).

Organizations must organize for and promote a culture of innovation to survive.

A company's orientation, business focus, type of people, and core competences can influence the way innovation is embraced and the degree to which it is leveraged.

Most companies recognize the need for innovation in order to be successful in their respective markets. However, few companies make this recognition central to their corporate culture. And the fact that the organization's culture, that is, its capacity to innovate, can be measured and managed is completely lost on these companies.

Management's job is to create a culture that supports risk taking and invokes a common sense of urgency. They must ensure that all employees have meaningful work and establish a climate where employees speak out and are empowered to make decisions. Most of all, managers must realize that all employees can innovate and create value (Goodrich and Aiman-Smith, 2007).

**2.3.2.3 Processes** *Activities include: Workflow Optimization, Time-blocking Activities, Task Definition, and Roles and Decision Delineation.*

*Processes define the patterns of interaction, coordination, communication, and decision making that people use to get work done. Processes are agreements or political alliances between management and staff in which resources are promised to do work in a certain way.*

<sup>1</sup>Bruce Harreld, Chief Strategy Officer, IBM Corporation.

Process assets enable consistent performance across the organization and provide a basis for cumulative long-term benefits to the organization. The organization's process asset library supports organizational learning and process improvement by allowing the sharing of best practices and lessons learned across the organization. It contains descriptions of processes and process elements, descriptions of lifecycle models, process tailoring guidelines, process-related documentation, and data. In a very real sense, it is a blueprint of the business.

Companies that lack a process discipline may achieve a fleeting but not sustainable advantage. Managers must continuously focus on their core business processes, making sure that they are streamlined, documented, and followed. And no process is more "core" to a firm than its innovation process.

**2.3.2.4 Tools and Techniques** *Activities include: Virtual Workspaces, Team Rooms That Facilitate Collaboration as Well as Forecasting Models, Project-Scoring Hierarchies, Competitive Evaluation Templates, Unstructured Text Analytics, and so on.*

A vast array and range of tools are available to help managers manage innovation more effectively and efficiently. Sophisticated information technology (IT)-based collaboration tools can synchronize communications across a firm's extended enterprise—literally 24 x 7. For example, international members of a product development team can simultaneously evaluate the design of a product or

service from their respective regional points of view. As a consequence, the resulting offering is stronger, costs less, and is easier and faster to produce.

An important new tool for early-stage product innovation is unstructured text analytics. This tool provides rapid insight into the market viability of new ideas before expensive development work begins. This tool is also particularly useful as an open innovation tool to find solutions for existing problems.

Similarly, a host of decision support tools is available to the same product development team to determine the product's sourcing, order demand, lifecycle costs, and overall competitiveness. The chief challenge for management is to select the minimum set of tools that provides the organization with the information it needs in a timely manner—and then

*Tools and techniques provide a mechanical or mental advantage in accomplishing a task. They facilitate communications and help process, analyze, and present data to aid management in decision making.*

relentlessly institutionalize them. Employees need access to the tools and must understand when and how to use them. Only after a tool set has been integrated with the firm's innovation process and has proven useful to decision making should management attempt to automate it. In their haste to find the "silver bullet," companies often waste precious resources and time trying to digitize tools before they are properly understood and tested.

**2.3.2.5 Metrics** *Activities include: Key Performance Indicators, Balanced Scorecards, Compensation Plans, and so on.*

Firms use a variety of metric types to gauge their proficiency as innovators. They use traditional customer outcomes (e.g., market share growth, customer loyalty) and augment these with in-line operational metrics (e.g., time to profit and percent of preferred/common parts). Other firms add indicators of knowledge or learning (e.g., number of patents).

*Metrics are a powerful management tool and are used to both motivate and measure the organization's IM proficiency.*

Regardless of the scorecard of metrics selected, it is important that:

1. The set of metrics chosen articulates the firm's innovation strategy. For example, if a company's strategic intent is to be first to market, it does little good to measure traditional cycle times. What counts is the number of times the company is first. If a company wants to be the low-cost producer, then perhaps measuring the percent of preferred/common parts used across its platform is a better gauge of success.
2. Employees' compensation is tied to their results. Many firms spend considerable resources benchmarking best practices, designing and documenting a new innovation process, then leave reward systems unconnected to the innovation process. It's no wonder that business performance doesn't improve; employees know that innovation really isn't the priority.

Properly used, metrics can propel the organization towards improving their IM proficiency and ultimately winning in the market.

## 2.3.3 Levels

A central problem of management is orchestrating organizational activities to meet the challenge of the environment (Narayanan, 2001) Organizations can be viewed as systems that are intricately linked and in constant interaction with their environment. Depending on how attuned the organization is to the environment, its economic performance can be

greatly altered. The last part of the IM Framework deals with the unique innovation challenge and activities caused at three levels of the environment: the Firm, the Industry, and the Macroevironment.

**2.3.3.1 Firm** *Activities include: Opportunity Recognition, Technology/Market Evaluation, Solution Development, and Commercialization.*

These activities represent the major stages in the problem-solving process firms use to manage innovation.<sup>2</sup> Hopefully, at this point, the role and importance that IM competences play in this process is clear. Opportunity recognition depends on being proficient in Idea Management; Technology/Market evaluation depends on Idea Management as well as possessing effective Market Management capabilities; they both depend on rigorous Portfolio Management, and so forth.

*The Firm Level captures the set of innovation management activities stemming from customers, suppliers, partners, and competitors directly related to the firm.*

Management can have a great effect on innovation at this level. With the organization structures they put in place, managers can include employees in decision making and gain more proprietary ownership for results. Organizational learning is a major factor in successful innovation. How open the organization is to external information can have a significant impact. The higher the level of communication is with customers and outside technical experts, the greater the probability of innovation. Managers should also encourage and support the informal flow of communications across the firm. This will result in a freer flow of information and exchange of ideas, thus helping the process of innovation.

Again, at this point, the role IM dimensions play in establishing the firm's environment should be evident. IM dimensions represent the necessary management activities needed to motivate, build, and improve innovation throughout the firm.

**2.3.3.2 Industry** *Activities include: Competitive Analysis, Participation in Industry Organizations Such as Trade Associations, and Spatial Clustering.*

*The Industry Level captures the innovation management activities caused by a firm and its competitors functioning in the same industry.*

<sup>2</sup>A simplified version of the model developed by Marquis (1969).

Beyond the firm is the environment of new entrants and incumbent competitors functioning in the same industry. At this level, environmental factors directly impact all competitors in the industry. Consequently, any patterns that emerge, that is, common problems with common solutions may be useful to companies operating in that industry. For example, knowing who and what represents best practice in a particular IM competence would be valuable to the competitors of a company. For this reason, the company's innovation models are often classified as "for internal use only."

Due to a number of factors, including the difficulty and costs associated with knowledge transfer, just the opposite effect can be observed at the Industry Level. In spatial clusters, like the Research Triangle Park of North Carolina, firms in the biotech and pharmaceutical industries have located operations in this area to draw on an "information infrastructure" of large research universities, entrepreneurs, and venture capitalists. The value of knowledge to these firms is so great that it forces even the most ardent competitors to come together.

Successful innovation firms need to sort out their industry competitors, partners, suppliers, and customers. Ironically, in an economy where no one company can possibly do it all, they may be the same.

**2.3.3.3 Macroenvironment** *Activities include: Understanding Demographics and Lifestyle Trends; Responding to Policy Decisions, Laws, and Regulations; Scientific Discovery Surveillance.*

Successful innovation organizations continuously monitor the social, political, economic, and technological environments for issues impacting their firms. For example, innovative firms in the consumer product industry are keenly aware of ethnic mixes, education levels, household formation, consumption patterns, and social habits. Successful innovation firms are also cognizant of the social acceptance of new technologies, like green technologies or genetically altered grains and vegetables. In the United States, these firms need to stay active in the national technological environment and monitor the discoveries coming out of the many national scientific centers.

This can be a time-consuming and expensive proposition for companies. And with the increasing economic interdependence of nations, the economic environment, and as a result the technological environment, is becoming more global. Nevertheless, it is well established that technological innovations can be traced to scientific research and the interplay with leading industry practitioners.

*The Macroenvironment Level captures the social, political, economic, and technological innovation management affecting all industries.*

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## 2.4 Summary

The IM Framework presented in Figure 2.1 provides a structured way of thinking about managing innovation. The framework doesn't become operational until it is populated. Firms must "fill in" or gain experience, establish practices, choose tools, and be able to teach the competences in each cell of the framework. At that point, the IM Framework becomes a useful repository for managers charged with improving their own organization's IM capabilities.

The IM Framework serves as the reference platform for training development. Multilevel education "tracks" should be developed around each essential IM competence (e.g., Idea Management). Each track might offer basic, experienced, and advanced instruction through discrete "modules," with time provided between levels for participants to apply their knowledge to their particular business operations. This type of progressive and modular design provides companies with a number of entry points based on their business strategy and current IM proficiency.

In order to create exciting new, breakthrough products and services, companies must work from the premise that innovation is a multidisciplinary process and is no longer the province of R&D. Training must be aimed at managers from all business functions (sales, operations, finance, human resources, field service, etc.) in formats that allow participants to experience the diversity of viewpoints so critical to innovation.

*All of these actions should be aimed at one thing: enabling managers to generate profitable growth through innovation.*

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## CHAPTER THREE

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# SERVICE DEVELOPMENT

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Thomas D. Kuczmarski and Rishu Mandolia

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### 3.1 Introduction

Services play a critical role in our economy; as of 2010, they accounted for over 75 percent of U.S. GDP. As global competition and customer expectations increase, it is no surprise that new service development has become increasingly more important. Customers' relationships with companies are no longer limited to single transactions or a tangible product; instead, they are often defined by multiple service-based interactions. As a result, companies need to constantly create new value for their customers, whether they are a pure services business or a product manufacturer trying to expand and bundle services around their products. Now more than ever before, profitable growth will depend upon a company's ability to master the discipline of new service development.

Services are fundamentally different from products and require unique considerations in their creation and development. The best approach for developing innovative new services, however, remains a systematic and iterative process that is based upon solving customers' problems and meeting their needs. This disciplined approach ensures higher success rates in the market, greater customer satisfaction, and reduced development costs. By delivering new solutions that address unmet customer needs, a company can develop innovations that set it apart from competitors and establish real differentiation.

Due to its different nature, service development has its own set of attributes, challenges, and processes that need to be distinguished from those of traditional product development. For example, "manufacturing" in service development often consists of support or "delivery" processes—

components that ultimately create the customer's experience. Customers play a direct role in the service delivery process, making their involvement in development much more essential. In addition, because the success of service delivery is highly influenced by the person, people, or technology that interfaces with the customer, minimizing variation in delivery quality and consistency is critical for success.

As our technology-laden society continues to change and evolve at an accelerated pace, customer expectations change as well. Rapidly changing needs and higher expectations add a level of complexity to service development in the twenty-first century. To meet these needs, the capabilities of service providers will need to evolve rapidly as well. This chapter will outline the unique aspects and emerging trends of service development and a customer-driven service development process to enhance the probability of success.

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## 3.2 How Service Development Is Different

Despite its pervasive use in today's business lexicon, the term *new service* is often misunderstood. What exactly constitutes a new service? What is unique about a service compared to a product? What is the relationship between services and products? Since the answers to these questions remain unclear to much of the business world, the majority of service development efforts are misfocused and inefficient. Understanding what differentiates services and makes them unique is the first step in enhancing new service development.

*The lack of understanding surrounding the word services leads to misfocused and inefficient new service efforts.*

Four unique-to-service qualities can help to define the word *service*. These are summed up in the four "I's":

1. *Individualized experiences*: Services are consumed differently by different customers.
2. *Intangible value*: The core aspect of a service is not a physical hard good, but the intrinsic value customers receive and the memories they retain.
3. *Instantaneous evaluations*: Customers' reaction to and assessment of the service is immediate.
4. *Inseparable components*: Services should be thought of as the holistic sum of their individual parts.

Winning companies intimately understand the four I's of service development and incorporate them into every facet of their offerings. For each of the four I's discussed in the following sections, let's take a look at innovative companies that have consciously addressed these unique aspects of service development.

### 3.2.1 Individualized Experiences

The most glaring difference between services and products is that every customer consumes a service differently than every other customer. Service is all about the memory that is created in the mind of the customer. Because service delivery is inevitably subject to variation and customers all have different perceptions, the exact service delivery and consumption interplay will rarely ever be replicated the same way twice. Providing services means doing something for someone else, not producing a product for mass consumption. This is one of the most critical elements of any successful service: the extent to which the provider can deliver a unique, customized experience to each customer rather than apply a generic one-size-fits-all solution.

With nearly 8,000 stores, Walgreens drugstores serve patients who speak a variety of languages. In pharmacies, it can sometimes be extremely difficult to explain to nonnative English-speaking patients how to take their medication properly. For patients to follow instructions when English is not their primary spoken language can be difficult. To solve this problem, Walgreens launched a new service called Multilingual Prescription Labels in 2002. Using this service, customers could now get their prescriptions in their preferred language. The new service reduced errors and increased overall customer satisfaction with Walgreens.

But Walgreens did not stop there. To further individualize its offerings, the company launched a complimentary Dial-A-Pharmacist service that enables quick access to a pharmacist who speaks the customer's language. Walgreens created a database of the languages that their pharmacists speak, enabling a patient to connect to any pharmacist on duty who speaks the desired language via in-store phones. Today, the prescription labels have expanded to cover 17 languages, and over 1,000 calls are received per month for Dial-A-Pharmacist.

### 3.2.2 Intangible Value

It is important to underscore that services are not hard goods, but rather intangible interactions or experiences. Consider, for example, legal advice from corporate counsel, software customization and installation

services from an information technology (IT) firm, or a consultation at the doctor's office. While all of these services leave the customer with something of value, the service—or value—they get is certainly nothing concrete that they can pull out of their pockets and show to their friends.

This unique aspect of services opens the door for both opportunities and challenges in development. Because there is nothing tangible for customers to evaluate beyond memories or receipts, the experience itself is what is digested and reevaluated down the line. The key point—experience—is the essence of successful new service development. For this reason, services need to make a lasting positive impression, satisfy customers' expectations, and be responsive to customer feedback in order to assure continued success.

Netflix was founded in 1997, and a decade later this new entrant had taken over the industry, literally pushing the incumbent giant Blockbuster into bankruptcy. Netflix gave customers the same physical product that Blockbuster did—DVDs—but by recognizing the intangible nature of the service, Netflix provided customers with a significantly superior experience. Besides eliminating late fees, Netflix made sure that its service provided a great customer experience through an easy-to-navigate website, queue management, and quick and convenient mailing processes. With its remarkably smooth and responsive service, Netflix kept customer satisfaction at industry-leading highs. In its early days, Netflix had 100 phone representatives for its 115,000 customers. But by the time its customer base had grown to 3.5 million users, errors had been reduced so much that the company only needed 43 representatives.

### 3.2.3 Instantaneous Evaluations

Another defining feature of services is the immediate and ongoing nature of the experience. Customer evaluation is not limited to the moment of the service delivery, but starts with the initial communication and often continues even after the service has been completed. This has significant consequences for how expansively developers should think about new service experiences and the different *touch points* the service covers.

At every contact between a customer and a company, new opinions and expectations are formed. Service providers have the advantage of being able to assess these evaluations and make actionable decisions based on this feedback much more quickly than product developers. It is imperative to capture these feelings and opinions as they happen to most effectively tailor services and make revisions accordingly. Of course, developers

should be careful not to react prematurely to a few outliers' reactions; customer feedback should be thoroughly studied to identify the reactions that are relevant to the entire customer base before making modifications.

When a customer orders a pizza, is he or she paying for the pizza or the convenience? Probably both. Domino's Pizza, America's largest pizza delivery chain, recognizes this. In 2009 the company launched a massive self-improvement campaign—with special focus on service and total customer experience.

Its new offerings started with a special “pizza tracker” service. Customers could now conveniently order their pizza from a computer and track it as the pizza went through the stages of (1) order placement, (2) preparation, (3) baking, (4) boxing, and (5) delivery. Customers were also invited to rate their experience and post reviews online. Recently, in a major step toward transparency, the company started publicly sharing these comments—including negative ones—by posting unvarnished comments on a large Times Square, New York, billboard.

Other components of Domino's campaign included “Show us your pizza,” wherein Domino's asked customers to share photos of actual delivered pizzas on its website. Some of these images were also used in a self-flogging ad campaign in which company executives publicly apologized to customers, with the promise to improve their service. Internally, these customer reviews were used as stimuli in a large-scale effort to reinvent the company's entire value chain to make sure that customers receive great experiences. Listening to customers seems to have worked; Domino's experienced a historic 14.3 percent quarterly gain in 2010.

### 3.2.4 Inseparable Components

Inseparable components underscores the fact that services are the collective sum of their individual touch points, spanning multiple contacts with the customer. When a service is performed, the holistic memory and perception is retained as one rather than separate experiences in the service chain. For example, the overall experience when flying on an airplane encompasses the ticket purchase online or over the phone, the check-in process, the flight itself, and the luggage retrieval. If there is a disconnect in service quality at one of the contact points—or even at subsequent ones—the whole service experience is negatively affected. For instance, if a customer's luggage is lost after he arrives at his destination, the entire service experience is ruined. Service development therefore needs to address the holistic aspect of services and the interplay between their numerous customer contact segments.

The inseparable nature of services is especially evident in ones that accompany products. On the surface, Amazon's Kindle seems like any other ebook reader; but then, why has Kindle been so successful while other ebooks have failed? The answer lies in Amazon's recognition of the importance of the inseparable components that make up the entire experience—which is about the service rather than the physical product. The Kindle store has the largest collection of ebooks in the market, making it easy for customers to get all their books in one place. Besides accessing their purchases on Kindle, customers can read them on their computer and other portable devices as well. The software is extremely easy to use and includes automatic wireless syncing. All these components seamlessly combine to give customers a hassle-free experience that has overturned the industry. Today Amazon sells more digital books than physical ones and continues to expand its product line.

Recently, many companies that have traditionally been fueled by the high quality of their products have been emphasizing ancillary services to competitively differentiate their products. Over the last few years, Lexus has shifted its business model to emphasize the service aspect of its dealerships. While the Lexus brand still stands for luxury, the company has successfully expanded it to include high-quality, reliable, and exceptional service as well. Now the Lexus brand stands for a luxurious experience, not just a luxury car. Other automobile companies, such as BMW, followed suit and began offering free lifetime maintenance for their high-end vehicles as well. Again, the service is offered as a complement to the product to help bolster the overall company message and the experience realized.

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### 3.3 The Service Development Process

Perhaps the single most important aspect of service development, one that is absolutely imperative for success, is a staged development process that hinges on the involvement of customers, employees, and key constituents. A staged development process is one that manages new service ideas as they move through various phases of development—all the way to launch. While the overall strategy for new service development should closely mirror that used for developing new products, service development requires a unique hands-on approach due to the complex, varied nature of service delivery. After a foundation is set that links the overall corporate strategy to the creation of new services, the development process differentiates itself from that used in new product development in both subtle and dramatic ways.

### 3.3.1 A Corporate Innovation Strategy

While many executives would view creating a new services strategy as a no-brainer, it is surprising how many fail to perform this step properly. Just as the foundation of a structure lays the base upon which to build, a new ser-

vices strategy lays the platform upon which to create new services. If you don't know what strategic roles you want new services to play within your organization, this will lead to haphazard and disjointed service creation, and it will be difficult to evaluate their success.

*A new services strategy lays the strategic platform upon which to create new services.*

An effective new services strategy should have four main elements:

1. The new service vision and the strategic roles that new services must play
2. The financial growth gap that new services are expected to fill over the next five years
3. Screening criteria to be used for moving ideas and concepts through the development process
4. A resource strategy that outlines the financial and human resource requirements for successful new service creation

Without a well-articulated strategy, companies often find themselves working on the wrong projects. It is also not uncommon for companies to fall into the trap of supporting too many or too few projects. This results in under- or overutilized innovation resources, which can lead to reduced morale among service providers and thus lower overall service quality. It cannot be stressed enough how important employee morale and motivation are in the creation of new services. Without the enthusiastic support of employees, often the very people who deliver the service to customers, new services are doomed to failure.

The financial growth gap helps determine the magnitude of the new service efforts that a company will attempt to fulfill. A large gap usually dictates breakthrough new services both inside and outside their current market or category. This point of reference prepares companies for the degree of risk they will need to undertake.

Establishing a set revenue target for new service projects from the very beginning also helps to ensure that the right projects are being pursued. Comparing variables such as category and market size, market share, recent new service successes, and available resources helps a company select the appropriate projects scope and reduce risk and employee

frustration in trying to meet unrealistic expectations. Similarly, the new service vision and strategic roles provide guidelines to help guide the selection of ideas as they move through the process.

The screening criteria help separate the winners from the losers, prioritize concepts, and assure continued overall alignment of the desired portfolio. The criteria provide metrics across a variety of categories to help companies understand the relative attractiveness of each new service.

### 3.3.2 Service Development and Shaping: The Voice of the Customer

The first stage of new service development is problem identification and exploration. It is here that acutely felt problems, frustrations, needs, and wants of customers and noncustomers are uncovered. The point is not to ask customers directly what they need or want, but to uncover this information

by understanding customers' behaviors, habits, preferences, and lifestyles.

By utilizing a range of qualitative research techniques, companies can zero in on and identify customers' biggest problems and frustrations, which often serve as the foundation upon which new solutions can be generated. This "needs and wants" focus can be broad (e.g., category service usage processes or routines) or narrow (e.g., service features, benefits, or dissatisfactions). The problem identification stage is the most *defining* stage of service development, as it identifies the most intensely felt customer-based problems and opportunities.

The second stage of service development is targeted new service ideation and conceptualization. The first objective is to generate dozens of new solution ideas that address the needs, wants, problems, and frustrations uncovered in problem identification. Participants in the ideation process should include customers and noncustomers as well as a cross-functional mix of employees. After ideas have been condensed and shaped, the screening criteria are used to determine which ideas should move on to conceptualization. Once this screening has taken place, the highest-potential concepts are then turned into concept statements, shaped and tested with customers, and evaluated financially through rigorous business analyses.

Solvent Systems International, Inc., helps customers such as auto body shops and dry cleaners reduce chemical waste. It's not part of an industry normally known for service innovation, but founder Steve Rundell has

*Identifying customers' biggest problems, frustrations, needs, and wants upfront is arguably the most important stage of new service development.*



developed winning solutions by listening to customers. Solvent Systems found that federal regulations charged companies for chemical waste they shipped offsite, even if it was sent to a distilling plant. To solve this problem, Solvent Systems uses trucks that go to clients' locations and distill their chemicals onsite. The service can typically reduce waste by up to 80 percent. It has been a great success and the company has expanded into new areas, including a used-cooking-oil collection service that turns the cooking-oil waste into biodegradable industrial cleaning products. These services provide win-win solutions for everybody by reducing customers' expenses as well as the environmental impact of their waste.

### 3.3.3 Employee Involvement and Service Blueprinting

Because so much of a service's success or failure will hinge on its successful delivery, it is absolutely essential to involve the delivery staff in the early problem identification and ideation sessions. These staff members have been "in the trenches," dealing with

customer feedback and complaints, giving them excellent frames of reference for identifying unmet needs and frustrations. Staff members can be a great source for hypotheses regarding customers' problems and needs, and for identifying areas of frequent or intense customer dissatisfaction with current solutions. Additionally, the delivery staff are the people who will ultimately transform a service concept into a well-defined customer-valued offering. Involving them from the beginning will improve launch effectiveness, thereby improving delivery.

*Staff members can provide valuable frames of reference for identifying unmet customer needs and frustrations.*

In addition to involving the delivery staff directly throughout the development process, another effective way of engaging them is by having them create service blueprints that map interactions, contact points, and routes of delivery for service ideas. For all services that have moved through to conceptualization, a service processes map—a graphical representation of the delivery process, including all possible contact points—should be created. It should map out the sequential flow of activities and interactions, those both visible and invisible to the customer. The initial draft should map out different possibilities for points of contact and service delivery. These different alternatives can then be tested once a prototype is ready. In addition, this will allow staff to better visualize their role in the overall service delivery process, making them feel like a valued, essential part of a larger team.

Let's look at the touch points involved in a newspaper experience for a customer. The billing process, ease of holding delivery during vacation, quality of the editorials, delivery of the newspaper to the doorstep, digital access, appeal of separate sections of the newspaper, and the like represent pieces of the total experience pie. While the text (in physical or digital form) is the core offering, all of the services that surround it are indeed inseparable and help to shape the collective experience. A service blueprint will help the newspaper company both identify all these different touch points and map out possible modes and styles of interaction in every key customer involvement situation. This map will help show the linkages among the different service and product attributes and help give employees a sense of their purpose in the overall value proposition the company is offering.

### 3.3.4 Prototype and Beyond: Differentiation through Delivery

The next major stage is prototype development and launch. In this stage, concepts that pass through screens are then turned into full-scale prototypes, and detailed market test and launch

*The launch of a new service is essentially never-ending.*

plans and service delivery plans are developed. The highest potential service concepts are then brought to life and refined and tested with customers. After being tested, tweaked, and validated by customers, the services are ready for launch in accordance with a specified roll-out plan. This plan must take into account a number of factors, including screening criteria, the new services strategy, and prototype testing results.

Prototype testing is one of the most essential elements of new service development. Unfortunately, many service companies omit the prototype testing and jump directly from concept to launch. This could not be more deleterious to successful service creation. Because services generally cannot be patented, are extremely susceptible to replication, and require few barriers to entry, it is imperative to garner customer feedback on a new service in order to improve and tweak it before a full-scale launch. Failure to do so can result in unsatisfied customers and leave an organization vulnerable to competition. This is devastating because of the financial ramifications of lost investment but is also damaging to the creative mindset and the chances of future risk taking and success.

The launch is another unique aspect of service creation because it is essentially a never-ending step. When a product is launched, a company's

hard work is essentially over; it is exactly the opposite with services. A service needs constant monitoring and assessment to make sure that it is still addressing relevant customer needs in the most efficient and effective way possible. There is always room for improvement with service, so constant customer feedback is essential.

In addition, it is more difficult to predict the reception a new service will get compared to a new product. Although it is possible to test a service much like a product (through qualitative and quantitative research with a representative sample of customers), often the service's value proposition is highly influenced by external circumstances. While many of these factors may be unforeseeable prior to launch, it is possible to mitigate the consequences of this lack of information by testing plausible market occurrences in prototype testing. Developers should start by identifying key variables that can impact the service experience. For example, the value of a service can be directly related to the number of people who will use it. The service can then be tested at different usage levels with customers in order to determine its effect on the service's overall value.

The possible impact of external circumstances, either positive or negative, also calls for constant customer feedback and monitoring after launch. Only with continuous understanding of the changing value propositions of the services provided can a company effectively reevaluate the service offered.

Today, intangible assets can represent over 80 percent of a company's value. But proper valuation of these assets is often not as easy as valuation of tangible ones. To meet this challenge, Ocean Tomo created a market-based system to value intellectual property—a live auction. This innovative platform gave customers an easy way to buy and sell intellectual property as simply as tangible goods. The results are significant; for example, a patent portfolio that had attracted bids of less than \$1 million through the tedious process of identifying buyers, calling them, doing due diligence, and trying to convince them to buy garnered more than \$15 million in winning bids through an auction.

The entire service has been designed for simplicity: Ocean Tomo publishes a catalog with detailed information about the intellectual property, sets a date for the auction, and tells people to show up if they want to buy. The service has been extremely successful and has led to a number of other firsts for the company, which has created the first equity index and the first exchange-traded fund.

Ocean Tomo is continuing to develop this innovation. The next step is creating a market for the charitable contribution of technology—Invent

for Humanity Technology Transfer Exchange Fair. Currently, even if a company is willing to give away technology to those who need it—like the Red Cross—there's no method for the transfer. To address this need, Ocean Tomo is creating a humanitarian market that will facilitate a commercial exchange through an auction market.

### 3.3.5 Training as Part of the New Service Development Process

Services, unlike products, are ultimately delivered either by people or with the assistance of people. Because all people are unique and respond differently in given situations, certain measures must be taken to ensure that employees have the resources and knowledge to act in the best interest of the company. Training of employees should revolve around three main areas:

1. The company's corporate strategy and the service's strategic role
2. Crisis management and troubleshooting
3. The actual delivery of the service

First, only with strong knowledge of the strategic role or objective of the service under the larger umbrella of corporate strategy can employees make decisions that will tie into the overall company objectives. Training them to see the larger picture will help ensure that they have the company goals in mind in every decision made. Second, employees need to be trained in extensive crisis management and troubleshooting situations. Only when they are well versed in the plausible mishaps will they be able to respond in a consistent and appropriate manner. It is imperative to invest in extensive training for the basic delivery of the service. Learning by doing is not an acceptable approach in service development, as this will lead to alienated customers and lost business.

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## 3.4 Emerging Trends in Service Development

Another characteristic unique to services is the alacrity with which they move and adjust to societal trends. While certain products continue to demonstrate their value decade after decade, few services stand this test of time, as people's expectations and needs are in constant flux.

In previous editions, we have talked about two notable trends that continue to impact service development: the development and utilization of technology and the blurring of the lines between products and services. As products further transform and customers continue to change, we find

these trends evolving into four interconnected trends: the four “S’s” of service innovation:

1. Seamless interactions and communications
2. Social technology integration
3. Stellar customer experiences
4. Scalability and expansion potential

### 3.4.1 Seamless Interactions and Communications

Growing communication technologies have impacted service development at its core by elevating both service development capabilities and customer expectations. To say that modern customers are constantly connected would be an understatement; the explosion of smart phones has redefined how cus-

tomers interact with a company. These forces work both for and against each other in the service development equation: as technology access increases, providers are able to better communicate and meet the demands of their customers, who, in turn, continue to increase their minimum standards.

Customers now expect to be able to access a company through multiple different channels and get a smooth, seamless experience across all of them. For example, an airline customer could use a website to check his mileage account and book a flight, call the customer service number to discuss a change, and use a smart phone application to check in at the airport. Additionally, the same customer now expects to be able to do any and all of these things using the smart phone app alone—and get the same quality of service and response as he or she would have by talking to a company representative.

Starbucks has a history of innovative firsts in its industry and continues to lead the pack with its mobile strategy. Just as the company makes sure that its customers get a consistent (but individualized) experience throughout its thousands of stores, it is making sure that this uniformity includes its mobile applications. The company’s latest application allows customers to order drinks and pay for them from the app itself. Additionally, customers can use the app to easily manage their account, reload their balance, check their reward status, find a nearby store, browse the menu, or check out promotions. The entire experience is designed to

*Customers now expect to connect with companies through multiple channels and get the same quality of seamless service across all of them.*

work seamlessly with the company's existing systems and meet customers' new expectations. The company has already installed mobile payment systems in over 1,000 stores with millions of transactions and continues rollout to the rest of the chain.

### 3.4.2 Social Technology Integration

The proliferation of social media technologies has significant consequences for new services as well. The way customers communicate and share information among themselves has fundamentally changed; this is something developers need to take into account when creating new services.

*The way customers communicate and share information has fundamentally changed.*

Social media and technologies can play different roles as they relate to any new service offering. For many services, social media integration can be an important feature that customers demand. More and more new services have an online component, and social media connectivity gives customers additional features they have become accustomed to—such as shared logins and the ability to post content directly to social networks. For others, social media may play a major role in marketing the service to new customers. These new technology platforms have become trusted hubs for modern customers, and they give companies an effective channel to engage in two-way communications with their target audience.

Social media have provided both businesses and customers with unprecedented reach at an extremely low cost. One additional impact of this trend is the ease of feedback collection for the service providers. They now have a captive audience from whom they can solicit feedback and suggestions, helping them provide better, more responsive service to their customers. It is not uncommon for leading companies to connect with customers, exchange messages, and promote offers through ever-expanding networks such as Facebook, Twitter, Groupon, Yelp, and Foursquare.

### 3.4.3 Stellar Customer Experiences

Another big impact of the social revolution is on the rate at which customers are able to share information among themselves. This can significantly benefit a company. Customers can now tell others of their great

*Companies are now under extra pressure to ensure that every customer receives great service.*

experiences and spread the word through reviews about services online, bringing new customers to a company. Websites such as Yelp provide an easy way for customers to learn about a company's services before actually using them.

But these comments can work against the company as well. Due to the archival nature of the Internet, negative reviews can exaggerate a single bad experience, making it seem representative to new online customers. This puts extra pressure on developers to be much more vigilant in their service blueprint development and ensure that services are designed to offer stellar experiences to every customer.

This trend impacts products too. Products and services now more often blend into a full experience rather than being separate offerings. For example, when you buy a cell phone, are you buying a product or a service? The phone itself is certainly a product, but it is only useful with the accompanying service. The line between products and services has continued to blur as people have become more concerned with convenience and simplicity. People now place more value on the interconnected and interrelated services that accompany many products. This trend has shifted the paradigm to the point where a once supplemental service can now be the defining benefit of a product/service combination. Extensive customer research is needed to determine the changing role of a specific service in the overall value proposition of the product/service package.

Ask customers, and they always have good things to say about Zappos. The company strives to create great customer experiences, believing in "delivering WOW through service." And this great competency has created amazing competitive differentiation for Zappos. Company CEO Tony Hsieh often says that he doesn't want to prescribe actions for employees that show how much Zappos cares about customers; instead, he wants employees to do things because they genuinely care about customers. All new employees are interviewed on cultural fit, and they go through four to five weeks of training that includes education about the culture and spending time on the phone with customers. In fact, the company offers \$1,500 to new employees to quit after their first week of training; Zappos really does not want employees who don't feel a genuine fit with the company's culture. This may seem excessive, but that's how strongly the company feels about creating stellar customer experiences.

### 3.4.4 Scalability and Expansion Potential

An important new trend for innovators is to design services with additional scalability and expansion potential from the start, going far beyond

the direct growth potential of the initial service. This does not mean adding new customers or expanding geographically. It means developing services as a platform on which further new services can be built.

*Services should be designed as expandable business platforms, not individual offerings*

Chicago Transit Authority's (CTA) Bus Tracker is an example of a service developed with scalability and expansion in mind. At its core, Bus Tracker was created to give customers a way to find out the location of a bus and the wait time at any bus stop. Users can access this information in a number of ways—from their computers, from smart phones, or via Short Message Service (SMS). The real-time data is also used internally to help CTA improve its operations, eliminating the need to track bus arrival times manually.

Additionally, CTA opened the platform with developer Application Programming Interface (API), which has led to a number of third-party applications for customers. CTA's philosophy is that the data behind Bus Tracker should be accessible to everyone, helping to make the decision to take public transportation in Chicago a no-brainer. CTA continues to expand this service, and it has developed a do-it-yourself display package and partnered with different community organizations and schools so that they can provide easy access to Bus Tracker in building lobbies and store-fronts. Recently, the organization expanded the tracker service to trains, using a completely different technological foundation but providing customers with the same benefit.

### 3.5 Summary

While new technologies have certainly helped innovative companies expand their boundaries and improve their services, they have also made it much simpler and cheaper for others to replicate competitors' actions. The fast follower is now able to play catch up much more quickly and inexpensively than the pioneer. Due to this phenomenon, it is imperative that companies test and shape new services prior to launch to ensure that they meet and exceed customers' expectations and requirements. If appropriate, they should also consider filing for a service mark as another source of competitive insulation.

Failure to act prudently gives competitors the opportunity to capitalize on months or years of hard work and innovation without making the time or financial investment. Companies first to market with a properly tested and shaped new technology stand to gain market share and



block competitors, while companies that hastily rush to market with an imperfect technology will at first succeed but ultimately fail as competitors flood the market. This increased competition also calls for greater attention to personalized, unique service delivery as a means to further differentiate the company from its competitors.

An example demonstrating the dangers of technology and new service development is Webvan, an online grocery shopping and delivery service. Webvan adopted a great idea, allowing customers to order and receive groceries and other goods without leaving the comfort of their home, but did not exercise patience when developing, testing, and perfecting their service delivery. Thus, their service ultimately failed as other providers were able to come in and offer higher-quality services at a much lower cost.

This chapter has looked at the defining features of service development and outlined an effective process for the creation of breakthrough new services. While service development shares many commonalities with product development, there are also stark differences that call for a unique approach. In addition to the need for a staged process and continuous customer involvement, extensive testing and feedback during the prototype and launch stage and the need for comprehensive employee training are the hallmarks of a successful new services process.

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## CHAPTER FOUR

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# BUSINESS MODEL INNOVATION: INNOVATION OUTSIDE THE CORE

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Heidi M.J. Bertels and Peter A. Koen

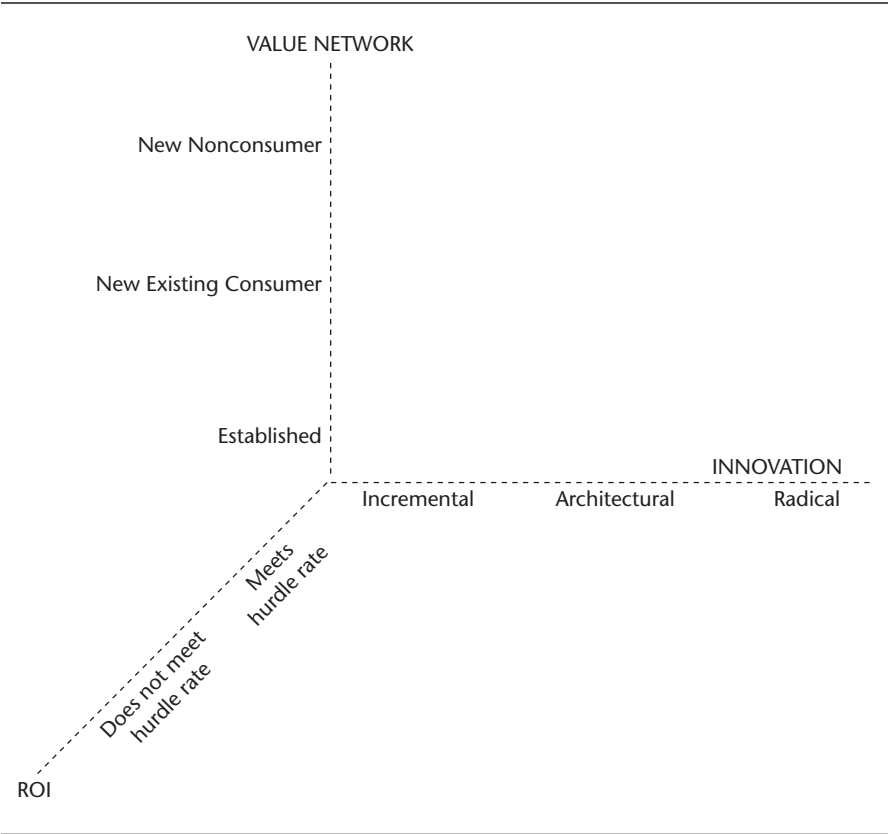
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### 4.1 Introduction

Established firms consistently demonstrate their ability to succeed with sustaining innovation. Intel, for instance, has been a leader in the development of next-generation microprocessor chips using new technology for many years. At the same time, however, companies like Intel have difficulty trying to pursue innovation that seems technologically unchallenging for them, but that might require a new partnership network (or *value network*) or that might seem financially unattractive when compared with the firm's traditionally accepted hurdle rate. Until the present, Intel has not been successful in entering the smartphone market with its microprocessors; at the same time, microprocessor producers for smartphones have started to compete with Intel in the mobile computing market. Further, incumbents have a natural tendency to focus on protecting the higher end of the market, which has more attractive profit margins, as opposed to the lower-end (Christensen and Raynor, 2003). Contrary to this tendency, Intel has been successful with the Intel Celeron, which it has developed to discourage entrants from moving into the microprocessor market at the low end.

In this chapter, we offer a three-dimensional framework that expands on technology and market dimensions to help explain the relationship between business models and innovation. The three-dimensional framework is depicted in Figure 4.1.

**FIGURE 4.1 A THREE-DIMENSIONAL INNOVATION TYPOLOGY.**



## 4.2 A Model of How Companies Can Innovate Their Business Models

We begin with the technology dimension. Within this dimension, the model distinguishes among incremental, architectural, and radical technological innovation. *Incremental innovation* involves the refinement, improvement, and exploitation of existing technology. *Architectural innovation* involves creating new ways to integrate components in a system based on current or incremental changes to existing technology (Henderson and Clark, 1990). Desktop printers, for example, involve no really new technology but are architecturally very different from large office printers. Finally, *radical innovation* introduces an entirely new core technology.

The second dimension is the value network dimension. A firm's *value network* includes "its upstream suppliers; its downstream customers,

retailers and distributors; and its partners and ancillary industry players” (Christensen, Anthony, and Roth, 2004: 63). It is the organizational reflection of how the firm is networked to compete within a business model and mirrors a complex network of commitments and relationships that need to be maintained (Romanelli and Tushman, 1994). Relationships in established value networks are valuable. Tripsas (1997), for example, observed that incumbents, even when clearly exhibiting inferior technological performance, had a higher commercial performance than start-ups when they could draw on specialized complementary assets not available to others, like sales/service relationships. This shows how value networks can be enabling to an incumbent. However, innovations that require modifications to a firm’s existing value network can be problematic, as it is difficult to establish new relationships or disrupt existing ones. This is illustrated by the Swiss watch industry’s inability to follow Timex’s introduction of the disposable watch in drugstores and other mass channels for fear of offending their current distribution channel: the jewelry stores (Porter [198]) cited by Lieberman and Montgomery [1988]).

On the value network dimension, we further distinguish between existing value networks (i.e., the value network the incumbent firm is currently active in), new value networks that target an existing customer, and new value networks that target nonconsumers. *New* value networks are value networks that are new to the firm on at least one dimension (e.g., supplier, distributor, customer). A new value network targeting an existing customer tries to reach a customer who was already using a product or service through a new value network. Zipcar, for example, targets existing consumers of car rental companies with a new value network involving owners of parking facilities, city officials, off-site maintenance, a new customer interface, and no physical rental offices. Examples of innovations that required a new value network and targeted nonconsumers are the Sony Walkman and angioplasty. The Sony Walkman created its own market in portable headphone stereos; hence, it targeted consumers who had no alternative before. Balloon angioplasty is a radical new technique whereby a catheter is threaded into a partially clogged artery and a balloon is expanded (Christensen and Overdorf, 2000). It provided a solution for lower-risk heart disease patients (nonconsumers), who previously did not undergo cardiac bypass surgery because of the high risks and costs associated with interventional therapy, and it enabled a new group of providers, cardiologists, to treat coronary artery disease. It is important to consider the value network dimension because it acknowledges the inhibiting and enabling nature of the entire network structure—not only a single market element—in which an incumbent is embedded.

The third dimension of the model is the hurdle rate dimension. The *hurdle rate* is the relationship of a project's financial projections to the minimal expected return and is a key factor in traditional disruptive innovation that relies on a low-cost business model. Low-cost business models are normally difficult for established companies to use because they do not meet the hurdle rates defined by the firm's cost structure and expected rate of return. However, it is possible for established firms to use low-cost business models successfully. Dow Corning developed Xiameter (Gary, 2004) as a Web-based discount channel through which customers could bulk order the company's more traditional products at a lower price without the customer service usually provided by Dow Corning. Xiameter became an important part of Dow Corning's service offering and prevented the erosion of their market share by companies focused on commodity customers.

*Business model innovation may be best understood by viewing it along the three dimensions of technology, the value network, and the hurdle rate.*

Using this model, five different incumbent strategies are possible. We now discuss each of these strategies.

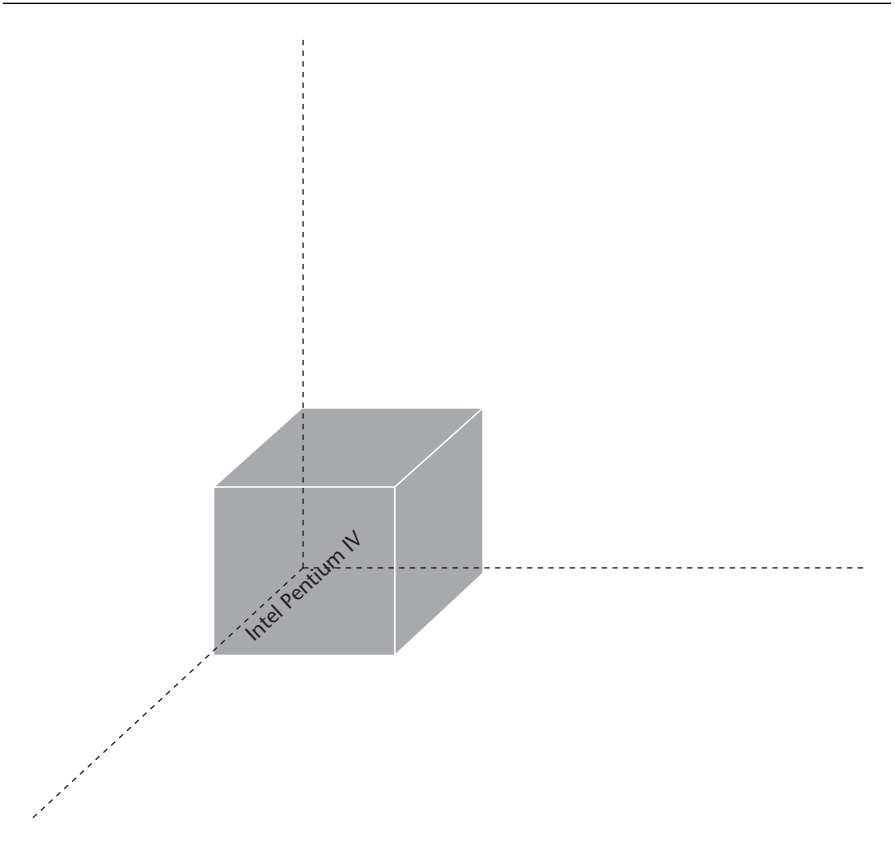
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## 4.3 Exploitation

Innovations leveraging incremental technology in the incumbent's existing value network to protect the status quo (i.e., prevent loss) are exploitative (Christensen and Raynor, 2003; Markides and Charitou, 2004; Smith and Tushman, 2005). They require minimal changes on all three dimensions of our innovation framework, extending previous actions, and therefore are exploitative on all three dimensions. We label this type of activity *exploitation* (Figure 4.2).

Exploitative activities are competency-enhancing (Tushman and Anderson, 1986) because incumbent firms are able to build on their existing knowledge and skills in technology and technological architectures. Similarly, when these competency-enhancing, incremental technological innovations are brought to market within the existing value network, there is no need to introduce new relationships with the potential to cause conflict (Markides and Charitou, 2004). Exploitative activities have existing or higher hurdle rates because they help the incumbent maintain a profitable status quo and hence ensure sustained revenue.

**FIGURE 4.2 EXPLOITATION.**



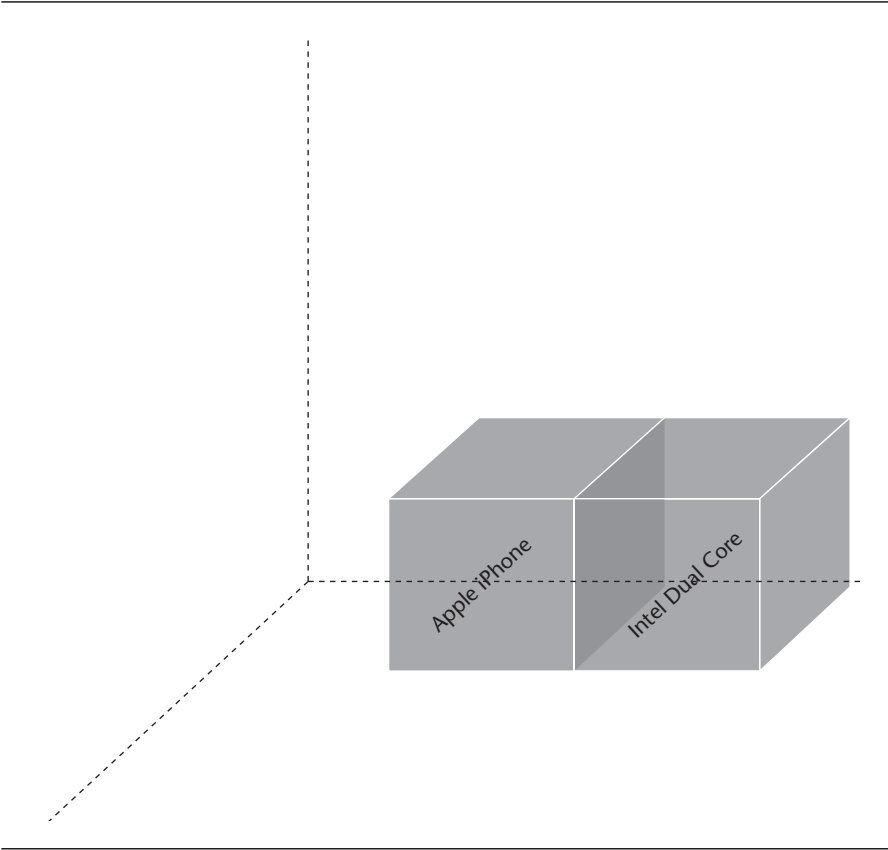
All activities pursued to bring to market the next generation of a company's current product are examples of exploitation, but exploitation may also involve higher degrees of innovativeness and/or creativity. An example is Emirates Airlines' offering of enhanced private suites in first class, equipped with individual storage, a coat closet, vanity desk, personal minibar, an extra-large seat convertible to a fully flat bed, a 23-inch wide-screen LCD screen featuring over 600 channels, à la carte gourmet cuisine, and an extensive wine list. It is targeted to the high end of an existing value network and involves incremental degrees of technological newness only. Another example is the Intel Pentium IV, which builds on the same technology as the Pentium III but targets the same value network with comparable hurdle rates.

## 4.4 Sustaining Innovation

A sustaining innovation strategy targets current or higher-end customers in an existing value network with an architectural or radical technology (Figure 4.3). It is sustaining because it leverages the established value network and maintains the existing financial hurdle rates. Sustaining innovation is more challenging than exploitation because it involves higher degrees of technological newness and may be competency-destroying. In highly dynamic markets like the fast-moving computer market (Brown and Eisenhardt, 1997), sustaining innovation is a core capability.

An example of a successful sustaining innovation by an established firm is the Apple iPhone. The iPhone is an architectural innovation

FIGURE 4.3 SUSTAINING INNOVATION.



compared to previous generations of mobile phones because it has no embedded keyboard. Instead, the user interacts with the device by manipulating content on a widescreen display by tapping, pinching, and dragging. The iPhone targets the high end of the existing smartphone value network. Although Apple redefined the relationship between the manufacturers of handsets and mobile operators, it leveraged the established value network to distribute and sell the phone. Another example of sustaining innovation is the development of the dual-core chip by Intel. The Intel Dual-Core Processor combines two execution cores embedded in one physical processor. The Dual-Core doubles performance while simultaneously reducing power consumption, yielding 2.5 times the performance/watt ratio of single-core processors and providing multitasking computing power previously unheard of.

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## 4.5 Value Network Innovation

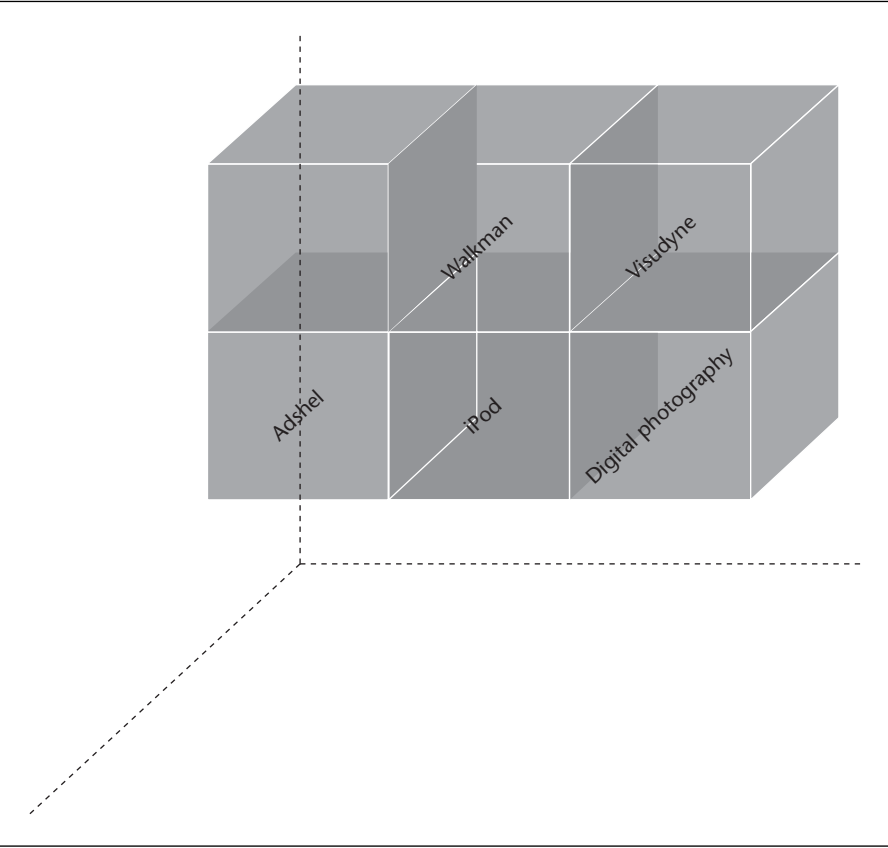
Established firms engage in value network innovation when they pursue projects that target new value networks while being able to meet the existing financial hurdle rate (Figure 4.4). Examples of value network innovations for existing customers are Adshel (an advertising company), the Apple iPod/iTunes, and digital photography.

Adshel disrupted existing manufacturers of bus shelters by providing free bus shelters to municipalities and charging for wall space. In doing so, Adshel created a new revenue stream in the value network. iTunes, which delivers single song tracks to consumers in a user-friendly format for download on an iPod, required Apple to build unique partnerships with the music industry, resulting in new value networks. The advent of digital photography required significant value network innovation for established filmmakers such as Kodak. Early Kodak products reinforced Kodak's existing value network. The Photo CD, which offered a way to store digitally images that originally came from a roll of film, made use of Kodak's established relationships with their retail channel (drugstores) by offering Picture Kiosks. However, companies that exploited the new value network associated with digital photography, such as those selling digital cameras and inkjet printers through retail electronics outlets, are the ones that capitalized on the change.

The other type of value network innovation targets nonconsumers. For example, the Sony Walkman created its own market in portable headphone stereos; hence, it targeted consumers who had no alternative before. Sony charged a premium for its products because of its fine reputation and technical leadership. Another example is the previously



**FIGURE 4.4 VALUE NETWORK INNOVATION.**

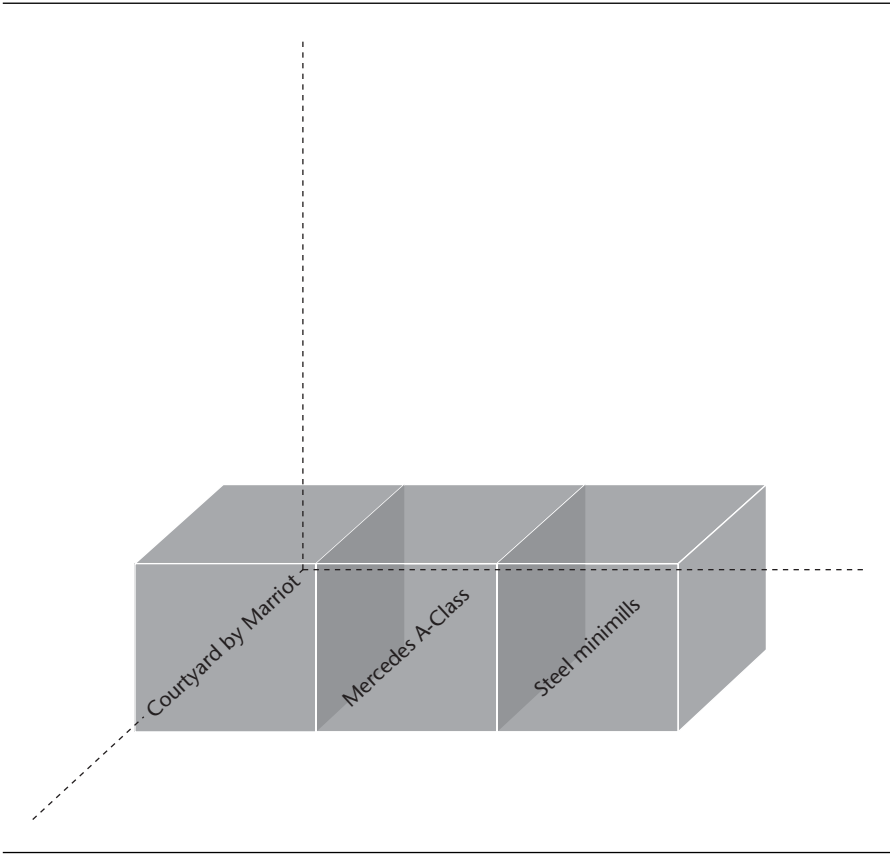


mentioned balloon angioplasty. A nonconsumer value network innovation involving radical technology that was successfully provided by an incumbent firm (Ciba Vision) is Visudyne, a contact lens that slows down macular degeneration related to age. It is sold to ophthalmologists through pharmacies rather than to end customers through the more traditional retailers for Ciba Vision's (Smith and Tushman, 2005) lens business.

### 4.6 Financial Hurdle Rate Innovation

Financial hurdle rate innovation (Figure 4.5) involves projects with a lower hurdle rate in the incumbent's established value network with any type of technological newness. For example, low-cost business models are hard for incumbents to use because they cannot meet the traditional hurdle

FIGURE 4.5 HURDLE RATE INNOVATION.



rates provided by the established firm’s cost structure optimized for a higher-cost business model. Projects that do not meet the traditional hurdle rate, however, may protect the higher end of the market by discouraging entry from the low-end, or they become very profitable endeavors over time that eventually may turn disruptive. For example, steel minimills have been disrupting integrated mills around the world since the mid-1960s, and Amazon.com has been disruptive to traditional bookstores (Christensen and Raynor, 2003). In both cases, disruption was caused by the use of a technology that made possible a lower-cost business model than those that were traditional for integrated mills and bookstores.

Other examples of hurdle rate innovations by incumbents are the Mercedes A-Class and Courtyard by Marriot. Hurdle rate innovations exploit existing value networks with lower financial hurdle rates. The Mercedes A-Class was the first-ever Mercedes for the middle-market segment. It was

targeted to new customers, who were younger than the typical Mercedes owner. Its development involved almost all new parts compared to previous Mercedes cars and incorporated Mercedes-Benz's first front-wheel drive design. It was branded as a Mercedes car and leveraged established sales channels and distribution networks. Marriot was successful with lower hurdle rate innovation through Courtyard by Marriot. Although the hotels have a restaurant and small conference rooms, other public places, like a lobby or ballroom, are scaled down or don't exist. Courtyard by Marriot targets the bottom of the more upscale segment of the hotel market, typically business travelers with limited expense accounts.

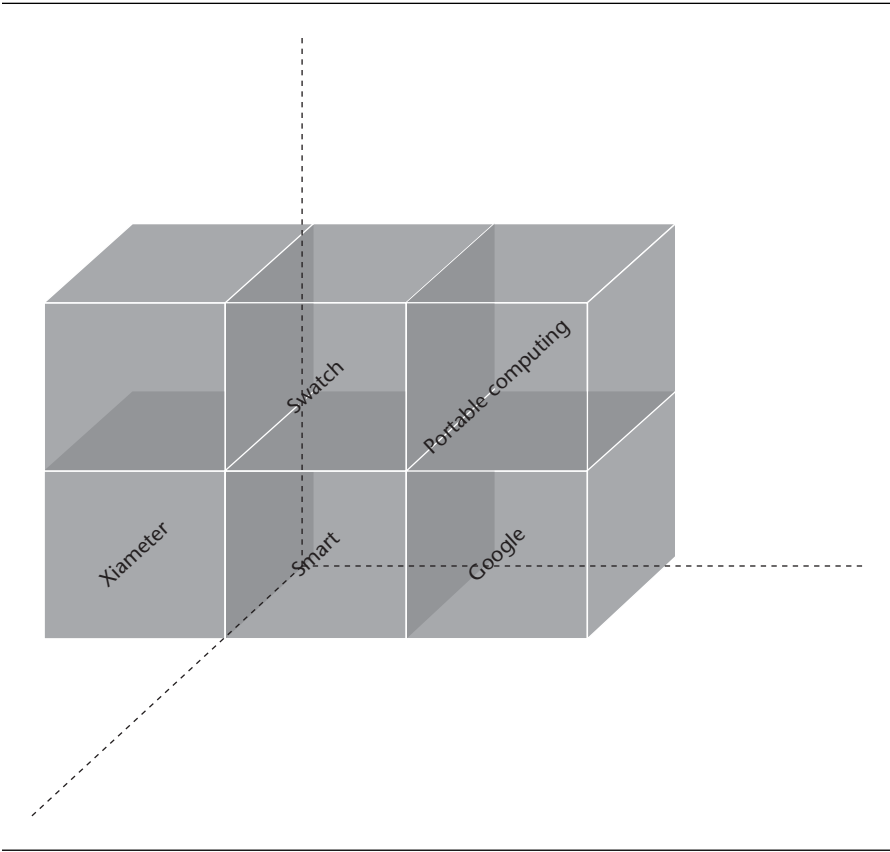
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## 4.7 Hybrid Innovation: Combining Lower Hurdle Rate and Value Network Innovation

A hybrid innovation (Figure 4.6) involves a project with a lower hurdle rate in a new value network with any type of technological newness.

Examples of hybrid projects for existing customers in new value networks are Xiameter, Smart, and Google. Xiameter is a Web-based discount sales channel owned by Dow Corning. Its major goal was to retain cost-conscious customers who no longer needed Dow Corning's added R&D services because of market trends to commoditization and who were fleeing to lower-cost suppliers. An entirely new sales channel that emphasized transactional sales (a website) as opposed to relational sales was established. To keep costs low, Dow Corning allowed only one way of handling issues such as method of ordering, order size, order-to-delivery lead time, and shipping and payment terms. The Smart (Swatch, Mercedes, plus art) was a revolutionary two-seater city car developed by Mercedes-Benz in partnership with Swatch. The color of the car could be exchanged by owning different sets of body panels. Smart deployed an innovative production and sales and distribution approach. Assembly took only 4.5 hours and emphasized maximum supplier involvement, with several suppliers setting up factories on site. Most Smarts were displayed in Smart towers, seven-story glass towers with a 27-vehicle capacity. Sergey Brin and Larry Page, the founders of Google Inc., invented a superior algorithm to search the Web while they were graduate students at Stanford. PageRank, the algorithm, favored pages that were referenced by other pages. Web search was monetized by paid listings, short text ads identified as *sponsored links* that appeared when searching on specific keywords. A whole new value network arose around the Web search/paid listings business model competing with the Yellow Pages. Google lowered the minimum cost-per-click bids compared to competitor Overture.

FIGURE 4.6 HYBRID INNOVATION.



Examples of hybrid innovation for nonconsumers can be found in the disk drive industry (Christensen and Raynor, 2003). Incumbents in the corporate Management Information Systems (MIS) market judged the market for portable personal computing to be too small and concentrated on delivering value for their current customers in terms of improving such things as capacity, speed, and reliability (Christensen and Rosenbloom, 1995). Interactions with their customers reinforced their ideas about which performance criteria should get priority. Portable personal computing offered different benefits, such as smaller physical size and ruggedness (Christensen and Rosenbloom, 1995), appealing to a set of nonconsumers in the MIS market. Swatch (Swiss + watch) was a quartz watch targeting the low end of the watch market in reaction to Swiss watch makers’ decreasing market shares. It was quite controversial to launch a

watch encased in cheap plastic within the Swiss watch industry, which had difficulty conceiving of itself as a low-end watch manufacturer. Swatch, a fashion product, was appealing to young people who had no interest in watches before. Swatch also adopted an unconventional retail approach; for example, the Veggie Swatch line was sold in fruit and vegetable markets, and Swatch opened a number of freestanding Swatch stores located in exclusive high-fashion districts.

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## 4.8 Summary

Christensen and colleagues (Christensen, Anthony, and Roth 2004; Christensen and Overdorf 2000; Christensen and Raynor 2003 ) created a theory of disruption: over time, how are established firms disrupted by entrants? The result of their work was a distinction between two types of disruption: low-end and value network disruption. We started to work on building our framework when we found anomalies we couldn't fit into the existing disruption terminology related to value network and hybrid disruptions. For example, Adshel, a value network innovation, caused low-end disruption by providing bus shelters to the community for free, but it didn't do so with a low-cost business model. Adshel developed a new upstream value network that enabled it to maintain a high-cost business model while offering a low price to the end consumer. Hence, because there is no low-cost business model involved, Adshel doesn't fit into the model of low-end disruption. Nor can Adshel's new business model be classified as a value network disruption because Adshel did not target nonconsumers.

Christensen and colleagues also discuss hybrid disruptors that use low-cost business models that are financially attractive to nonconsumers. Since price is a performance criterion and value networks arise around bundles of performance criteria (i.e., value) to be brought to market, the traditional distinction between low-end and value network disruption is blurred when a newly valued bundle of performance criteria leading to a new value network includes a low price to the customer. We overcome this problem by proposing a hurdle rate and value network dimension. We distinguish explicitly between new value networks that are attractive compared to incumbents' hurdle rates and new value networks that are not, arguing that value network and the financial hurdle rate are independent innovation dimensions. To illustrate this point, there exist both business models arising around new-to-the-world products such as the Sony Walkman, which target nonconsumers but have healthy profit margins and therefore meet established hurdle rates, and those arising

around, for example, Swatch, which targets nonconsumers with a low-cost business model. Whereas it might have taken some time for Sony to build up enough momentum (i.e., enough sales) for the Walkman to be profitable, there is no low-cost business model necessary to sustain this business. Further, there are both pure low hurdle rate innovations leveraging existing value network (e.g., Intel Celeron, Mercedes A-Class) and pure value network innovations maintaining existing hurdle rates (e.g., Adshel, Zipcar). Our model also adds hybrid innovation for the existing consumer that is not accounted for when using the traditional notion of hybrid disruption. This addition allows us to better understand cases such as Ikea and iTunes, which target existing customers (not nonconsumers) with a new value network and with a lower hurdle rate.

In summary, business model innovation may be best understood by viewing it along the three dimensions of technology, the value network, and the hurdle rate. Accordingly, companies should consider five different incumbent strategies: exploitation, sustaining innovation, value network innovation, hurdle rate innovation, and hybrid innovation.

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## CHAPTER FIVE

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# OPEN INNOVATION AND SUCCESSFUL VENTURING

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Rob van Leen and Marcel Lubben

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### 5.1 Introduction

*Open innovation* is a term coined by Henry Chesbrough of the University of California, Berkeley, which holds that an organization, in order to accelerate innovation, can and should use both internal and external ideas, as well as internal and external paths to market. In the traditional model of *closed innovation*, companies relied on the assumption that innovation processes needed to be inspired, driven, and controlled by the company. Chesbrough, however, argues that internal R&D, traditionally the driving force of innovation, is no longer the invaluable strategic asset that it used to be; this is due to a fundamental shift in the way companies generate new ideas and bring them to market. “The boundary between a firm and its surrounding environment is more porous, enabling innovation to move easily between the two,” argues Chesbrough (2003a, p. 36).

Chesbrough’s argument for open innovation holds that there exists a multitude of ideas outside an organization, that companies should be active buyers and sellers of intellectual property, and that technology assets have no inherent value independent of the business model used to employ them. He defines *open innovation* as

[t]he use of purposive inflows and outflows of knowledge to accelerate internal innovation, and to expand the markets for external use of



innovation, respectively. Open Innovation is a paradigm that assumes that firms can and should use external ideas as well as internal ideas, and internal and external paths to market, as the firms look to advance their technology. (Chesbrough, 2003b, p. xxiv)

Open innovation is facilitated through several open innovation tools, including in- and out-licensing, alliances and acquisitions, technology scouting, and corporate venturing—either by investing indirectly (through a venture capital fund) or directly (as a shareholder) in externally founded start-up companies or by spinning out internal activities as (independent) ventures, thus delineating external versus internal corporate venturing.

Open innovation requires people to work together—with trust, mutual respect, authority, and resources to act—across organizational boundaries. It requires open communication (information/knowledge sharing), entrepreneurial behavior, and multidisciplinary collaboration with external and internal partners in all phases, as well as an absence of incomprehensible and redundant rules.

Further key success factors for open innovation include:

- Strong strategic commitment by senior management of the company
- A tailored organizational structure that enables efficient steering of innovation platforms
- Focus on building relationships with external partners throughout the innovation pipeline
- A continuous drive to improve

*An organization, in order to accelerate innovation, can and should use both internal and external ideas, as well as internal and external paths to market.*

This chapter will take a closer look at corporate venturing as open innovation tool and discuss the following topics:

- Open innovation models
  - Innovation matrix
  - Open innovation funnel
- Venturing
  - Corporate venturing
  - Benefits of corporate venturing
  - External corporate venturing: best practice
  - Venturing strategy

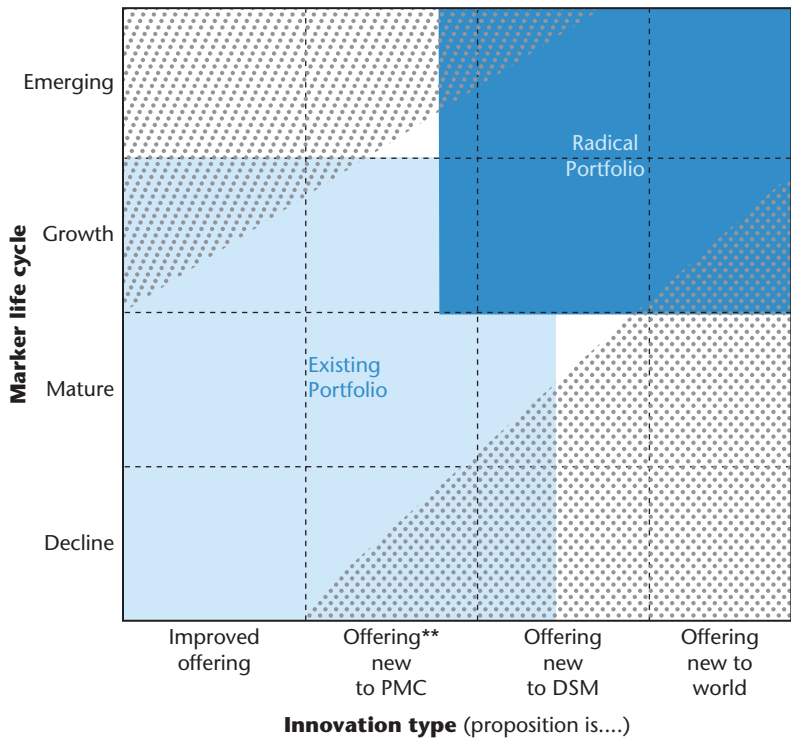
- Venturing portfolio risk management
- Organizational structures that facilitate successful venturing
- The venturing process
- The cultural dimension

5.2 Innovation Matrix

Our company, DSM, uses portfolio management to manage the balance between incremental and radical innovation using the 4x4 matrix (Figure 5.1) developed by the Philips CTO office. Incremental innovation exploits existing technologies, processes, or systems, making them better, faster, and cheaper, while radical innovation explores new technologies, new business models, and breakthrough businesses.

The matrix facilitates discussions on the composition of the innovation portfolio and helps optimize the mix between incremental and

FIGURE 5.1 PHILIPS 4X4 INNOVATION MATRIX.



radical innovation within the company. The use of the 4x4 matrix offers different innovation perspectives—from market-share battle in existing spaces to opening up new spaces—which allows comparison of different platforms and, in turn, enables companywide portfolio management.

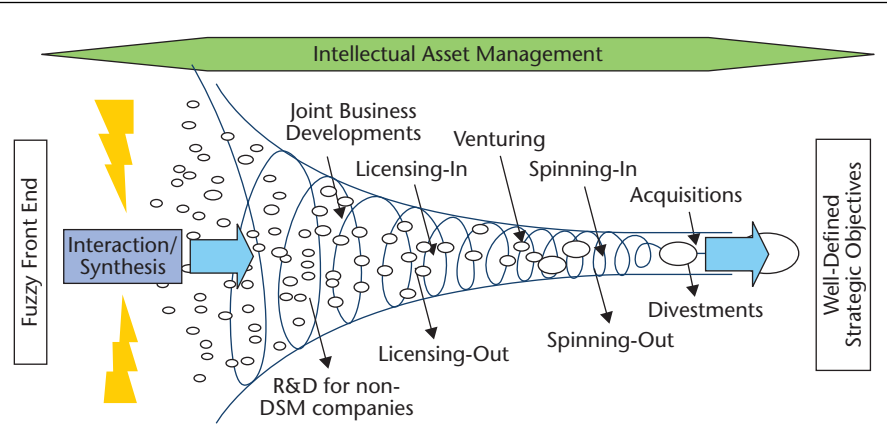
This chapter will take an in-depth look at corporate venturing, which is situated predominantly in the top right-hand quarter of the 4x4 innovation matrix, as it is almost exclusively applied to new business creation opportunities in emerging or growth markets.

This is an area where, by definition, detailed knowledge of market dynamics or technology platforms still needs to be developed; it also entails high levels of uncertainty and many parallel options to achieve an end goal. This quartile is very suitable to the concept of venturing and collaborations with promising start-ups, as venturing allows companies to have a small stake in several start-ups instead of betting all on one horse.

### 5.3 Open Innovation Funnel

At the heart of DSM’s open innovation process is a permeable and porous funnel (Figure 5.2), which represents a business’s project portfolio. In this process, there is a continuous interaction between the projects in the funnel and the external world. As a result of this interaction (for which various tools are available), potentially interesting opportunities can enter the funnel sideways. Similarly, to optimize the project portfolio, developments that have a less favorable fit, show less progress, or have inferior prospects can leave the funnel sideways.

FIGURE 5.2 DSM’S OPEN INNOVATION PROCESS.



All these interactions can happen at any moment in the process. The attention of the portfolio manager (for instance, a new business development manager or a business manager) has to cover the entire funnel from left to right, including the various tools that allow interaction with the external world. It is the responsibility of the portfolio manager to continuously optimize the project portfolio by focusing on the most promising prospects.

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## 5.4 Venturing

### 5.4.1 Traditional Venturing

Traditionally, venture capitalists (VCs) are individuals or investment firms that invest in early-stage, high-potential, high-risk start-up companies. VCs are expected to bring managerial expertise as well as capital to their investments. A core skill of a traditional VC company is the ability to identify early novel opportunities that have the potential of generating high returns within the investment period (five to seven years).

### 5.4.2 Corporate Venturing

In discussing corporate venturing, it must be noted that there are in fact two types of corporate venturing—internal and external. Internal corporate venturing relates to new business opportunities with internal start-up companies. External corporate venturing, on the other hand, can be either indirect (via VC funds) or direct, involving a corporation directly investing in start-ups.

For many larger corporations that want to start with external venturing, the first and least risky step is via participation in external VC funds to “learn the trade,” to develop networks, and to build to deal flow (a pipeline of new leads) before moving on to engage in direct VC investments.

External corporate venturing is defined as the practice where a large firm/corporation takes equity stakes in small but innovative (start-up) companies or participates in venture capital funds, with the objective of gaining a specific competitive advantage. In order to facilitate achieving such an advantage, the corporation may also provide management, technical and marketing expertise to the start-up companies in order to grow the value of the start-up company.

The main difference between corporate venturing groups and regular VCs is the requirement for a strategic link between the start-up and

the company of the corporate venturing group. Whereas regular VCs are primarily driven by the financial return for their investors, corporate venturing groups need a link with the mother company; some corporations require a very strong link (e.g., signed codevelopment or cocommercialization agreements before investing), whereas other corporations find a fit with the overall company's strategy or innovation spaces sufficient.

### 5.4.3 Benefits of Corporate Venturing

The reasons to consider corporate venturing are myriad. Corporate venturing offers organizations a valuable window on the world by exploring emerging markets, technologies, and products in order to enhance their product portfolios and technology toolboxes. Additionally, it offers faster access to products, technologies, and markets at a potentially much lower cost base and at a lower risk than self-started ventures.

Corporate venturing is also an ideal way to access and test new business models, to team up with companies up- or downstream in the value chain, and to create an innovation culture with expanded boundaries. Its aim is clear: to invest in companies complementary to the organization's own technology/business in order to establish a (stronger) position in the value chain.

As well as providing financial support, corporate venturing offers start-ups access to the company's knowledge, know-how, resources, complementary technologies, production facilities, networks, and sales channels, as well as the functional expertise present within the organization.

To both the company and the start-up, venturing also offers a possible step up to acquisition: it enables an evaluation of technology/application and future business development potential, as well as an assessment of the extent to which the start-up fits with the organization's own business, allowing a thorough decision to be made on potential acquisition. It needs to be stressed that acquisition by the company is only one example of an exit; an acquisition by another corporation often represents an exit, as does a sale of the start-up to a private equity partner. And obviously, an initial public offering (IPO) is also a way of generating an exit for the VCs. The company of a corporate venture group doesn't always need to acquire a start-up to create strategic return.

If the market develops as foreseen, it is easy to step up the commitment and initiate a collaboration with a start-up or continue toward an acquisition. If, on the other hand, the opportunity drifts too far from the core innovation strategy, it is relatively easy to exit while potentially still creating, at least, a financial return on the investment. The equity stakes

in several well-spread new business opportunities can be viewed as option fees for certain new market or technology developments. If the overall portfolio is managed well (both from a strategic and a financial perspective), the options have created pay for themselves (and can indeed be quite profitable) through the strategic and financial return on investment.

#### 5.4.4 External Corporate Venturing: Best Practice

Corporate venturing has evolved significantly over the past few decades (see the box “Venturing at DSM: A Historical Perspective”) into a more strategic, structured, and sophisticated area of business activity.

The remainder of this chapter will explore in more detail the best practices that companies should consider applying if they are to establish and run a successful external corporate venturing (ECV) operation.

It is important to note that the best practice approach outlined below represents an optimal approach for DSM. There is, however, no one-size-fits-all approach when it comes to venturing, which means that the venturing strategy, organization, tools, and approaches adopted need to be tailored to each company’s particular vision, business strategy, and objectives.

##### **Venturing at DSM: A Historical Perspective**

DSM began exploring avenues of open innovation in 1992, when it first invested in a VC fund—on the one hand because it was seen as a potential buyer for some nonstrategic internal start-ups (spinning out), and on the other hand to gain more insight into possibly interesting new external business developments.

Because DSM’s first VC fund participation was exceptionally successful in terms of financial return on investment generated, and because DSM soon realized that it could learn from VCs how to manage new/emerging specialty businesses, the decision was made to expand participation in VC funds.

DSM chose to focus on participations in external VC funds, initially to learn the trade, develop networks, and build deal flow, moving to direct investments later on. In 1998 an agreement was reached with the VC fund Life Science Partners (LSP), which allowed a DSM employee to be seconded to LSP. In hindsight, this proved to be a very effective pathway into the venturing world.

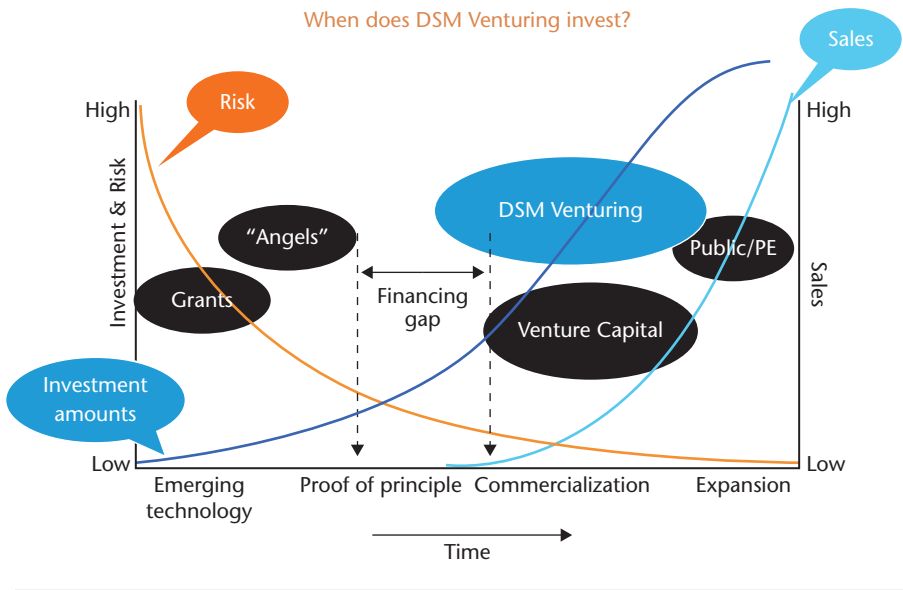
In April 2001, DSM established its corporate venturing unit, DSM Venturing BV, to further professionalize its venturing approach in support of its *Vision 2005* strategy. At the end of the *Vision 2010* strategy period, DSM Venturing BV was stronger than ever. With innovation, sustainability, alliances and partnerships as well as high-growth economies also featuring as key elements of DSM's new strategy, "DSM in motion: driving focused growth," venturing will continue to play a pivotal part in contributing to these key strategic performance indicators.

Through its participation in various VC funds over the years, DSM has also come into contact with other corporate venturing pioneers, including Philips, BASF, Henkel, DuPont, and Bayer. A few of these companies, including Phillips and DSM, founded the Corporate Venturing Network of the Netherlands (CVNN) in 2002, which started out as the New Business Development Platform.

## 5.5 Venturing Strategy

In developing an overarching venturing strategy that provides a strategic framework against which all venturing opportunities and activities are assessed, there are a number of key issues and questions that need to be addressed (refer to Figure 5.3):

- Perhaps the most fundamental strategic consideration in relation to corporate venturing is the objectives that the overall venturing strategy must achieve: must the portfolio achieve primarily strategic objectives, financial objectives, or a combination of both? For DSM, strategic objectives are the primary drivers of the venturing strategy. Collaborations between the start-up and the relevant DSM business unit are of prime importance, and the start-up must, first and foremost, deliver against the business unit's innovation strategy and objectives. However, this strategic rationale is not sustainable long-term without a proper financial return, which is why DSM Venturing always evaluates its investment leads against both strategic (first) and financial (second) criteria.
- If strategic objectives are indeed the primary drivers, two key issues must be addressed: what types of objectives must be achieved, and how will the return be measured? Once these questions have been answered, consideration of the following questions will provide a detailed analysis of the opportunity.

**FIGURE 5.3 VENTURING STRATEGY FRAMEWORK.**

- Will the venturing strategy focus on early-stage, expansion-stage, or late-stage companies? This is of strategic relevance because of time to market, required management attention, and a number of other factors. It is also relevant to financial risk/return profiles.
- What will the typical investment amounts be? This is relevant to the strategic objectives because it determines the level of influence in the company. Financially, it is relevant because it determines the exposure to a single opportunity. What are the expected ceiling and floor? How much money should be reserved to engage in follow-on investments in order to prevent dilution?
- What type of representation should be taken in the company? For example, should the venturing group opt for a board seat, an observer seat, or a position as shareholder? A board seat potentially gives a lot of influence in the company. This can be positive (the potential to influence the financial return and strategic return of the company) but it can also create personal liability for board members (depending on the jurisdiction). This needs to be assessed.



- The geographic scope: should it have a global span or a regional focus?
- What are the key technologies, market needs, and priorities?
- What are other key strategic considerations, such as matching the start-up's areas of interest with the company needs?

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## 5.6 Venturing Portfolio Risk Management

Corporate venturing entails risk, which is why corporate venturing capital must be seen as risk capital. In a typical portfolio of, for example, 10 portfolio start-ups, we see that out of the 10 investments, 2 or 3 start-ups might offer an exceptional return, 4 or 5 might earn back approximately the amount invested, and 2 or 3 might prove to be a complete failure. This ratio of success/failure is one of the main reasons why a venture portfolio must have sufficient breadth to spread out and limit risk.

An example: by the end of 2011, DSM had invested in 39 portfolio companies. It has exited 14 and is still a shareholder in 25. A successful venturing strategy is, in our opinion, built on two key parameters: (1) a wide portfolio and (2) a 5- to 10-year vision and return perspective (both strategic and financial) instead of a 2- to 3-year one.

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## 5.7 Organizational Structures That Facilitate Successful Venturing

Successfully dealing with external ventures in the context of a larger corporation is a complex process, as external ventures work at different speeds than larger corporations.

The establishment of a separate and dedicated corporate venturing unit can aid the corporate venturing process in various ways. It provides, for instance, a window on the world—on new technologies and markets—while still being able to capitalize on internal expertise.

The corporate venture unit also tends to be small and made up of experienced investment managers who bring broad experience as business (development) managers with a strong affinity for technology to the table. These individuals have a very specific profile: they are entrepreneurial and need to be able to make links with the businesses of the corporation as well as with the external start-ups and other coinvestors.

The benefits of operating a separate corporate venturing unit include:

- Division of duties, which avoids conflict of interest: the investment manager needs to feel responsible for the success of the external venture, while the corporate business interest needs to be managed by a representative from the business: these tasks should not be performed by the same person
- Corporate venturing experts who guide a complex process
- Representing all businesses of the company

The venturing unit is not evaluated by traditional corporate yardsticks (e.g., profit, return on investment) but on the basis of (1) strategic return (in DSM's case, the number of strategic collaborations between the start-ups and the relevant DSM businesses) and (2) financial investment portfolio return.

The corporate venturing unit, with its venturing expertise and objectives independent of those of specific businesses, helps to develop a balanced portfolio that has sufficient breadth (spread) to (1) cover the relevant markets of the mother company and (2) ensure a managed financial risk and an optimal return on the portfolio investment.

Furthermore, this approach separates financial and strategic responsibilities. While the venturing unit maintains financial responsibility for the venture, the business unit in question shoulders responsibility for strategic collaboration with the start-up. The relevant business unit should work closely with the external start-up in order to ensure a high-level strategic fit as well as a pragmatic alignment with the innovation portfolio of the business unit in question.

It is important that corporate venture units apply firewalls with respect to certain key information on their start-ups. A prime responsibility of the corporate VC is to act in the interest of its start-ups. This also means that the board members of the corporate VCs need to prevent the risk of conflicts of interest and they need to continuously question what can be discussed between the start-up and the core business and what needs to remain within the walls of the corporate VC. Needless to say, these conflicts of interest need to be prevented at all cost, because they are (1) detrimental to the reputation of any corporate venturing fund and (2) can create liabilities for the corporation as a whole.

A separate venturing unit, while facilitating the intricacies of a venture deal, puts the strategic responsibility firmly within the business unit, thereby ensuring that it maintains a strong sense of deal ownership. While

the venture unit will be actively involved in encouraging and fostering collaboration, it will always be at arm's length to ensure that the start-up keeps its identity, its entrepreneurial spirit, its key people, its agility, its enthusiasm, and its business responsibility.

The venturing unit works in collaboration with business groups to support the company's middle- to long-term innovation and growth ambitions. Introducing new and innovative start-ups to the mother company and at the same time making sure that there is alignment with the business strategy is one of the key success factors of any corporate venturing unit. At DSM, the rule is that without the written buy-in of the management team of the business unit, the investment in the start-up will not be pursued.

At a very early stage, DSM chose to introduce the concept of Venturing Support Groups. In almost all DSM Business Groups (BGs) and Emerging Business Areas (EBAs), Venturing Support Groups bring together senior business, R&D, and New Business Development (NBD) managers and DSM Venturing's investment managers. The teams meet on a quarterly basis to discuss and overlay the deal flow with the BG's strategic innovation goals. In this way, the venturing unit is an integral part of the open innovation approach, focused on teaming up with innovative players all over the world.

The most important aspects of the organizational model that facilitates successful venturing are:

- Continuous and structural alignment and cooperation between the venturing unit's core team and the Venturing Support Groups in the business units, as well as in the daily interaction between business representatives and investment managers.
- Clear division of roles and responsibilities between the venturing unit for (1) financial return and (2) board representation in the venture and the businesses for strategic return.
- Fast decision-making structures and clear authorities to meet the dynamics of the VC industry. It is recommended to always set out clear champions/ key contacts (who carry the responsibility for the collaboration) for a venture at the business, both in the setup of the collaboration and during the collaboration. Businesses that have already done so have clearly benefited. Those that have not committed to this extent have realized much less benefit.
- Agility and (local) market representation and insight. In the case of DSM, the strengthened influence of high-growth economies such as

China, India, and Brazil will have an impact on the venturing strategy. It is important to create deal flow from the high-growth regions while at the same time ensuring embedding within the corporate strategy. For this reason, DSM has decided to embed venturing activities in high-growth regions in local corporate innovation centers in both India and China.

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## 5.8 The Venturing Process

Venturing distinguishes three phases/activities.

### 5.8.1 Sourcing, Signaling, and Screening of Innovation Opportunities through Start-ups

**5.8.1.1 Sourcing.** *Sourcing* means tracking down and identifying investment opportunities. These can come from a number of sources:

- Conferences and investor meetings attended by investment managers.
- Through deal flow of the funds that the company is invested in and through limited partner meetings organized by the funds for their (corporate) investors.
- Through contacts in the markets from the BGs.
- It is important to have a healthy balance between business-driven opportunities and venturing-driven opportunities, and it is also important to remain in sync with the innovation objectives of the business unit (again through Venturing Support Groups). This point cannot be overemphasized; in today's world, business strategy and tactics are continuously evolving. Not keeping in sync will damage the credibility of a corporate venture unit—and a corporate VC's understanding of the innovation strategies of the company's businesses is its lifeline.

**5.8.1.2 Screening.** A successful venture strategy holds that a collaboration must pass two key filters:

#### **Primary Filter—Strategic Relevance**

- Is the start-up's activity related in any way to DSM's business strategy, which is based on the three global megatrends (i.e., global shifts, climate and energy, and health and wellness)?
- Is it related to the company's competence base or is it a logical extension thereof? Often the start-up offers new inroads to the company

or a chance to play in adjacent segments of the value chain. There should, however, be a logical connect that will allow the company to benefit from the opportunity that the venture offers; if the venture is too far outside the core business, there will be no ownership and hence no learning.

- Does it offer, as its first priority, strong strategic benefits for business units, which in practice means, does it support their innovation agenda?

Only when all strategic criteria have been met is the financial filter applied.

### **Secondary Filter—Business Viability**

- Is it a viable business proposition?
- Is there an attractive return potential?
- Does the company have a CEO and management that can deliver?
- Are there exit opportunities other than spinning in, that is, acquisition by the mother company?
- Are there other investors interested and willing to invest?

If a start-up does not pass the necessary financial filters, other forms of collaboration may still be worth considering. Joint-development and/or commercialization agreements with start-ups may prove a viable alternative to minimize the capital outlay and risk while pursuing the opportunity.

## **5.8.2 Investment Process (Due Diligence, Negotiations, Deal Making)**

Proper due diligence is of the utmost importance. To be considered are:

- The ability of the management to come up with and execute a strategy that maximizes success for the start-up. This is a vital point; an excellent management team might create more value with an average idea than a substandard management team does with a brilliant idea.
- The financial situation of the company: how much money is needed until the exit. This does not necessarily mean that the venture should become self-sustaining, but there needs to be an exit for the current investor(s). This could be, for instance, a mergers and acquisition (M&A) exit in which the start-up is bought by another (often larger) corporation or new investors enter, offering the possibility of taking over the shares of the existing investors.

- The strength of their intellectual property (IP: patents and know-how): can they protect their technology position? Are they building an entry barrier or is the concept easily copied? Do they have freedom to operate?
- The realism of the business plan and the go-to-market strategy. It is important to learn whether the company is an attractive investment and whether a good syndicate can be built with coinvestors that can buy into the venturing perspective (and vice versa). Once a potential syndicate has been built, it is important to achieve a fair company valuation. Obviously, there is always tension between the existing investors and the founders on one side (who would like to see the value increase significantly with each capital round) and, on the other side, the new investors, who would like to step in at a lower valuation to increase their chances of a high return. A number of very specific VC terms (for instance, preferential rights and antidilution protection) are negotiated, as well as board representation and the mandate of the board, which needs to be balanced with the management of the company.

### **5.8.3 Investment Management (Creating Strategic and Financial Value from the Investments)**

Investment management means three things for DSM:

- Maximizing the chances for collaboration with DSM by facilitating continuous dialogue between the DSM business units and the venture; ideally, this should lead to very valuable win-win deals that both DSM and the venture move forward. DSM Venturing does not want to pursue collaborations that, for example, grant so much exclusivity to DSM that it damages the value of the start-up; it should truly be a win-win situation, or its chances of success will decrease significantly.
- Steering the company for maximum value creation by being responsible and diligent board members acting in the interest of the venture.
- In the later stages, working toward an exit. The exit can be an acquisition of the venture by another company or the sale of the shares in the venture (either before or after an initial public offering or new listing on a stock market) to new or existing investors.

Typically, phase 1 takes from a few hours to a couple of months for one specific new opportunity; phase 2 takes four to six months; and phase 3 is

anticipated to last for three to seven years, depending on the development stage of the start-up company invested in.

In all three phases, the venturing unit collaborates closely with DSM BGs, both in ad hoc daily contacts and through quarterly structured venturing support meetings.

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## 5.9 Cultural Dimension

Besides working on processes, structures, organization, and definitions, there is a clear focus on people and culture in DSM. The company recognizes that people are of the utmost importance in realizing open innovation, including venturing. An environment—or, more precisely, a culture—is needed that stimulates people to change long-standing habits and procedures, to act more openly, and to take responsibility. Open innovation is first and foremost about people, their mindsets, and a company culture that facilitates and stimulates innovation; the systems are in place in order to support the process and help management keep track of progress.

Besides various innovation training programs, DSM initiated a business plan competition to stimulate cross-BG, cross-discipline cooperation focused on creating new business opportunities at the intersection of life sciences and materials sciences, one of DSM's future key growth areas.

One of the ways DSM boosts its innovation performance is through the “Excellence in Innovation” program. This program focuses on:

- The stimulation of BG innovativeness with the aim of improving innovation strategy and capabilities as well as inspirational leadership
- Further guaranteeing top project delivery through enhanced project management performance, better team composition, and effective behavior
- Deepening market understanding through extensive market and customer assessments, including the search for innovation partners in the market
- Creating the right environment for entrepreneurs and enhancing entrepreneurial behavior
- Driving performance and results orientation by setting and tracking innovation targets throughout the organization and role modeling on performance orientation

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## 5.10 Summary

Given DSM Venturing's strategic and financial return after more than 10 years of investing, we conclude that it is possible to successfully prioritize strategic objectives while still generating an above-industry average financial return on the portfolio.

Key to successful venturing are:

- Developing a coherent overarching venturing strategy and establishing a dedicated venturing organization and capability
- Applying both a strategic filter (first) and a financial filter (second) when screening investment opportunities
- Continuous investment in structural and ad hoc alignment of venturing activities with running businesses
- Role and accountability separation for strategic and financial returns
- Continuous top management commitment
- Continuity of expertise and internal and external networks through the long-term commitment of team members

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Mr. van Leen has worked for DSM since 1987. He has held various positions in the company, including Business Group Director of DSM Food Specialties, Business Unit Director of DSM Dairy Ingredients, and Technology Director of R&D at DSM Food Specialties. He has a PhD in Mathematics and Physics from Nijmegen University and an MSc in Biologics from Utrecht University. He also holds an MBA from Nyenrode University.



**Marcel Lubben** is Managing Director of DSM Venturing and Licensing. DSM Venturing is the Corporate Venture Capital unit of DSM, a strategic investor in start-up companies active in life sciences and material sciences, and DSM Licensing is DSM's Corporate Unit for in- and out-licensing of core technologies and products for DSM.

Mr. Lubben has worked in different roles before leading DSM Venturing and Licensing. He has held positions in Program Management within DSM Research and Sales and Business Development within DSM Pharma Chemicals, and he has been Global Head of Marketing, Sales, and Business Development for DSM Biologics. In January 2009, he joined the DSM Innovation Center as Managing Director of DSM Licensing and later added the Venturing responsibilities.

**DSM—Bright Science. Brighter Living™** Royal DSM N.V. is a global science-based company active in health, nutrition, and materials. By connecting its unique competences in life sciences and materials sciences, DSM is driving economic prosperity, environmental progress, and social advances to create sustainable value for all stakeholders. DSM delivers innovative solutions that nourish, protect, and improve performance in global markets such as food and dietary supplements, personal care, feed, pharmaceuticals, medical devices, automotive, paints, electrical and electronics, life protection, alternative energy, and biobased materials. DSM's 22,000 employees deliver annual net sales of about € 9 billion. The company is listed on NYSE Euronext. More information can be found at [www.dsm.com](http://www.dsm.com).



## CHAPTER SIX

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# SUCCESS FACTORS OF NEW PRODUCT DEVELOPMENT FOR EMERGING MARKETS

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Anna Dubiel and Holger Ernst

*I think a low-cost product must be designed from scratch, something our European engineers can't easily do. They don't have the right mentality and would set excessively high standards for even the smallest details, ending up with an overengineered and too expensive product.*

—JØRGEN CLAUSEN, FORMER CEO, DANFOSS A/S

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### 6.1 Introduction

In the last decade, so-called emerging markets (EMs) like India, China, and Brazil have rapidly gained in importance for multinational corporations (MNCs) headquartered in developed countries. They have become much more than low-cost labor suppliers and sales markets for outdated products. For an increasing number of MNCs, they have turned into core markets generating a considerable portion of revenues. For instance, for P&G, developing markets<sup>1</sup> represented in 2009 32 percent of net sales, up from about 20 percent at the beginning of the 2000s (P&G, 2009). Another example is China, which in 2009 became the world's biggest car market in terms of number of units sold (Reuters, 2010). However, EMs are not only increasingly attractive but also very challenging for Western companies. Often MNCs

<sup>1</sup>P&G defines developing markets as the aggregate of Central and Eastern Europe/Middle East/Africa, Latin America, ASEAN/Australia/India/Korea, and Greater China.

have to expand into unfamiliar mid-tier and low-end market segments that they left unnoticed in the past. In most cases, existing products or older products offered at slightly lower prices will not sell successfully. Thus, most MNCs will have to design completely new products meeting local needs at costs matching average local income levels. Companies offering different product features in EMs can enjoy even higher margins than in their home market (Deloitte, 2006, p. 9). Clearly, MNCs have to “unlearn” much of what made their new product development (NPD) successful at home and acquire new competencies (Deloitte, 2006; *The Economist*, 2010). A good example is General Electric (GE), which designed a series of basic healthcare devices equipped only with essential functionalities instead of all technologically feasible bells and whistles (Immelt, Govindarajan, and Trimble, 2009).

This chapter will first discuss the main opportunities and risks for MNCs innovating for EMs and then present eight success drivers of NPD for middle and lower market segments of EMs. These factors have been identified as crucial for success in a number of studies (see the box “The Search for Crucial NPD Success Factors in the EMs’ Context”). For illustrative purposes, an additional case study about Siemens Healthcare will be introduced (Section 6.5). Its experience will show that lessons learned from this chapter can be beneficial in the MNC’s home market too, as the company successfully introduced products originally designed for EMs on its home turf. We end with a summary of the main points of this chapter.

### **The Search for Crucial NPD Success Factors in the EMs’ Context**

The majority of the existing research on NPD success factors is confined to NPD activities in developed markets, first and foremost the United States and Canada (see, for instance, the excellent reviews of Ernst, 2002, or Montoya-Weiss and Calantone, 1994). The academic world has so far rarely focused its attention exclusively on drivers of new product success in EMs (as exceptions see, for example, Anderson and Markides, 2007) even though there exists evidence that some NPD success factors might be country specific (Henard and Szymanski, 2001). The topic has also been of interest to leading consulting companies (see, for instance, Deloitte, 2006, or Shankar, Ormiston, Bloch, Schaus, and Vishwanath, 2008). Both types of studies combined provide some helpful recommendations for successful NPD for EMs. We supplemented these findings with 26 interviews with experienced managers from 12 German and U.S. firms (partly on-site in EMs) and in-depth case studies on specific NPD projects and R&D sites in EMs.

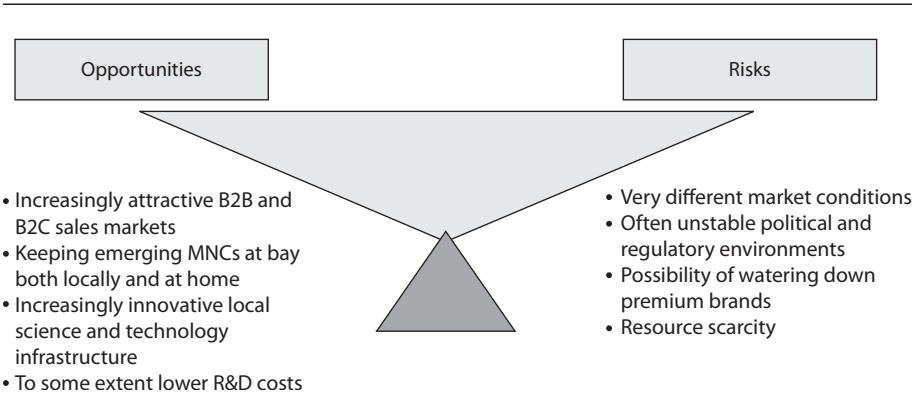
## 6.2 Opportunities and Risks in EMs

Before deciding to enter EMs, firms should take into consideration both local opportunities as well as potential local risks (see Figure 6.1).

MNCs face a number of opportunities in EMs that help them to secure long-term growth. In particular, EMs become more and more attractive sales markets: Their purchasing power grows on the country, firm, and household levels; local customers increasingly have use for products traditionally sold in developed markets, as well as appreciate and are ready to pay for technological innovations. In this context, it is important to note that EMs are not homogeneous. Depending on the industry, they consist of several—sometimes very distinctive—market segments. Often three main market segments can be distinguished: the premium, the middle, and the low end (Gadiesh, Leung, and Vestring, 2007; Shankar et al., 2008; *The Economist*, 2010). The purchasing power of the premium segment is high, and customers are eager to pay for internationally acclaimed brands. These customers seek high-end products with many state-of-the-art features. The middle market, by contrast, consists of value-seeking customers with mid-level incomes very consciously selecting products with a certain price-performance ratio. This means that products have to be equipped with only decisive features and be significantly cheaper than those in the premium segment—in other words, “good enough.” In the low-end segment, customers are able to pay only for the basic product features at prices that are a fraction of those in the premium market.

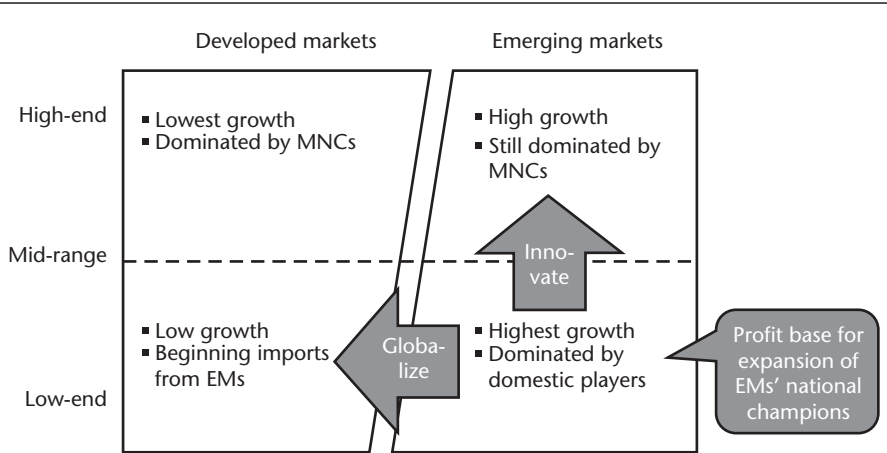
As MNCs typically enter EMs with their traditional high-quality and high-functionality products—sometimes with minor (price)

**FIGURE 6.1 OPPORTUNITIES AND RISKS FOR MNCs IN EMs.**



adjustments—they tend to address the local premium market segment in the first instance. In this segment, MNCs usually have a strong competitive position. In the middle and lower market segments, by contrast, they are generally scarcely represented and face fierce competition from local firms. Especially in the low market segment, it is difficult for MNCs to match the cost structure of local rivals. However, in many industries, the current premium market is shrinking or developing at a much slower pace. For this reason, it becomes increasingly attractive for MNCs not only to keep their positions in the premium segment but also to expand into the good-enough market (Gadiesh et al., 2007; Shankar et al., 2008; *The Economist*, 2010). It is estimated that 2 billion people may join the middle class by 2030 (Goldman Sachs, 2008). In some industries, this segment is already the dominant one in terms of overall market revenues (Gadiesh et al., 2007). And it seems realistic for many MNCs to be able to match the offerings of cost-savvy local firms in this segment. Moreover, MNCs should not let local firms take this segment by default. For many of them, it is the perfect training ground for increasingly innovative NPD helping them to expand in the premium segments of EMs, as well as transferring new products to developed markets and challenge MNCs on their home turf (see Figure 6.2). Consider firms like Lenovo,

**FIGURE 6.2 INTERNATIONAL EXPANSION OF COMPANIES HEADQUARTERED IN EMs.**



Adapted with kind permission from Springer Science+Business Media: Ernst, Dubiel, and Fischer (2009), p. 32 and Siemens AG. Strategische Bedeutung lokaler F&E in Emerging Markets, in *Industrielle Forschung und Entwicklung in Emerging Markets: Motive, Erfolgsfaktoren, Best-Practice-Beispiele*, edited by H. Ernst, A.T. Dubiel, and M. Fischer. Wiesbaden: Gabler Verlag.

Haier, or Suzlon. A decade ago, most of them were not regarded as a serious competitive threat to Western MNCs in both EMs and developed markets. Now their products are not only conquering middle and even premium segments of EMs but also successfully redefining competition in developed economies by creating totally new markets. A good example is Haier, which changed the market for wine refrigerators in the United States from a connoisseur-based to a mainstream product category (Zeng and Williamson, 2007).

EMs are attractive for MNCs apart from their vast sales markets. Many EMs heavily invest in science and technology and thus turn into promising R&D locations. For instance, China ranks third worldwide in terms of number of researchers (OECD, 2007) and produces 5 million graduates per annum—four times more than a decade ago (*The Economist*, 2010). This local innovative potential can be tapped for NPD for local as well as worldwide markets. A number of MNCs also report lower NPD costs associated with NPD activities conducted in EMs.

EMs are as risky as they are alluring because they differ sharply from familiar markets in many aspects (see again Figure 6.1). First, local market conditions are often very distinct. For instance, even though the purchasing power of many local customers is growing at a fast pace, it is still relatively low. Local customers not accustomed to Western brands may be very volatile in their purchase behavior, too. Also, the often poor local infrastructure hinders operations. Second, in several EMs, MNCs are exposed to unstable political and regulatory environments. For example, weak intellectual property protection laws make it particularly challenging both to conduct NPD and to offer the latest products locally. Third, some MNCs fear that their premium brands may be diluted by expanding their product offerings to lower market segments. Last but not least, many MNCs in EMs face resource scarcity like limited supplier capabilities and high R&D employee turnover, making it difficult to sustain NPD quality. Thus, developing successful new products for and in EMs is anything but an easy task. What's more, most MNCs are handicapped since they have based their NPD capabilities on understanding the needs, technical requirements, and adequate pricing of developed markets' customers (Deloitte, 2006). Additionally, they often face unfavorable cost structures as well as limited local distribution and service networks (Deloitte, 2006; *The Economist*, 2010).

*Before deciding to enter EMs, firms should consider both the local opportunities and the potential local risks*

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## 6.3 Successful NPD for EMs

As described above, EMs can be very promising, yet due to their specifics, MNCs should fine-tune their NPD activities. To succeed, products should be designed to brave poor infrastructure and survive in harsh operating conditions. They should be profitable even with often thin profit margins per item. In many cases, this will not be possible with minor adjustments to existing products; an adequate price-performance ratio may seem feasible only by designing the product from scratch. The following eight key factors can help companies to maximize the success of NPD for EMs.

### 6.3.1 Adapt Your Innovation Strategy

For MNCs serving for most of their history customers at the top of the economic pyramid, the design of low-cost middle-tech products marks a major shift in operations. In order to succeed, the companies have to adapt their organizational structure, culture, processes, and human resources (HR) management. These far-reaching changes should be guided by a clear strategy laying down the intended course of action. It's inevitable that EMs are assigned a visible place on the company's agenda, and top management backs this development.

Siemens, for example, introduced a strategic initiative called SMART in order to be better prepared to compete in EMs. SMART stands for simple, maintenance-friendly, affordable, reliable, and timely-to-market products aiming at customers the company left unnoticed in the past. As the initiative is part of an overarching company program and is further coordinated by headquarters, it enjoys appropriate visibility and serves as a forum for best-practice sharing among the company's business units (Siemens, 2010).

### 6.3.2 Meet Your New Customers

To develop sought-after products for EMs, MNCs should learn about the real needs of their new customers. This has to be done from the bottom up, as familiar Western customer profiles and behaviors hardly ever match those of the new clientele. For this reason, the company has to listen very carefully to its potential customers. This can necessitate the use of totally new market research tools and techniques. Pioneering MNCs confirm this by going to great lengths to meet the customer in his or her social environment.

Customer orientation was crucial for designing a basic handset for low-end segments of EMs for as little as US\$ 25 (*Business Week*, 2005). Before starting the actual product development process, Nokia's engineers spent considerable time conducting ethnographic research as well as experiencing local living conditions through trips to India and Nepal. This approach allowed them to design handsets meeting local demands in terms of both price and specific features like more legible screens in bright sunlight or "iconic" address books for illiterate users (McGregor, 2006).

### 6.3.3 Offer a New Price-Performance Ratio

Well-executed market research close to the new customer is an extremely important step in the NPD process. It allows the MNC to find out what customers really want and are willing or able to pay. Affordability in this case means that products must be an order of magnitude cheaper than those in developed markets. Examples of successful companies demonstrate that stripping off features from existing Western products cannot cut their prices considerably, as complexity and costs are built into them. Rather, designing a product from scratch seems to be the more promising course of action.

The Dacia Logan—a low-cost car designed by the French car manufacturer Renault in Romania—is an attractive price-performance offer for EMs' middle-class customers. The full-fledged car not only has a price tag starting at US\$ 6500 and is spacious enough to transport up to five people with their luggage, but also has an appealing life-cycle cost structure. For instance, it can be serviced at half the cost of a comparably sized Renault car model. Nor does the maintenance have to be done by an authorized Renault workshop; even basic technicians are able to do it without difficulty (Kukreja and Dubiel, 2010).

### 6.3.4 Apply "Gandhian" Engineering

To develop products with an appropriate price-performance ratio, the mindset of MNC headquarters' employees has to change, too. EM constraints necessitate a new attitude toward scarcity and cost consciousness. Such a willingness to simplify products, make them more economical, and think outside the box may be called a "Gandhian" approach to NPD (Pralhad and Mashelkar, 2012). This is not straightforward, as engineers coming from and working in developed markets are often inclined to apply the newest technological solutions to products they design.



To succeed in EMs, developing simpler and more robust products should become an equally acclaimed achievement within a company as developing products packed with the newest bells and whistles.

Consider Bosch, a leading German automotive supplier, which learned that value engineering—the ability and will to design products meeting tough cost constraints—and simplification are very important to EM customers. To help Tata Motors meet its ambitious goals for its Nano car model, Bosch’s engineers came up with some unconventional solutions. They decided to hone the injection technology for two-wheelers and adapted it for use in a car. For the diesel engine, they simplified a tried-and-tested product using an off-the-shelf plug-in pump to generate injection pressure. The team responsible for developing some of the Tata Nano parts gained recognition within Bosch, winning in 2008 the company’s Innovation Award, which is granted to products of particular business importance to Bosch (Neuhaus and Dubiel, 2012).

### 6.3.5 Localize R&D Activities

The experience of leading MNCs demonstrates that new products for EMs can be best developed locally in these markets. First, local engineers should best understand local market needs. Second, this practice helps to lower development costs. Third, engineers from developed markets are often less open to apply unconventional solutions and are limited by the *not-invented-here* syndrome. Fourth, local R&D improves delivery time—another essential requirement for presence in dynamic markets. However, best-practice examples of MNCs show that in order to profit from the expertise of local R&D units, they should be granted over time “ownership” for innovative projects. Local scientist and engineers should therefore be responsible for certain products or product lines and should not act solely as an “extended workbench” of headquarters’ operations.

GE has established R&D facilities in India in the last decade and has invested heavily in these subsidiaries (Dubiel, 2009). In particular, the R&D center in Bangalore—the biggest outside of the United States—grew between 2000 and 2008 alone from 300 to 3,800 employees. For instance, portable and low-priced electrocardiogram (ECG) devices have originated there, as local engineers knew the precise price-performance ratio that physicians serving local rural areas would need. The Bangalore-based R&D team adapted as this ECG’s printer a device used in Indian portable ticket machines, a product presupposing an open-mindedness toward unusual problem solutions.

### 6.3.6 Adapt Marketing and Sales

Developing a low-cost, clearly defined functional product is not straightforward, and getting it to the market, especially in faraway locations, poses a comparable challenge. Competitive product prices presume efficient distribution. So, how does Nokia control its network of an estimated 90,000 points of sale in India? The Finns learned to work with local means and became a local market leader. Their fleet of sales vans tours rural areas and teaches people about mobile phones (Ewing, 2007). As most of these first-time buyers prefer to talk to sales reps in person instead of calling hot-lines, Nokia's shops on wheels are also responsible for after-sales service.

Getting a mobile card for a Nokia phone in Mumbai further unveils local specialties of the product's value chain. Network providers like Vodafone sell them through independent vendors distributing prepaid cards to local shops. Airtime for a few cents—as people usually have irregular income—is offered in kiosks along with all other products of daily life. And if from time to time a wealthy customer comes along asking for an expensive airtime recharge, the kiosk owner calls a mobile hawker who keeps expensive airtime cards ready for a certain city district. The result is a win-win situation for all parties involved. The kiosk owner does not need to tie up his capital and keep expensive cards in store, the customer quickly gets the requested recharge, and the freelance hawker has a job.

### 6.3.7 Introduce New Business Models

India is the fastest-growing mobile telecommunications market in the world and, moreover, a very competitive one. On average, customers spend humble sums of US\$5–6 monthly on phone calls, but through good connections to Western markets, they are up-to-date with technological developments and brands. Hence, they are quite demanding. What's more, the telecommunications market in urban areas is becoming saturated, pushing providers to expand in faraway rural areas where people have even less money to spend and telecommunications infrastructure is rare at best.

Nokia Siemens Network (NSN), the Finnish-German mobile infrastructure provider, has come up with a new solution combining smart technology with a business model innovation. The combination minimizes the capital and operational expenditure for operators, allowing them to profitably enter low-end market segments. The cost-effective, easy-to-implement and operate solution, called Village Connection, rests upon a partnership between a mobile network provider and a local entrepreneur supported, when necessary, by a micro-finance provider. The entrepreneur, as the franchisee, interacts with subscribers on the operator's behalf.

### 6.3.8 Find a Local Partner

Finding a local partner can considerably speed up learning about local market conditions and overcome the liability of foreignness. Some pioneering companies already demonstrate how to partner and network in EMs to achieve outstanding results. These cooperative ventures tackle all parts of a company's value chain. With regard to NPD activities especially, good relationships with local science institutions and industry networks are of great importance. To establish ties with Indian universities and secure a steady stream of top-notch graduates for its R&D sites, GE invites professors from well-known local higher education institutions to spend a sabbatical at GE's R&D facility in Bangalore (Dubiel, 2009). Furthermore, GE cooperates with the Indian Institute of Technology (ITT) on joint research projects. Excellent connections to the National Chemical Lab in Pune were particularly helpful for establishing the R&D center on the subcontinent.

The presented factors enhancing NPD for EMs have been identified in a number of firms of different industries and sizes, so they can be regarded as universal. Even though this list does not claim to be complete, these factors cover multiple aspects of NPD. It is important to note that they should not be implemented separately but rather as a self-reinforcing package of measures. Table 6.1 once more summarizes the most important success factors of NPD for EMs.

**TABLE 6.1 SUCCESS FACTORS OVERVIEW.**

Success Factor	What Matters?
1. Adapt Your Innovation Strategy	Explicit consideration of EMs in the company's NPD strategy; top management backing; clear companywide communication of the new strategic approach
2. Meet Your New Customers	Willingness to apply new market research approaches; going where the customer is; involvement of local lead users and opinion leaders
3. Offer a New Price-Performance Ratio	Focus on pivotal product features only; no overengineering; considerably lower costs throughout the whole product life cycle; designing products from scratch
4. Apply "Gandhian" Engineering	Willingness to simplify solutions; scarcity mindset of employees; use of the good-enough approach; outside-the-box thinking
5. Localize R&D Activities	Place responsibility for local products in the hands of local engineers; establish networks with local partners
6. Adapt Marketing and Sales	Openness to unconventional sales channels and promotion activities; employment of local brand ambassadors
7. Introduce New Business Models	Questioning existing business models; working with local partners; bottom-up thinking
8. Find a Local Partner	Excellent network within the local industry, science institutions, and nongovernment organizations; overcoming the liability of foreignness

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## 6.4 Global Benefits

Pioneering MNCs demonstrate that they can profit from their NPD activities directed toward EMs in more developed markets too. First, R&D facilities established in EMs with the aim of developing local products can be assigned tasks in NPD projects aiming at developed markets as well. This can range from supportive back-office activities like documentation to the full responsibility for certain product parts. In this way, the MNC can leverage the huge local engineering and natural sciences talent for global benefit. Second, localizing NPD and assigning more ownership for innovative NPD projects to local teams can help the firm to create a truly global mindset. Most MNCs have focused for years only on developed markets; thus, the cultural distances between employees were relatively small. And even as the company internationalized marketing and sales, these operations often remained detached from local roots. Not so R&D: To flourish, an active exchange with local stakeholders like science and industry representatives is indispensable. Through contact with EM R&D colleagues, headquarters' employees of an MNC can become more internationally oriented and overcome the *not-invented-here* syndrome. The firm as such also enriches its NPD culture by developing more frugality facets—a capability also helpful in developed markets, where no-frills products clearly gain ground in some segments. Third, NPD for the EMs' mass segment can help to lower the overall costs of premium products by achieving economies of scale—for example, in raw material purchasing (Shankar et al., 2008). Fourth, some MNCs successfully introduce full-fledged products originally developed for EMs in developed markets that cater to the needs of totally new customer segments. This phenomenon has become known in recent years as *reverse innovation* (Immelt et al., 2009). For instance, the portable, low-cost ECG device developed by GE for rural India has been introduced in the United States, where it has attracted new customer segments (Immelt et al., 2009).

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## 6.5 The Case of Siemens Healthcare

A computed tomography (CT) device developed by Siemens Healthcare is a very good example of a product successfully developed by an MNC for the Chinese middle market segment (Siemens, 2010). Siemens, like many other premium high-tech suppliers, ignored this growing customer group in the past. What's more, Siemens successfully reversed its innovation

process, that is, it introduced the CT scanner in more developed markets, such as Germany. So, how did the company manage its NPD activities in order to succeed?

As already mentioned, Siemens recently introduced the new innovation strategy called SMART. This new strategic approach, developed with the backing of headquarters and top managers, places EMs—especially their middle and lower market segments—visibly on the company's NPD agenda. The company's consulting division is also responsible for promoting the new approach and disseminating best practices to the business units. As the Healthcare Division for the first time developed an all-new CT scanner for middle market customers—that is, regional midsize hospitals—learning about their needs was particularly important. Most of these customers cannot afford high-end devices, have limited experience with Western products, or face other environmental restrictions like frequent power blackouts. However, they increasingly have to replace their outdated equipment or buy new devices for the first time. To better meet the new customers' needs, Siemens involved some local lead users—that is, local hospitals—in the NPD process. This helped the NPD team to decide which product features were most important and how much such a device could cost. In the end, the CT scanner had a unique just-enough functionality exactly meeting the market demand. It reliably performs all standard examinations with the exception of sophisticated heart assessments. It is particularly well suited for less experienced medical staff due to its user-friendly interfaces and an automated workflow. And at least equally important, it sells for only one-sixth the price of Siemens' high-end machines. The market-oriented development was also enhanced by localizing R&D. The responsible NPD team in Shanghai worked under a Chinese project leader and had full ownership of the whole NPD process. Needless to say, the all-Chinese scanner was developed from scratch. It is not just a downsized German product at the end of its life cycle. Moreover, 90 percent of the CT's components are sourced locally. Selling the CT system to the middle-market customer requires some adaptations, like far-reaching training for the hospital staff. To signal Siemens' well-known quality and reliability, the CT scanner is marketed under the Siemens brand name.

Beyond offering the CT system in China, Siemens has successfully sold it to other EMs, as well as—maybe even more interestingly—to numerous more developed countries. Robust, relatively cheap, and user-friendly, the device is attractive for developed markets' first-time buyers at the lower market end. Small clinics and private practices acquire it for day-to-day examinations mainly in the fields of orthopedics, urology, and dentistry.

In addition, full-fledged hospitals buy it to lessen the burden on existing high-class machines. And tight budgets in many developed markets' healthcare sectors may enhance sales.

The device has clearly helped Siemens to tap totally new market segments in EMs and even developed markets. In addition, it might help keeping emerging Chinese competitors both in China and worldwide at bay as they increasingly develop more sophisticated medical equipment for more and more demanding market segments.

## 6.6 Summary

EMs are already very attractive for numerous MNCs. Their importance is likely to increase further in the future, as they are becoming the engine of the global economy. Although innovating for these markets is not an easy task, several product examples demonstrate that it is possible. To succeed, MNCs have to learn new skills and detach themselves from taken-for-granted assumptions about the world order. Best practices show that changes in strategy, NPD processes, structure, and HR management touching the very heart of an average company's business model are necessary. But it is worthwhile. Such a successful transformation allows the development of low-cost, clearly defined products from scratch that exactly match local market demands. What's more, new products originally developed for India's or China's middle markets may also be successful in the MNC's home markets, and local R&D sites may be used as laboratories for worldwide innovation.

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## SECTION TWO

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# STARTING

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*The secret of getting started is breaking your complex overwhelming tasks into small manageable tasks, and then starting on that first one.*

MARK TWAIN (1835–1910), AMERICAN HUMORIST,  
WRITER, AND LECTURER





CHAPTER SEVEN

EFFECTIVE PRACTICES  
IN THE FRONT END OF INNOVATION

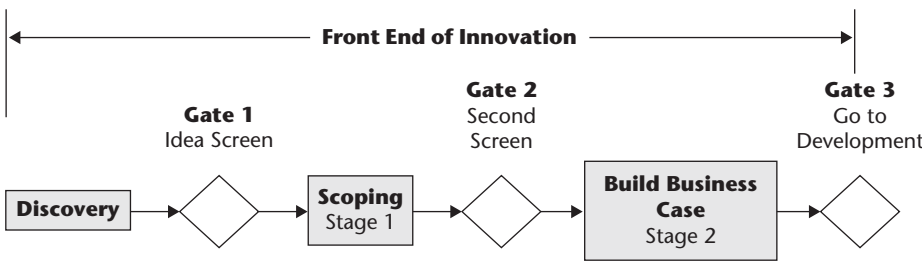
Peter A. Koen, Heidi M.J. Bertels, and Elko Kleinschmidt

7.1 Introduction

Most companies have adopted a formal Stage-Gate® process (Cooper, 2001) for managing projects at the front end. The first three stages are shown in Figure 7.1 and divide the front end into three sequential stages separated by management decision gates. The remaining stages, which are not shown in the figure, concern the development process.

The front end can also be shown as a holistic process model, which we have labeled as the *new concept development (NCD) model*. As shown in

FIGURE 7.1 STAGE-GATE PROCESS FOR THE FRONT  
END OF INNOVATION.



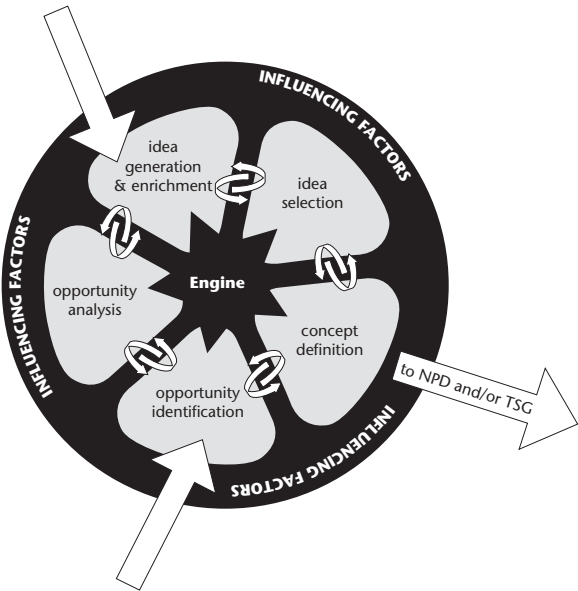
Used with permission from Cooper (2001).

Figure 7.2, the NCD model divides the front end into three different areas (see Koen et al., 2001, 2002). The engine, or the center of the model, accounts for the vision, strategy, climate, leadership, and overall management issues that drive the five activity elements of the front end. The second or inner part consists of five activity elements: opportunity identification, opportunity analysis, idea generation, idea analysis and concept definition. The third element consists of the external environment that influences the engine and the five activity elements.

*New concept development comprises the engine—the five activities of opportunity identification, opportunity analysis, idea generation, idea analysis and concept definition—and external environment influencers.*

Using the NCD model as a lens, we frame the discussion of seminal results from six large-scale noteworthy studies on the front end of

**FIGURE 7.2 HOLISTIC MODEL OF THE FRONT END. THE ENGINE ACCOUNTS FOR THE VISION, STRATEGY, AND CLIMATE AND DRIVES THE FIVE ACTIVITY ELEMENTS. THE MODEL RESTS ON THE OUTER ELEMENTS, WHICH ARE THE INFLUENCING FACTORS, SUCH AS THE ENVIRONMENT AND REGULATORY FACTORS THAT THE COMPANY CANNOT CONTROL.**



Used with permission from Koen et al. (2002).

innovation. These studies include Kleinschmidt, Koen, and Reilly (2005); Bertels, Koen, and Kleinschmidt (2009); Bertels, Kleinschmidt, and Koen (2011); Langerak, Hultink, and Robben (2004); Verworn, Herstatt, and Nagahira (2008); and Poskela and Martinsuo (2009). Based on these results, we prescribe effective, if not best, practices for managing the front end.

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## 7.2 Overview of the NCD Model

As Figure 7.2 shows, the engine or center of the model drives the five activity elements of the front end. We further divided the engine into two principal areas: (1) senior management and climate and (2) teams and collaboration.

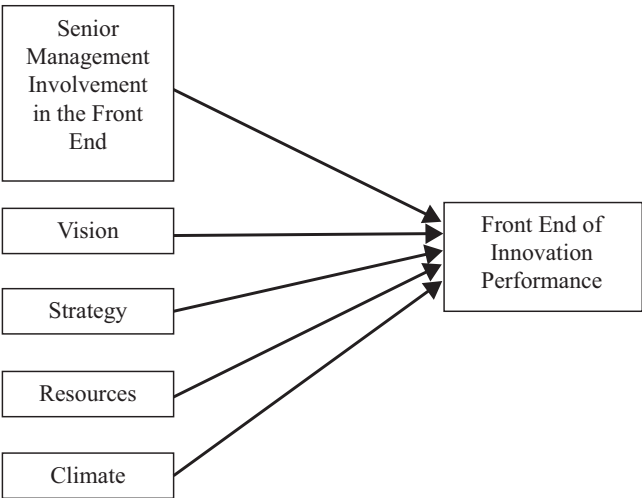
The five activities or controllable elements of the NCD model consist of the three major parts: (1) opportunity identification and analysis, (2) idea generation and selection, and (3) concept definition. An *opportunity* refers to the business or technology gap that a company realizes by design or accident that exists between the current situation and an envisioned future. An example of an opportunity is when a food company identifies the need to develop low-fat products due to the rising consumer interest in low fat but has no ideas and few products that can be sold in this segment. An *idea* is the most embryonic form of the new product or service. An example is where a food company has an idea for a new food product—perhaps nonfat potato chips—which will meet the needs of the new opportunity. In order to develop this product, the company's research group envisions several ideas for candidate molecules that will provide the same flavor but will not be absorbed in the body like fat molecules. A *concept* refers to a product that has a well-defined form, including its primary features and customer benefits. An example of this is where a food company—in this case Kraft—established a scientific program to develop and test specific nonfat molecules. The outcome of this development effort was Olestra, a nonfat molecule that is used to produce potato chips—Lays Light—with no fat. We have found that these expanded definitions better explain the activities that occur in the front end and provide a more precise language. Without them, people frequently confuse *opportunity identification* with *ideation*. The former refers to the effort of broadly determining unmet markets and trends, while the latter refers to specific ways to provide solutions to the problems identified in the opportunity space.

### 7.3 Organizational Resources and Climate

The organizational resources for the front end and the climate of the organization define the foundation for all front-end activities. Figure 7.3 shows study results. The thickness of the arrows denotes the relative importance of the variables in relation to having a successful front end. In this case, all of the variables were equally important.<sup>1</sup> The key variables are as follows:

- *Senior Management involvement in the front end* is the degree to which senior managers are personally involved in front-end activities, play

**FIGURE 7.3 RELATIONSHIP BETWEEN ORGANIZATIONAL RESOURCES AND CLIMATE AND SUCCESS OF THE FRONT END. THE THICKNESS OF THE LINE DENOTES THE STRENGTH OF THE VARIABLE’S INFLUENCE ON FRONT-END PERFORMANCE. IN THIS CASE, ALL FIVE AREAS CAN BE CONSIDERED EQUALLY IMPORTANT.**



<sup>1</sup>In order to measure front-end performance, we developed a multi-item measuring tool. Such measuring tools have become well accepted in the new product development literature (e.g., Cooper and Kleinschmidt, 1993; Song and Parry, 1996) for measuring overall new product development success since actual quantitative product development performance, which one would consider the gold standard, is too difficult to reliably obtain since the numbers are not often kept and are considered highly confidential when they are.

a central role in project reviews, participate in making key decisions, help champion new front-end projects, and play an integral role in them. P&G, under A.G. Lafley's leadership, has been consistently rated as one of the top 10 innovation companies in the world. In his book *Game Changer* (2008), coauthored with R. Charin, the former CEO of P&G describes how he established innovation as a central foundation of his company. Front-end activities, especially for transformational and disruptive products and services, are always more risky than incremental and manufacturing improvements. Middle managers find that they have no appetite to support riskier projects if senior management is unwilling to support them.

- *Vision* establishes the areas for front-end projects and gives clear directions to them. It describes a future aspirational state. Vision is distinct from strategy. For example, Apple Computer's vision<sup>2</sup> is to bring the "best user experience to its customers through its innovative hardware, software, peripherals and service." They want to accomplish this goal through the company's "unique ability to design and develop its own operating system, hardware, application software and services" in order to bring to the customer new products and solutions "with superior ease-of-use, seamless integration and innovative design."

The ideas for the next breakthrough typically come from employees who are closest to the consumer or user of the company's products or services. Often these breakthrough ideas are not in the company's pipeline. The vision provides the constraints or lens through which the people closest to the consumer can envision a new product or service. For example, Apple's vision embodies products and services in which the hardware and software offerings are integrated and combined, making products like the iPhone and iPad congruent. In contrast, a television with no integrated software would not fit within Apple's vision, and their employees would instinctively know this.

- *Strategy* provides an investment roadmap to the innovation initiatives and should be congruent with the company's vision. In Apple's case, their strategy defines particular products (e.g., iPod, iPhone, Mac computer) and product enhancements and services (e.g., iTunes and Apple stores) that would be supported within their investment horizon.
- *Resources* represent the degree to which sufficient funds are allocated to front-end activities: opportunity identification and analysis, idea generation and enrichment, and concept definition. Directing resources to the front end is obviously necessary for success. However,

<sup>2</sup>From Apple's September 2011 10K Report.

the authors have found this to be one of the most difficult and perplexing challenges for senior management: allocating sufficient resources to transformational and disruptive products. Directing resources to higher-risk projects means separating them from incremental projects—which, in turn, will have an effect on near-term quarterly earnings. This creates a quandary, as many senior managers are judged on the basis of quarterly earnings during the current fiscal year.

- *Climate* is the recurring patterns of behavior, attitudes, and feelings within an organization. Climate embodies the deeper and enduring values of the organization and is difficult to change. Human beings tend to be extremely sensitive to any form of criticism. A climate that supports the individual and allows ideas to be expressed without any retribution or criticism is a critical part of ensuring a creative environment, which, in turn, leads to new innovative products. In addition, it is important to align the incentives with the type of efforts that need to be made. Dan Pink, in his popular book *Drive* (2011), summarized abundant research showing that monetary rewards and recognition worked well for rudimentary tasks typically required for sustaining or incremental projects. However, his analysis also showed that for transformational and disruptive efforts, where creative thinking was required, monetary awards did *not* work and were even counterproductive to success. He found that the climate required for innovative thinking required the organization to support autonomy (people want to have control over their work), mastery (people want to get better at what they do), and purpose (people want to be part of something that is bigger than they are).

Our research suggests that the organizational resources and climate are the most important parts of the front end. Khurana and Rosenthal (1998) in their study of 10 incremental and two radical projects, and Poskela and Martinsuo (2009) in a more recent study of 137 Finish companies, found similar results. This is an important conclusion, as literature sometimes places more emphasis on the importance of idea generation. Often companies start new front-end initiatives with an ideation brainstorming session or a companywide request for new ideas. The research indicates that the company first needs to get their organizational resources (i.e., senior management commitment, vision, strategy, and resources) and climate aligned in order to be successful.

*Organizational resources and climate are the most important foundational parts of the front end.*



A recently published book entitled *Collective Genius* (2012), by Linda Hill and her colleagues, is a study of innovation leaders across 10 research sites including California, Dubai, India, and Korea and spanned both service and product industries. The authors found that the great innovation leaders created an environment where the employees felt empowered to be creative. The great leaders led from behind. This concept is best captured in a quote from Nelson Mandela: “A leader . . . is like a shepherd. He stays behind the flock, letting the most nimble go on ahead, whereupon the others follow, not realizing that all along they are being directed from behind.”

Our research also concludes that all of the organizational resources and climate are equally important. In fact, all parts of the engine are critical to a successful front end. This result aligns well with Lafley and Charin’s book *Game Changers* (2008, p. 10), where they state that successful innovation can happen only if it is “integrated into how you run your business; its overall purpose, goals and strategies, structure and systems, leadership and culture.” The authors further state that successful innovation can only occur when the key elements of leadership, vision (i.e., purpose and value), strategies including stretch goals, culture, and their enabling structures and processes are all organized together.

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## 7.4 Teams and Collaboration

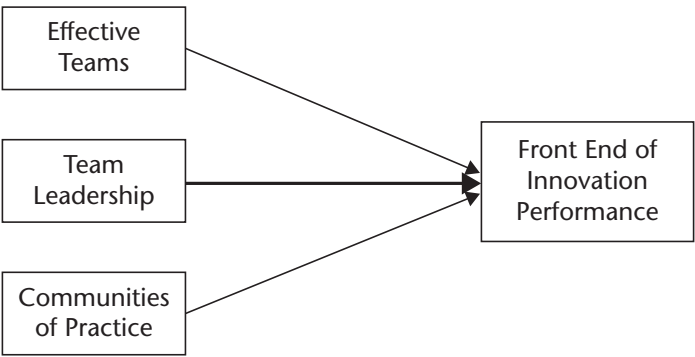
Teams have become the work arrangement of choice for most front-end projects. It is well accepted that teams outperform individuals acting alone or in large organizational groups (Katzenback and Smith, 1993). In addition, how the people on the teams collaborate is an important variable. A book by Sawyer (*Group Genius: The Creative Power of Collaboration*, 2007) provides convincing evidence that having an effective network is more powerful than the creativity of a lone genius. A memorable example discussed in Sawyer’s book recounts how Thomas Edison’s original design for the light bulb sockets consisted of two wire strips, one on either side of the bulb, such that the bulbs needed to be mounted straight up or they would fall out of their socket. This turned out to be a significant problem, as the first uses of the bulbs were in oceangoing ships. As it turned out, one of Edison’s laboratory assistants observed Edison opening the screwtop lid on a can of kerosene and concluded that the light bulb should have a similar screw-in base. Many other examples abound illustrating the power of collaboration. The story of 3M’s post-it notes is legendary. But it took Art

Fry, who worked in product development and was frustrated with paper bookmarks falling out of his hymn book, to determine a practical use for Spence Sliver’s new adhesive that did not quite stick.

Figure 7.4 shows additional study results. The thickness of the arrows denotes the importance of the variables’ relationship to having a successful front end. The key variables included the following:

- *Effective teams* consist of the team members, who are passionately committed to their front-end project and spend time and effort beyond their expected job requirements. Most significant breakthroughs today consist of the integration of existing ideas and technologies, the understanding of complex manufacturing processes often implemented in multiple plants around the world combined with an understanding of the unarticulated customer needs in different cultures and countries. It is impossible for any single individual to possess the knowledge to

**FIGURE 7.4 RELATIONSHIP BETWEEN TEAMS AND COLLABORATION AND SUCCESS OF THE FRONT END. THE THICKNESS OF THE LINE DENOTES THE STRENGTH OF THE VARIABLE’S INFLUENCE ON FRONT-END PERFORMANCE. IN THIS CASE, TEAM LEADERSHIP IS CONSIDERED TO BE TWICE AS IMPORTANT AS HAVING AN EFFECTIVE TEAM OR A COMMUNITY OF PRACTICE.**



be successful. At the extreme, effective teams meet the conditions of an X-team (Ancona and Bresman, 2007). These investigators studied high-performance innovative teams at Microsoft, Southwest Airlines, BP, Merrill Lynch, and other companies and found that the teams:

1. Created high levels of activity outside of their team. This consisted of gaining early top management support and funding and spending a lot of time understanding customer needs before developing the prototype.
2. Engaged in extreme execution by simultaneously developing their prototypes while continuing to engage in consultation with the customer and getting feedback from senior management.
3. Incorporated both discovery and execution in their activities. Not only did the team create the new product or service, but they moved as quickly as possible to the prototyping stage while engaging both the customer and the other parts of the organizations that had to manufacture and sell the new offering.

In order to develop an effective team, it is also critical that the team have a variety of abilities, skills, and knowledge. Research has shown that heterogeneous teams are more creative than homogeneous ones. Recent research by Woolley and Malone (2011) has indicated that teams including women have higher collective intelligence than those consisting only of men because women bring a higher level of social awareness and skills to the team processes.

- *Team leadership* defines the characteristics of having a leader with recognized credibility and leadership experience. We found that team leadership was approximately twice as important as having either an effective team or community of practice (Figure 7.4). This is not a surprising result, as it is the team leader's responsibility to do three important things:
  1. *Choose team members.* Selecting the right team members based on their domain knowledge, interpersonal skills, diversity, experience, and track record will ultimately determine the success of the project. Often the best candidates will not be easy to get. The ability of the leader to create the best team will often account for its success.
  2. *Lead the team.* A great leader needs to set team goals and norms very early as a team will also develop its own climate, just as a company does. The leader is typically the most influential person in developing these norms. Finally, the team leader needs to lead the team from behind, as was discussed previously.
  3. *Manage senior management.* Front-end projects typically have considerable risk and uncertainty. In our experience, this can only be dealt with if the team leader has the trust of senior management.

This trust is developed over time from previous successes he or she has had in the company. This factor should not be underestimated, since the team leader will often require much more latitude to resource seemingly risky pathways that will be difficult to justify quantitatively. Senior management will often withhold the resources required or ask for additional information, which will be time-consuming to obtain without a high level of trust. We have found that a team leader with a high level of trust who has had previous profit-and-loss responsibility is superior to a more inexperienced leader who understands the front end but has not yet earned his or her credentials with senior management.

- *Communities of practice* (COPs) are groups composed of members who share information, insights, experience, and tools in an area of common interest (McDermott, 2000). Unlike divisions or teams, these are mostly voluntary groups with no real reporting structure or accountability. We were surprised that our research identified COPs to be as important as teams. We believe that this result highlights the importance of having effective collaboration mechanisms both within and external to the team. The importance of having an effective collaboration was further confirmed by Rob Cross and his coauthors (2008) using network analysis tools to compare under- and high-performing teams. These authors found that the high-performing teams were better at networking both within the organization and outside of it.

*Team leadership was found to be twice as important as having either an effective team or communities of practice.*

A recent study by Bertels, Kleinschmit, and Koen (2011) indicated that climate has an important effect on COPs. They found that a favorable climate enhances collaboration and that the use of COPs further improves collaboration within such a climate. They also found that COPs are not effective in organizations without a supporting climate.

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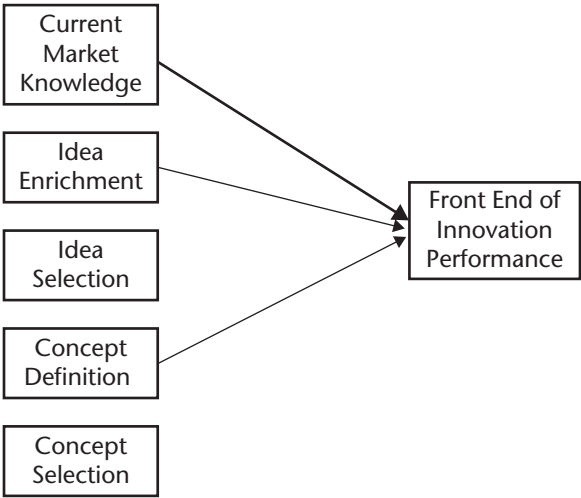
## 7.5 Activity Elements Associated with Incremental Products

The activity elements for the front end, the inner part of the NCD model, are discussed in the next two sections. We, like others, have found that there are both similarities and significant differences between the activities associated with incremental and breakthrough product development

efforts. Figure 7.5 shows the results of our study for incremental products. The key variables were as follows:

- *Current market knowledge* captures the degree to which the company thoroughly understands the marketing, economic, and regulatory environments.
- *Idea enrichment* defines the information-based system that the company uses for sharing, capturing, and building on new ideas.
- *Idea selection* captures the organizations method of idea selection and evaluation.
- *Concept definition* measures the degree to which the company develops formal methods for understanding the market and sales effort, the technical requirements, manufacturing feasibility, and economics. This variable can be considered synonymous with the development of a business plan.
- *Concept selection* captures the organization’s method of evaluating and selecting concepts for moving forward.

**FIGURE 7.5 RELATIONSHIP BETWEEN INCREMENTAL ACTIVITIES AND SUCCESS IN THE FRONT END. COMPANIES WITH HIGH FRONT-END PERFORMANCE WERE MORE PROFICIENT THAN THOSE WITH LOW FRONT-END PERFORMANCE IN THE AREAS IDENTIFIED BY A LINE. THE THICKNESS OF THE LINE DENOTES THE STRENGTH OF THE VARIABLE’S INFLUENCE ON FRONT-END PERFORMANCE. IN THIS CASE, CURRENT MARKET KNOWLEDGE WAS THE MOST IMPORTANT VARIABLE.**



Research indicates that the three most important activity areas in the front end for incremental products are current market knowledge, idea enrichment, and concept definition. Successful companies in the front end appear much better at activity elements associated with understanding the market, idea enrichment, and concept definition than less successful companies. These results are consistent with the research of Cooper (2001) and Verworn, Herstatt, and Nagahira (2008).

*The three most important activity areas in the front end for incremental products are current market knowledge, idea enrichment, and concept definition.*

The research further indicates that the most important activity element for incremental product development is understanding the current market. Yet, the standard approach for understanding unmet customer needs through focus groups, affinity diagrams, and quality function deployment methods has been found to be deficient in providing the deep insights needed. Traditional market research is now being supplemented with ethnographic techniques. *Ethnography* is a descriptive methodology for studying customers in relation to their environment (Kelley, 2005). Ethnographic techniques involve methods for gaining real knowledge of the customers by observing them in their own environment. For example, P&G has their

employees spend hours with women, watching them do laundry, clean floors, apply makeup and diaper the children. They look for nuisances that a new product might solve. They return to the labs determined to address the feature woman care about most. (*Wall Street Journal*, June 1, 2005, p 1.)

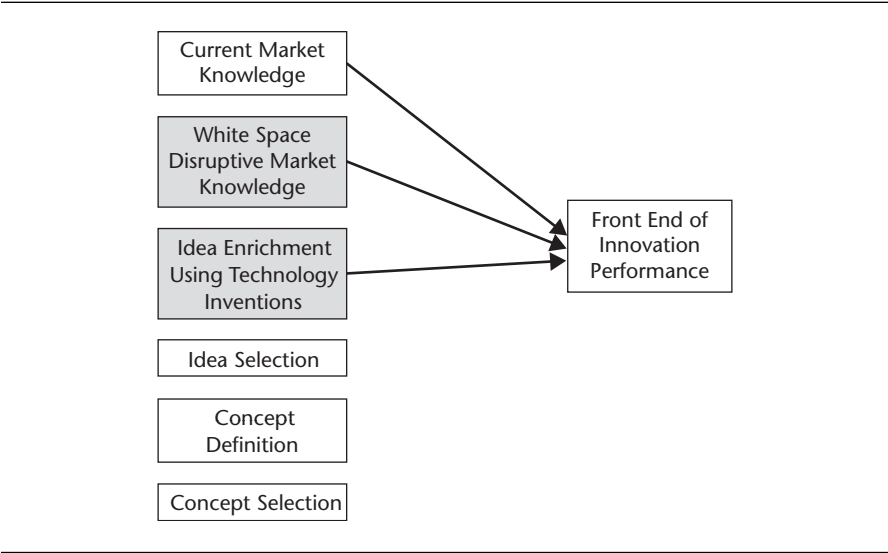
As a result of ethnographic research, P&G changed the packaging of individual tampons to noncrinkle plastic, which allows teenage girls to be able to open them in the bathroom without anyone knowing. In its first year of introduction (2004), the product obtained a 17 percent market share.

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## 7.6 Activity Elements Associated with Breakthrough Products

The activity elements for breakthrough products are shown in Figure 7.6. Four of the elements—understanding current market knowledge, idea selection, concept definition, and concept selection—are similar to those in incremental product development. We found one new variable, white

**FIGURE 7.6 RELATIONSHIP BETWEEN BREAKTHROUGH ACTIVITIES AND SUCCESS IN THE FRONT END. THE SHADED AREAS ARE THE VARIABLES THAT ARE DIFFERENT FROM THOSE FOR INCREMENTAL ACTIVITIES IN FIGURE 7.5. COMPANIES WITH HIGH FRONT-END PERFORMANCE WERE MORE PROFICIENT THAN LOWER-PERFORMANCE COMPANIES IN THE AREAS IDENTIFIED BY A LINE. THE THICKNESS OF THE LINE DENOTES THE STRENGTH OF THE VARIABLE’S INFLUENCE ON FRONT-END PERFORMANCE. IN THIS CASE, ALL THREE AREAS SHOULD BE CONSIDERED EQUALLY IMPORTANT.**



space/disruptive market knowledge, and we needed to modify the variable idea enrichment as follows:

- *White space disruptive market knowledge* captures the degree to which the company actively looks for new disruptive businesses, will accept business margins that are less than those of the current business, and reviews opportunities for disruptive products and technologies.
- *Idea enrichment using technology inventions* captures the extent to which the company assesses new technologies and technology-driven inventions.

For breakthrough products we found that the following three variables were equally important: current market knowledge, white space disruptive market knowledge, and idea enrichment using technology inventions. The

first two variables were expected to be important, but the importance of the third variable was unexpected. These results imply that companies that succeed in the breakthrough area are better at enriching ideas with technology inventions. Perhaps the technology allows the company to develop a proprietary advantage over their competitors that is required for the long-term success of a breakthrough product.

Understanding white space markets is a fundamentally different process than understanding the company's current market. Corning's optical fiber program, General Electric's development of computerized axial tomography, Motorola's development of the cell phone, and Searle's development of NutraSweet (Lynn, Morone, and Paulson, 1996) were breakthrough products when they were introduced and created entirely new markets. Lynn and coauthors found that development of these products did not follow the traditional serial Stage-Gate™ process, but used a process that they called "probe and learn." The development effort followed an iterative process in which early versions of the product were tested in the market, redesigned, and then tested again. The market probes allowed the company to better understand the emerging features and benefits that would provide value to the customers, as they could not articulate their needs in an unknown market without actually using the new breakthrough product.

*The three most important activities areas for the front end for breakthrough products are current market knowledge, white space disruptive market knowledge, and idea enrichment using technology inventions.*

In a similar theme, IBM explores new white space opportunities using an emerging business opportunity (EBO) unit that is separated from the mainstream during its initial efforts to understand the needs of the market. In the beginning, the strategy for a new opportunity is an iterative process, as it would sometimes "take a year to a year and a half to get the strategy we were happy with. It would change three or four times" (Garvin and Levesque, 2005, p. 10). EBO review meetings are held at monthly intervals and are focused on strategic clarity and understanding significant unmet customer needs; this represents a fundamentally different process from the more structured incremental development process gate review meetings. The EBO system, initiated at IBM in September 2000, has proven to be very successful. As of 2006, the EBO unit was responsible for generating 26 percent of total IBM revenue, or \$22 billion in new revenue for the company (O'Reilly, Harreld, and Tushman, 2009).



Also interesting is that concept definition—which was strongly correlated with success in incremental products (see Figure 7.5)—was not significantly related to success in breakthrough products. Langerak, Hultink and Robben (2004) also found no correlation between business planning efforts and success. Instead, we suggest, akin to the findings of Brinckmann, Grichnik, and Kapsa (2010), that the business planning process, as opposed to the actual business plan, will have a higher correlation with success. Together these results indicate that developing a business plan is critical to the success of incremental products—but not breakthrough products. Traditional business planning done for incremental product development efforts may be incongruent with the planning required for breakthrough products.

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## 7.7 Summary

The following are general conclusions about the front end of innovation:

- Senior management commitment to the front end (i.e., management involvement, setting a vision and strategy, committing resources, and providing a reinforcing climate) appear to be the single most important factor.
- Effective teams, their leaders, and having a COP that encourages collaboration are critical elements to a successful front end.
- Both incremental and breakthrough projects require strong understanding of the market. However, formal methods for quantifying the market and sales effort and determining the detailed requirements for manufacturing feasibility and economics (i.e., concept definition) are important drivers of success for incremental products but not for breakthroughs.
- The process and practices for developing breakthrough products require fundamentally different routines than those for incremental products. The new routines that have proven to be successful adopt a more iterative or learning approach.

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## CHAPTER EIGHT

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# GETTING LIGHTNING TO STRIKE: IDEATION AND CONCEPT CREATION

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Christopher W. Miller

*It is about thinking outside of the box, within a box.*

RICH NOTARGIACOMO, THE EASTMAN KODAK COMPANY

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## 8.1 Introduction

Effective new product ideation is intensely focused. It is at its best when it is fact based, fast, fun, and flexible. Ideation or brainstorming within new product development (NPD) uses data, as well as the expertise and experience of key people (company employees and customers), to create a nexus, a pressure point in the product development cycle. It is more structured, more aggressive, and more intellectually demanding than many ideation activities. A well-populated product portfolio of early-stage concept candidates is the reward for an aggressive search for targeted new ideas. A secondary goal of ideation is to attract the resources and excitement necessary to drive that portfolio through the product development process.

This chapter will take you through a step-by-step process for moving to a roughly screened set of beginning concepts. The steps are:

1. Chartering for ideation
2. Team formation: the right people to build the right ideas

3. The ideation session (ideation and initial concept building)
4. Screening, developmental thinking, and final concepts

These steps are embedded in the broader discovery phase of the NPD process generally described as:

- Strategy for growth culminating in a discovery charter
- Team formation and training
- Value chain needs and technology fact finding and forecasting
- *Ideation and concept creation*
- Concept shaping (technical feasibility and customer need)
- Preparation for Gate Zero

This chapter will take the classic approach of an innovation effort sponsored by a company or companies in a multiday format with a diverse team. The goal is to create the ideal environment for mental lightning to strike.

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## 8.2 Chartering for Ideation—the Secret of Focus

*We were able to pull the team together behind a common exciting direction. The new ideas that emerged were critical to our future success.*

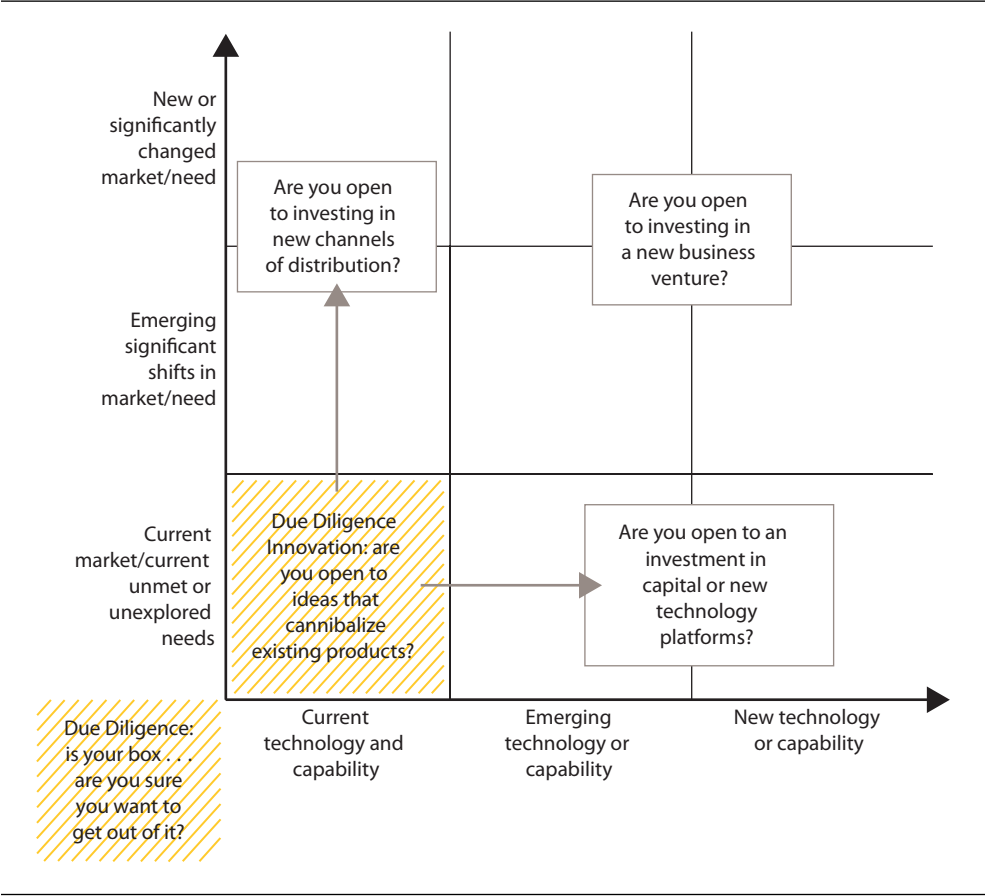
(LINDA STEGEMAN, LUCENT TECHNOLOGIES)

Ideas are infinite, but our tolerance for ideation is not. Ideation is like climbing a tree; you always start at the bottom. Most of us never get past the lower branches, and the low-hanging fruit we find can become very familiar. There is a blurry line between low-hanging fruit and the fruit that is lying overripe on the ground. The odds are good that if you bring together the same team for the same task year after year, you will see the same idea set. Spending time on the ideation focus is where the team will have the greatest opportunity to overcome the concern of idea repetition. Reconfirm your NPD team's charter and, if possible, narrow your scope to a search for ideas in a specific area(s) that you have determined to be promising or strategically interesting. To quote Barbara Goss of Armstrong World Industries, "We had reviewed our data to the point of burnout. Then came the breakthrough. It is so obvious—the answer came from creatively framing the questions."<sup>1</sup>

<sup>1</sup>Barabara Goss quote as told to the author.

Framing your ideation task starts with understanding what kind of idea you are looking for. This direction should be in your charter and informed by the company strategy. Are you looking for a new idea in your existing market space using existing capabilities and capital, or are you looking for ideas that expand your market or technology footprint? Both are important types of innovation. Be clear on your objective so that the ideas you present are what the organization was seeking from this project. This means that there is an initial understanding of the magnitude of the investment you are willing to make during development and commercialization (Figure 8.1).

**FIGURE 8.1 MARKET TECHNOLOGY DIAGNOSTIC. THE TYPE OF INNOVATION YOU ARE LOOKING FOR IS OFTEN DETERMINED BY THE TYPE AND AMOUNT OF INVESTMENT YOU ARE WILLING TO MAKE IN MARKET AND CAPITAL DEVELOPMENT.**



In the ideation charter the team should specify the market segment, unmet needs, and specific technologies or capabilities that will drive or limit ideation. Armed with these data nuggets, you can target specific high-probability branches of your idea tree. You should aim to do the following:

- Have focused project goals. Did you discover directions or opportunities in your earlier research that would suggest a more refined targeting of the charter? (example: the NPD charter might be targeted at *health care software*, the ideation charter at *operating room software*).
- State the product development challenge as a “problem-solving task” (example: *develop an exciting set of next-generation patient care software tools for the new operating room nurse*). Both the market segment and the technical pallet are alluded to in the few directive words of the task.
- Establish three to five key criteria to aid the team during the ideation process (examples, compelling need, platformability, feasibility, meaningful differentiation, size of the opportunity). These will be used during the screening process by the core team in Step Four.
- Focus on a limited dataset from your discovery research that will drive and focus the ideation. Limit yourself to 10 to 12 compelling needs and 10 to 12 driving technologies. Present these in a way that can be easily grasped and that excites the idea creation process (Figure 8.2).

You will create hundreds of ideas. The challenge in chartering is to be sure that these ideas are properly targeted for the customer you seek to serve and the capability your company would like to use or develop.

## 8.3 Team Formation

*I was surprised at how badly we needed the help of outsiders to get our ideas.*

(JONI SAHHAR, THE EASTMAN KODAK COMPANY)

When you start your focused ideation process, you should be able to look around the room and see (Table 8.1):

- Decision makers who own the resources needed to move the charter forward
- Implementers who can advance the ideas through to market (R&D, marketing, sales, finance, legal and regulatory, operations personnel)
- Experts, that is, guests who represent the value chain as well as key technologies



**FIGURE 8.2 KEY NUGGETS FROM THE DISCOVERY WORK ARE NOT JUST DOCUMENTED BUT PRESENTED IN A WAY THAT CHALLENGES THE IDEA CREATION TEAM.**

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- Diversity, that is, targeted and creative customer representatives, noncompetitive product development professionals, experienced idea generators

A frequent problem with the ideation process is the lack of diversity in ideas. This can best be overcome by bringing in external experts and customer/consumer idea generators. It is impossible to predict where the next ingenious idea will come from, but you increase the odds of success

TABLE 8.1 THE INNOVATION SESSION: NUMBER OF PEOPLE AND LENGTH OF SESSION.

Ideators: Facilitators	One-Day Yield: Idea Yield Beginning Concepts	Two-Day Yield	Three-Day Yield
8 ideators: 2 facilitators	200-ideas yield: 30 beginning concepts	400-ideas yield: 60 beginning concepts	600-ideas yield: 90 beginning concepts
16 : 3	400 : 60	600 : 90	800 : 120
24 : 4	600 : 90	800 : 120	1000 : 140
30 : 5	800 : 120	1000 : 140	1200 : 160

*Note:* Most teams pull 10 to 20 concepts from ideation into their portfolio. The odds favor those who can be more selective. The data show that the 1200th idea is as likely to generate a winning concept as the first.  
*Source:* Based on unpublished records of over 200 ideation sessions over a 15-year period.

when you narrow your focus and broaden your team to include previously uninvolved parts of your value chain:

- There was genuine pleasure in the room as the WaterPik® team saw its Director of Engineering lend his substantial expertise to help 11-year-old Noah as they designed his perfect “Slam Dunk” showerhead. The result of the ideation was two new platform launches: the *Down Pour* and the *Misting Massage* shower head product lines (Figure 8.8).
- It was Cindy Daub, a therapist and parking garage customer, who had the beginning idea for the patented precast concrete Tilt-T from High Concrete Structures, which led to a nearly 20 percent reduction in construction costs.
- The computer company’s NPD team went to Joshua’s college dorm room to test the first mock-up of a product concept he had helped develop in their ideation session a few months before. The first product was launched a few months later.

Customers are strong idea generators. Mike Johnson, of the University of Michigan, asks us to treat customers “as fellow engineers who are unencumbered by organizational and technology constraints.” (See Figure 8.3.) There is substantial evidence that ordinary customers are better idea generators on the scales of originality and user value. On the scale of ease of implementation, they are equal to both lead users and experts (Johnson, 2002). Eric Von Hippel of MIT has long held and documented countless cases of users as innovators. Creative consumers are not rare;

**FIGURE 8.3 TREAT CUSTOMERS AS FELLOW ENGINEERS WHO ARE UNENCUMBERED BY ORGANIZATIONAL AND TECHNOLOGY CONSTRAINTS.**

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they are the rule. If problems exist, it is because we fail to provide a process and the preparation to make them successful.

After identifying unmet needs through ethnographic fieldwork, Western Union® wanted to remain close to the customer during their ideation and concept generation process. Five local consumers who represented the target demographic were invited to join the innovation process. They were met at their homes and given short training sessions on what to expect, how to generate ideas, and how to write concepts. During the ideation session with a dozen company experts, each consumer was paired with a core team member to ensure that if concerns or questions occurred, they would be immediately supported in bringing their ideas forward. After concept screening, these same consumers were invited to return and describe their needs and the concepts they had helped develop to the president and his staff (Perry, Woodland, and Miller, 2002).

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## 8.4 The Ideation Session

*Don't wait for lightning to strike. Get out the lightning rods!*

(BILL ROBSON, INNOVATION FOCUS, INC.)

For every hour of ideation, you should have spent 10 to 100 hours on preparation. Most of the folklore on NPD is about this glamorous “moment” when the

light bulb goes on. However, the best ideas bounce like ping-pong balls; they generally don't flash on like lights. Creativity can be a complex, exceedingly personal, and fragile process. Those who seek to control the power of creative thinking also can destroy it. No matter how long the list of ideas is or from how many sources you may have drawn insight, ideation will be sterile without that momentary spark of recognized genius (da Vinci, c. 1509; Osborn, 1942; Prince, 1970). In order to spark the ideation session, three different types of exercises are often utilized: creativity, analytic, and experiential.

### 8.4.1 Creativity Exercises

*Presession work* can dramatically enhance the creativity and productivity of a team. To help your team enter the session ready to go, consider two basic rules: (1) Information briefings should be shared outside of the ideation session. A briefing document before the session can be a big help. (2) Ask team members to come in with ideas. A Minnesota stainless steel mesh manufacturer assigned each participant a Standard Industrial Category and asked them to spend two hours in online research looking for ideas they could steal from other industries. It was fun to see who could be the biggest idea thief.

*Creativity exercises*, at the heart of ideation, come in the form of metaphor building or irrelevant thinking followed by a forced connection to the task. For example, a Hershey's team was asked by their facilitator to go on an imaginary vacation. One subteam went on a ski vacation to the Alps and brought back a travel poster as instructed. The poster had snow-covered mountains with "shoosh" marks curving down the mountainside. The facilitator asked the full team to imagine what kind of candy that made them think of. One idea was "a white kiss with a chocolate stripe, a shoosh mark, curving down the side." This idea later became Hershey's Hugs (Figure 8.4).

Metaphor-building exercises create a deviation from the straight-forward listing and idea building within ideation. The initial ideas that emerge following an exercise may be impossible or far-fetched but, if conceptualized, can yield surprising results. Here are some example exercises from among hundreds of possibilities:

- If your technology were an animal, what kind of animal would it be? What would it want to do in the market?
- Open a newspaper to a page at random. Look for a product idea in the middle of the page.
- List your favorite life experiences. Take time to write about them. Invent ways to make the product like these experiences.

**FIGURE 8.4 IMPORTANT IDEAS CAN COME FROM CREATIVITY EXERCISES WHEN PRESENTED TO AN IDEA-FRIENDLY TEAM. THIS TEAM WILL PLAY WITH AN IDEA AND IS NOT AFRAID TO TRY TO CONVERT AN IMPOSSIBILITY INTO A POSSIBILITY.**

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Vini Bansal, Head of Package Design at the Thomas J. Lipton Company, was working with a team on new ways to deliver Wishbone® salad dressing to warehouse stores. His facilitator invited him to walk on an imaginary beach and find objects. A large list of objects was created. Each team participant selected one object to build ideas around. Vini chose the clamshell, which eventually became the “clam-pack” case, which yielded two patents.

Good resources for these types of exercises are *Thinkertoys*, a handbook by Michael Michalko (1991), and *Idea Stimulator*, one of several helpful smart phone apps. Warning: A common rule of thumb is that there is no such thing as a bad idea. Take the pressure off your group and flip that rule to “There is no such thing as a good idea.” All new ideas are incomplete and imperfect, but as Einstein is reported to have said, “If at first an idea is not absurd, there is no hope for it.”

### 8.4.2 Analytic Exercises

*Analytic exercises* can also drive new thinking. A simple morphological analysis comparing the top customer needs from your charts (y-axis) by key technologies (x-axis) can provide an ideation roadmap. Build the grid and examine each block for logical or fantastic connections.

**TABLE 8.2 MORPHOLOGICAL ANALYSIS ON POTATO CHIP TRENDS:  
(1) SELECT NUGGETS, (2) BUILD THE MATRIX, (3) CREATE IDEAS  
AT THE INTERSECTIONS.**

	Technology Nuggets		
	No Fat- and Cholesterol- Reducing Fat Substitutes	There Are 500 Varieties of Potatoes	Nitrogen Flushing Will Extend Shelf Life
Older people like salty, sour, and hot foods	Hot n’ Sour low- fat chips	?	?
Ethnicisms sell: Amerimex Spanglish Menu	?	?	?
Supermarkets want new product news, not new brands	?	?	?

**8.4.3 Experiential Exercises**

*Experiential exercises* can drive creative thoughts from surprising sources. Over lunch, a group of heavy equipment manufacturers were taken on a tour of a printing plant; another time, they spent their lunch hour climbing over a new fire truck, combing it for possible features. Experiential exercises generated about 20 percent of the total number of ideas. British Air developed its *Business First* service based on the principles observed in a Bentley car. A packaged goods company had its ideation team start with a three-hour ethnographic exercise that involved going into the homes of real consumers, returning to the ideation session, and building collages about their experiences. Postsession feedback from the ideation team suggested that the resulting concepts were more connected to real market needs than research-based ideation alone would have been.

After every exercise—creative, analytic, or experiential—there is an opportunity to list the ideas that have emerged. Select from the list and build initial product concepts.

**8.4.4 Facilities**

Ideation is a messy process that is best done in an environment with lots of space (Figure 8.5). A rule of thumb is to provide 50 to 100 square feet per participant. For a group of 24, provide at least 2,400 square feet. Seek a 40x40 flexible meeting space; the remaining space in small, comfortable

**FIGURE 8.5 IDEATION SESSION: IT IS IMPORTANT TO FIND A LARGE, COMFORTABLE, AND CONVENIENT LOCATION.**

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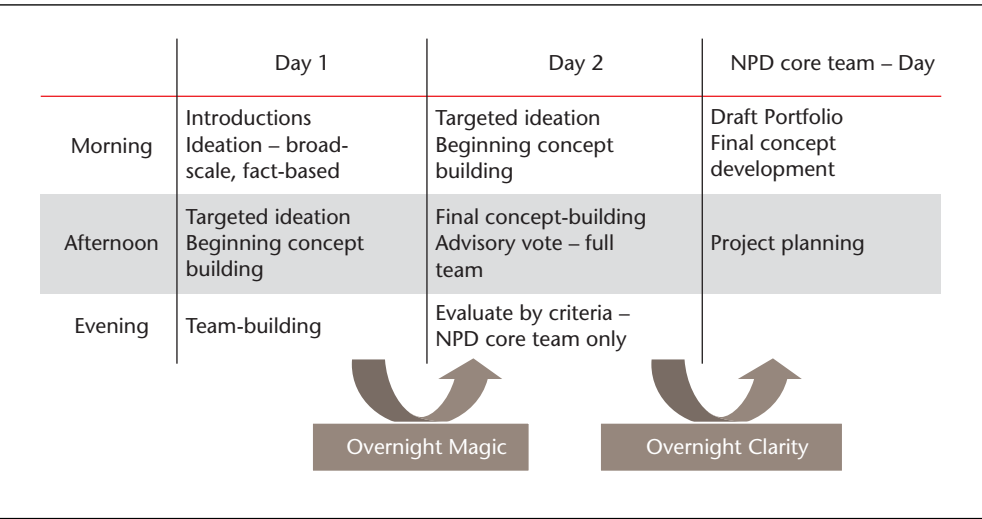


rooms or areas can be used for breakout groups. Pay attention to lighting (natural if possible), ventilation (within your control), and a large variety of foods and beverages available continuously. A local hotel or country club can usually meet the group's needs; however, there are several other creative options that companies have utilized. Black & Decker used an entire floor of a building that was not in use. Johnson Controls used their design lab in California. The group at the Children's Museum of Indianapolis worked in the heart of the museum itself. A farm equipment manufacturer worked in a double-wide trailer on the grounds of the Grasslands and Muck show in Warwickshire, England. The Crystal Flash Energy team worked in their lunchroom surrounded and energized by the hubbub of daily business. No matter where it is, your location should offer a rich and stimulating sensory mix but remain free of distractions.

#### **8.4.5 The Ideation Schedule**

The structure of a successful innovation cycle is scripted to the minute by highly trained facilitators who are secure and experienced enough to take advantage of exciting developments that redirect the process. Many approaches work. Following is a process that has proven effective over three decades and for hundreds of organizations and product types (Figure 8.6):

**FIGURE 8.6 THE CLASSIC IDEATION AND CONCEPT GENERATION PROCESS.**



This process can last for a few hours to a week. It works best when there is “hang time,” a sleep cycle, within ideation and within selection and concept development. This encourages creativity, integration, and clarity.

- Day 1* The first day is about gaining maximum breadth. It begins with aggressive broad-scale idea generation building on what has been learned in the prior stages. This process may include:
- Creativity, analytic, and experiential exercises and activities involving all participants
  - Expert and customer “goldfish bowl” focus groups embedded in ideation
  - Bursts of structured, high-speed ideation (two to three ideas per minute)
  - Targeted small groups focused on subtasks and building beginning concepts
- Day 2* The second day is about being sure that all the bases are covered and digging deeper
- Targeted breakout groups focused on specific needs or technologies
  - Targeted breakout groups chasing wisps and solving unsolvable problems
  - Initial screening through voting
  - Outside guest, customer, and expert feedback
  - Core team sorting of beginning concepts by criteria from the charter



*Day 3* The third day is a review of the screening results and concept building. A portfolio of 10 to 20 beginning concept clusters is selected.

- Reviewing the results of the sort by criteria
- Selecting and clustering beginning concepts for the portfolio
- Refining the clusters into formal concepts
- Creating a first-cut *bubble chart* that can give the team a view of the suspected portfolio value
- Portfolio-driven action planning

Ideation does not have to end at 5:00 p.m. on session days. Teams are likely to go off to dinner anyway, so make it a part of the ideation process. One food products team got a bus and went to five restaurants, sampling appetizers at each one. Another company took their team to a Phillies baseball game. Although it is fun to keep the ideas flowing in all locations, here are some guidelines so that you don't burn out your idea generators early on in the process:

- Idea generators need rest.
- Idea generators need time to catch up with their work and family.
- Push for activities that allow for flexible physical activity and fluidity of social interaction (avoid sit-down white tablecloth dinners).

**8.4.5.1 Documentation.** It is important to document every idea. Every idea may have value for the sponsoring company and, of course, nothing should be lost. One Fortune 500 company was able to review ideation data over a span of 12 years and found a portfolio of valid concepts that at the time of creation were deemed impractical. Key documents for your record include:

- A complete attendee list
- Legal agreements with all participants and proof of compensation
- The idea list
- Concepts developed (the original signed paper napkin if necessary)
- Presession research and stimulus
- Process description

**8.4.5.2 Process.** Use a structured, facilitated innovation process (Table 8.3). There are many strong processes (Miller, 1999; VanGundy; 1987). Most of these are generic creative problem-solving techniques that can be easily adapted to building product concepts. Computer-assisted and Web-based techniques have been emerging for 30 years. They are clearly

TABLE 8.3 IDEATION RULES OF THE ROAD.

For Ideation Management	For Creativity
Use a notepad to collect ideas and connections that could be lost.	Ideas are infinite; there is always more than one right answer.
Headline your comments so that they can be captured by the facilitator (e.g., I wish . . . ; We could. . . ; How to . . . ).	Stay focused on the objective, no matter how narrow; between any two ideas there is another idea.
Be open to the ideas of others; turn raw ideas into better ideas.	All ideas are connected; play with metaphors and seeming irrelevance.
Turn questions and concerns into ideas (e.g., “That would really cost” could be stated as “How to get the cost down”).	Only those who attempt the absurd will achieve the impossible.
Share time with others; get all points of view on the table.	“Pain plus time equals humor.” Don’t be afraid of your past mistakes; laugh at yourself.
You can do anything, but you can’t do everything. Do not reject ideas; select the ones appropriate for you at this time.	Risk taking and resistance create positive balance, but it takes a lot of risk takers to pull along one well-meaning voice of reason.
Be playful and physically active; the mind and the body move together.	Learning, creativity, and humor use the same mental processes—connection making.
Avoid interruptions; clear your schedule and turn off the cell phones.	Creativity takes practice and an intense desire to be good at it.

viable but have yet to be proven, except when a team cannot be colocated for the period of the innovation session (Kahn, Miller, and Benson, 2001). The primary challenge is that programmed processes are predetermined and less flexible than face-to-face facilitated processes. The social interaction at breaks and the power of informal side comments and conversations are not yet reproducible online. Videoconferencing suffers from debilitating logistics, putting the remote location at a constant disadvantage in the meeting flow and inhibiting conversation. Technology, if aggressively facilitated, can make otherwise geographically impossible groups possible. Experience, however, suggests that technology too often intrudes on group intimacy and dilutes the excitement associated with ideation. Building commitment to ideas is associated with building commitment to one’s fellow ideators. Commitment to action is as important as the idea itself.

*Remember, there is no such thing as a “good” idea.* Ideas are like babies; they are pretty ugly at birth and are doomed to an early death without help. Ideas are seeds that may grow and lead you to other ideas. Never look for the big idea; only look for the next idea.

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## 8.5 Concept Screening and Developmental Thinking

*I fear that I am looking at baking soda in the refrigerator in my concept set and might fail to see it.*

(DENNIS ESHELMAN, PRESIDENT, HERSHEY GROCERY PRODUCTS)

The decision support system within the innovation session is concerned with nurturing beginning concepts. A gardener must cull two of every three plants to adequately nurture the remainder. Some concepts are rejects and some are defective; others don't fit your task or your team, even though they are good and valid. On a rare occasion, an idea will emerge that is stronger than the task and may require a redirection of your previous thinking.

Screening should be dynamic, have distinct selection stages, and not be dependent on a single static review or pass. Here is an example process:

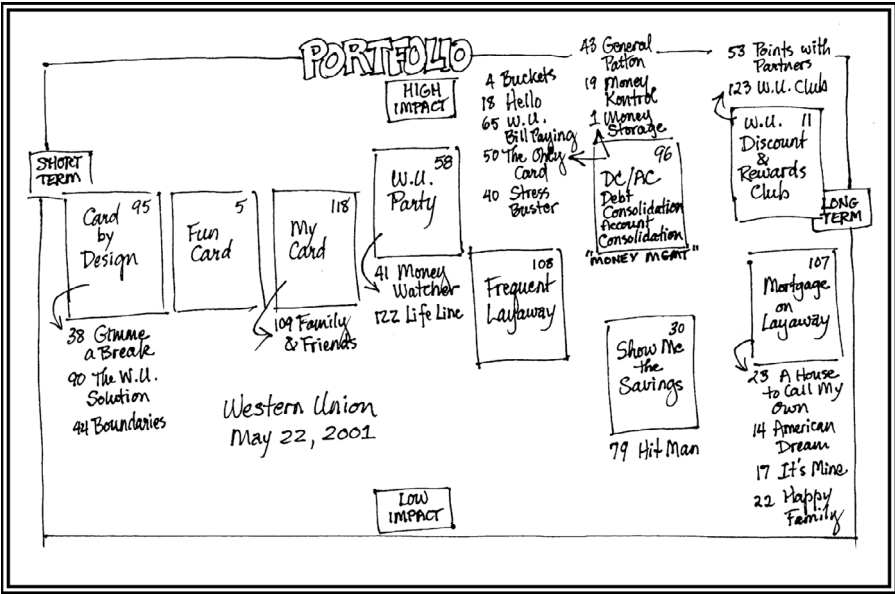
1. *Advisory vote(s)*: The full ideation team gives an advisory vote at the end of all concept building. Each person votes on approximately 10 percent of the total number of concepts. For example, if there are 100 concepts, each individual receives 10 votes. About one-third of your beginning concepts will get multiple votes and rise to the top; newer thinking generally falls second and may need special attention; and one-third will get no votes and drop away. (Note: the drops may be great little features to embed in other concepts.)
2. *Rough screen by criteria*: The core team evaluates all concepts using the three to five unweighted rough criteria established specifically for this purpose in the ideation charter. Screening by criteria ferrets out key concepts and allows the core team important study time to carefully review all concepts. The results are tabulated and fed into the portfolio development discussion.
3. *Affinity sort*: Once each team member has had a chance to read all of the concepts and rate them by criteria independently, sorting them into like clusters can help prevent the loss of small ideas that can be good additions but do not themselves rise to the level of a significant concept. In the affinity sort, simply cluster like concepts together. You will discover that important ideas rarely have a single author.
4. *Portfolio*: Discussion, development, and clustering ensure a set of beginning concepts that challenge the task from several angles. Be informed by, but do not allow yourself to be driven by, the tyranny of the numbers emerging from the criteria screen. Seek the best possible solutions to

the customer’s problems. Match the solutions with your organization’s ability and interests. Beginning concepts may be clustered into like product or platform sets. A portfolio should have short- and long-term opportunities with a variety of risk assessments. The core team derives the portfolio based on a discussion balancing the objectives of the charter with the discoveries made in the ideation.

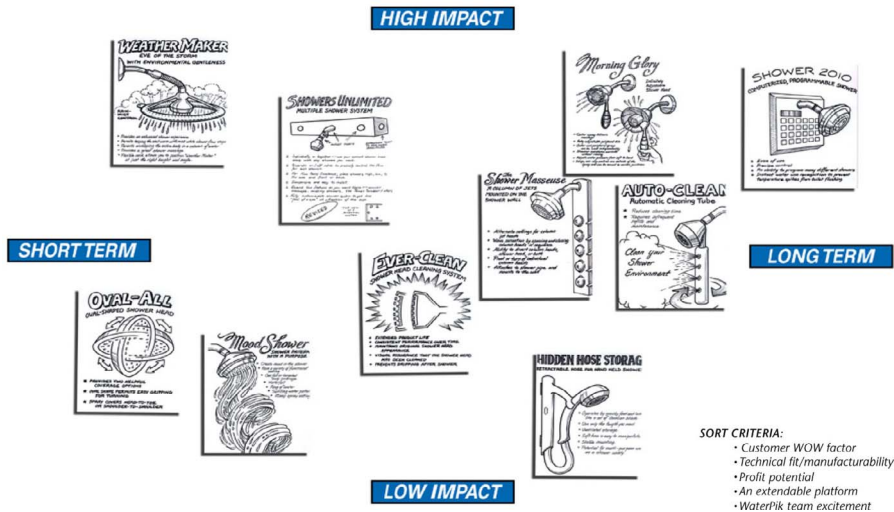
Always remember that these are beginning concepts that can and should be molded. You should work to evaluate what they can become, not what they are. Be cautious about using collaborative decision making. Decisions tend to regress to the mean thinking of the group. This average of group thought is based on collective wisdom. Wisdom is based on experience. Experience can lead us along known, well-traveled paths. Leave room for the passionate advocate to drive an idea forward through the full discovery process.

Following the creation of your draft portfolio, the beginning concepts and clusters can be turned into more complete concepts (Figure 8.7). What constitutes a concept varies dramatically from one organization to the next.

**FIGURE 8.7 EARLY-STAGE CONCEPT PORTFOLIO. CONCEPTS HAVE BEEN ROUGHLY LAID OUT WITH RESPECT TO ONE ANOTHER. SOME CONCEPTS HAVE BEEN CLUSTERED WITH LIKE CONCEPTS.**



**FIGURE 8.8 THE WATERPIK SHOWERHEAD PORTFOLIO AFTER DEVELOPMENTAL THINKING AND CONCEPT WRITING. THE NEXT STEP FOR WATERPIK WAS FOCUS GROUP RESEARCH.**



A concept should be enough of a statement to drive the idea to the next stage—formal development. Frequently, the next step will be developmental thinking by the team focused narrowly on improving this idea. (See Figure 8.8.) This developmental work can be done with consumers, with a technical team, or both. Several leading concepts that were created during a Hershey Foods baking cocoa ideation session were presented to a group of consumers who were frequent bakers for developmental work. The question was not which of these concepts should move forward; rather, the question was “What else could these concepts be and how would you describe them?” One concept, a spray-on powder for cake decoration, was changed by consumers to a sprinkle-on form, reducing the time to market from three years to six months. Developmental work can proceed immediately after portfolio construction.

## 8.6 Summary

*I’ve been in advertising and marketing for about thirty years and if somebody had told me that two hundred beginning concepts could be generated, screened, and refined by consumers, prioritized by feasibility and business potential, and distilled to about ten finished winning concepts in four days, I would have thought that there’s a better*

*chance the Jack of Spades would jump out of the deck and spit cider in my ear (referring to the musical Guys and Dolls).*

AL CARLSON, FORMER BRAND MANAGER, THOMAS J. LIPTON COMPANY

Ideation and concept creation present a highly focused opportunity to build more than just the portfolio of concepts necessary to fill your product pipeline. Ideation is a time to build the customer-centric, innovation-friendly culture necessary to drive your product ideas through to market. Throughout the NPD process, you will need to call on an adherence to the voice of the customer and a willingness to invent new solutions to make your product concept a market reality. CUNA Mutual and National Liberty Corporation had been working jointly to bring products to market, with little success for four years. In frustration the teams were sent into the desert together, only to return with a clearer understanding of why they did not want to work together. Finally, Carol Myers, Vice President of Marketing at National Liberty and her CUNA Mutual partner, Janice Schlimgen, agreed to throw out all ideas and start from scratch. Starting with the basic consumer needs and basic capabilities of the two corporations, they were able to create a new, untainted, and shared set of products. The first of these, “Acorn,” went to market through the Veterans Life brand within three months. The team went on to launch a large variety of products. Janice and Carol agree that the real work of joint ideation built the team commitment necessary to attain this shared accomplishment.

Approaching ideation with an attitude of rigorous openness allows you to include a variety of knowledge sources (voice of the customer, technical, strategic) and people. This rigor will provide focus, structured creativity, and screening. The openness is not one of passive acceptance but rather an aggressive openness and excitement about where any idea might lead. Lightning strikes those who stand exposed and in the open.

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**Christopher W. Miller**, PhD, NPDP, founded Innovation Focus, Inc. (IF) in the late 1980s. He has managed and coached over 3,000 discovery-stage projects. IF is recognized as a voice of the customer and idea development firm specializing in discovery and innovation. For over 30 years, Chris has studied group dynamics and creative problem-solving in product development. Prior to forming IF, he had the opportunity to work with two major corporations, Philips NA and White Consolidated Industries. Today, Chris and his firm assist many of the Fortune 100 corporations to connect real market needs with their current and emerging technologies in search of new product and service ideas.

Chris has authored numerous articles and books on the topic of NPD, including the chapters “Hunting for Hunting Grounds: Forecasting the Fuzzy Front End” in *ToolBook I*, “Ethnography” in *ToolBook II*, and “Slingshot Groups” in *ToolBook III*. Chris is a past Entrepreneur of the Year award winner (Ernst & Young) and has received the Ruth Waxman Award for outstanding community service from the Volunteers for Medical Engineering.

He was proud to serve as President for the Product Development and Management Association in 2003.



## CHAPTER NINE

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# PORTFOLIO MANAGEMENT FOR PRODUCT INNOVATION

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Scott J. Edgett

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### 9.1 Introduction

Portfolio management is a critical management process that executives use to successfully drive product innovation. The ability to define a product innovation strategy and implement this strategy on a project-by-project basis, month after month, makes effective portfolio management capabilities a critical determinant of success. Organizations that have been able to develop and maintain a successful portfolio approach report more effective resource allocations, improved pipeline management, better alignment of initiatives with the innovation strategy, and improved overall performance. One executive articulated the benefit as follows: “having a solid portfolio management process in place allows me to have the confidence that we are funding projects in the right priority to aid in achieving our strategic goals while also ensuring that our people are working on the right projects as we continually strive to leverage our scarce resources.”

Portfolio management addresses the question “How should corporations effectively allocate their product innovation resources—R&D and other new product resources?” Portfolio management is all about maximizing resources to achieve strategic product innovation objectives. Executives who optimize their R&D investments by defining the right product innovation strategy for the firm, by prioritizing the innovation pipeline, and by achieving the ideal balance of projects will come out ahead in the long run.



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## 9.2 Portfolio Management Defined

*Portfolio* is one of those words that is widely used within most organizations but is also widely misunderstood, as people operate under different definitions. There is no universal definition. For our purposes, we define a portfolio as comprising two parts—strategic and tactical.

*Strategic process:* Strategic portfolio management is a process that is strongly linked to organizational innovation strategy. It is used to better select and pursue investments/opportunities in markets, products, and technologies—for example, deciding how much to invest in market A versus market B or product line A versus product line B.

*Tactical process:* Tactical portfolio management is a tactical way to allocate or select initiatives. It is a prioritization process for project selection and resource funding. Tactical portfolio management deals with constraints to better manage the pipeline flow. For example, if we have a pipeline of 100 active projects, what is the priority of each of these projects and which projects should rise to the top of the list for funding priority?

Portfolio management is a combination of both approaches—strategic and tactical. As a result, what conceptually should be easy to do quickly becomes, in practice, a challenge in many organizations. This is mainly because the portfolio decision-making process encompasses, or overlaps with, a number of other decision-making processes within the business. Portfolio decisions typically include periodic and holistic reviews of the total portfolio of all projects and implement the product innovation strategy for the business. This includes strategic resource allocation decisions within selected arenas.

*Portfolio management  
requires both strategic and  
tactical approaches.*

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## 9.3 Challenges to Good Portfolio Management Practices

There are five unique facets to good portfolio management that make it one of the more challenging decision-making functions in an organization (Cooper, Edgett, and Kleinschmidt 2002a):

1. Portfolio management for product innovation deals with future events and opportunities; much of the information required to make project selection and prioritization decisions is at best uncertain and at worst unreliable.

2. The decision environment is dynamic. The status and prospects for projects in the portfolio are ever-changing as markets shift and new information becomes available.
3. Projects in the portfolio are at different stages of completion, yet all projects compete against each other for resources. Therefore, comparisons must be made between projects based on information that differs in quality and quantity.
4. Resources available to be allocated across projects are limited. A decision to fund one project may mean that resources must be taken away from another, and resource transfers between projects are usually not totally seamless.
5. Finally, data availability and reliability are critical. Without good data, it is very hard to have an effective portfolio management process.

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## 9.4 Four Main Goals in Portfolio Management

How should one go about setting up a portfolio management system? There are four main goals that an effective portfolio management system should aim to achieve (Cooper, Edgett, and Kleinschmidt 2002b):

1. *Strategic alignment:* The main goal is to ensure that, regardless of all other considerations, the final portfolio of projects truly reflects the company's innovation strategy. This involves determining that all projects are "on strategy," support the strategy, and/or are critical components of the strategy and that the breakdown of spending across projects, areas, and markets is directly tied to the business strategy.
2. *Maximize the value of the portfolio:* Here the goal is to allocate resources to maximize value for a given spending level. That is, projects are selected to maximize the sum of the commercial value of all active projects in the pipeline. This can be measured, for example, by a business objective such as net present value, return on investment, or likelihood of success.
3. *The right balance of projects:* The goal is to achieve the desired balance of projects in terms of a number of parameters to ensure strategic alignment. For example, a company might seek the right balance in terms of long-term projects versus short-term ones; or high-risk versus lower-risk projects; or across various markets, technologies, product categories, and project types (e.g., new products, improvements, cost reductions, maintenance and fixes, and fundamental research).

4. *The right number of projects:* Most companies have too many projects underway for their limited available resources. The result is pipeline gridlock: projects take too long to reach the market, and key activities are omitted because of a lack of people and time. An overriding goal is to ensure a balance between resources required for the active projects and resources available. A common approach to achieve this goal is managing the key resource limits or performing a resource capacity analysis.

Separating portfolio management into the two distinct, but related, levels of strategic and tactical help to achieve these four key goals. This also permits different decisions to be addressed at their appropriate degree of intensity and at different levels within the organization (e.g., whether the issue is of a strategic nature or a resource allocation nature).

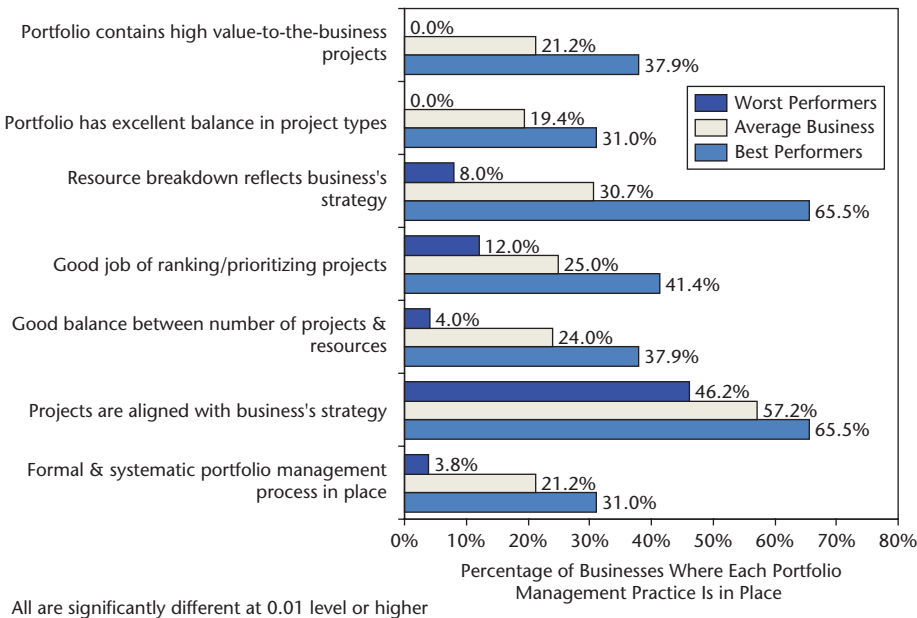
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## 9.5 How Do You Measure Up? The Habits of Good Portfolio Practices

Some of the best practices in portfolio management that have been observed in previous studies and the impact of each practice are presented in Figure 9.1. Benchmark your organization's capabilities by asking yourself how you would measure up and then compare your answers to the scores provided in Figure 9.1. On each variable, score yourself on a 0–100 scale, where a score of 100 is the highest. Then see how you compare. Are you in the best performer, average, or worst group of companies? These benchmarks provide an excellent way to identify where you are strong or where you might need to improve in portfolio management (Cooper and Edgett, 2006; Cooper, Edgett, and Kleinschmidt 2004, 2005).

1. *A portfolio that contains high-value projects for the business:* Does your portfolio contain profitable, high-return projects with solid commercial prospects? Picking the winners—the high-value-to-the-business projects—is no easy task. And only a small minority of businesses (21.2 percent) claim to have achieved the ability to do this. Best performers fare better here, with 37.9 percent indicating high-value projects in their portfolios; no worst performers make this claim. Seeking high-value projects is the most strongly correlated element with new product development (NPD) performance of all the elements listed in Figure 9.1.
2. *A portfolio that has an excellent balance in terms of project type:* The portfolio has a good mix of long-versus short-term and high-versus low-risk projects across markets and technologies, for example.

FIGURE 9.1 PORTFOLIO MANAGEMENT PRACTICES—IMPACT ON PERFORMANCE



3. *A breakdown of spending (resources) in the portfolio that truly reflects the business's strategy*: This is another practice designed to achieve strategic alignment—ensuring that spending splits across project types, markets, business areas, and so on mirror the strategic priorities of the business. If there are disconnects between the stated business strategy and where the resources are spent, the portfolio is in trouble and strategic alignment is missing.
4. *Good job of ranking and prioritization of projects*: Here management strives to focus its NPD efforts and creates a list of projects in order of their priority for resources. A weakness here usually suggests that the pipeline is under stress.
5. *A good balance between the number of projects undertaken at any one time and the resources available (people and money)*: Ideally, management tries to balance resource availability (usually people and time) with resource demand (the number of projects) and strives not to do more projects at a time than can be handled effectively. Seeking the right number of active projects is a challenge as companies try to do more with less or manage with tight resource constraints.

6. *A portfolio of projects that is aligned with the business's objectives and strategy:* This practice is the one strength of the seven portfolio practices considered, with the majority of businesses (57.2 percent) achieving strategic alignment. This practice is also a strong discriminator between best and worst performers and is correlated strongly with NPD performance.
7. *A formal and systematic portfolio management system in place:* A portfolio management process in place allows management to have regular reviews of the portfolio to ensure that the strategic and tactical elements of the portfolio are in place.

In spite of the recent emphasis on portfolio management, the benchmarking evidence in Figure 9.1 suggests that most businesses still find it a challenge in terms of implementing best practices and achieving desired results from portfolio management. Having a good portfolio management practice is easy to wish for but hard to put into practice. The company needs to have strong strategic alignment, a good balance of resource demands and supply, effective project prioritization, and a portfolio of high-value projects that also has the right balance of projects and a project mix that mirrors strategic priorities.

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## 9.6 Warning Signs That You May Be Having Portfolio Problems

Some indicators that you may be experiencing portfolio problems are usually reflected in some common traits surrounding your product innovation. These typically include:

*Poor strategic alignment:* Projects are selected without reference to strategic selection criteria. This translates into no strategic direction for the projects selected; projects are not aligned with the business strategy; many strategically unimportant projects are in the portfolio; and R&D spending does not reflect the strategic priorities of the business. The end result is a scattergun R&D portfolio and a new product effort that does not support the company's innovation strategy.

*Low-value projects:* There are too many mediocre projects in the pipeline—too many extensions, modifications, enhancements, and short-term projects. Many of them are of marginal value to the business. This translates into a lack of high-value, high-reward projects, while the

few really good projects are starved for resources; they take too long and may fail to achieve their full potential.

*No focus:* Another common outcome of poor portfolio management is a strong reluctance to kill projects: there are no consistent criteria for Go/Kill decisions, and projects just get added to the active list. The result is a lack of focus—too many projects and resources thinly spread. This, in turn, leads to increased time to market, poor quality of execution, and decreased success rates. The pipeline is gridlocked.

*The wrong projects:* Poor portfolio management means that often the wrong projects are selected. With no formal selection method, decisions are not based on facts and objective criteria, but rather on politics, opinion, and emotion. Many of these emotionally selected projects fail, wasting scarce resources.

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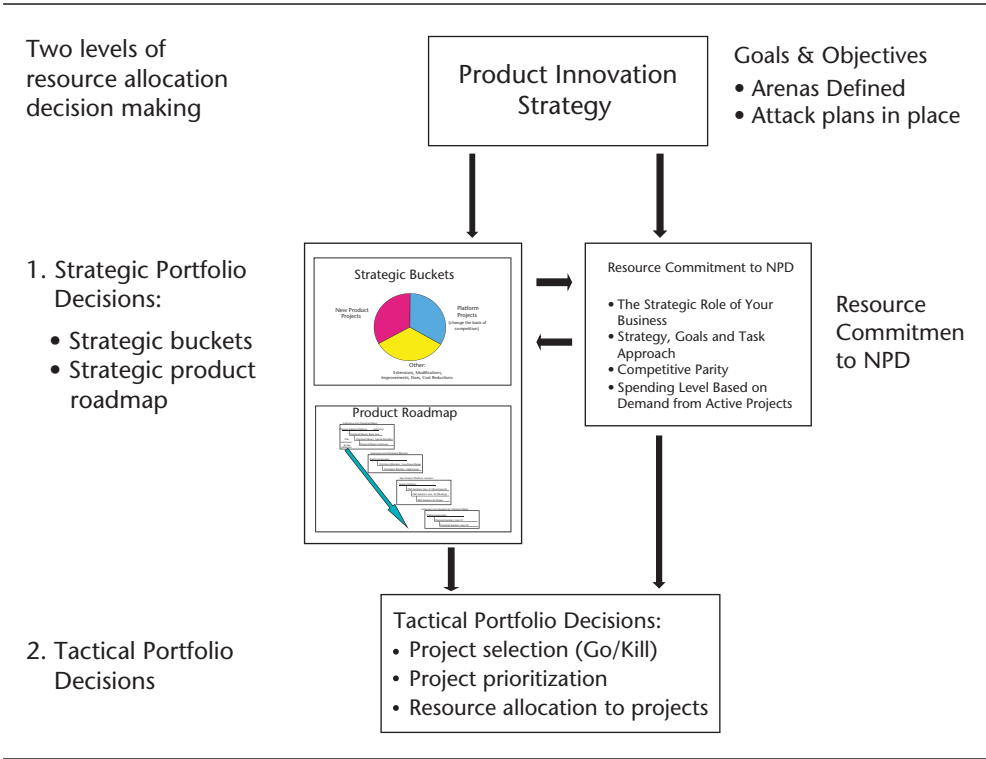
## 9.7 Developing a Strategic and Tactical Portfolio Management Overview

Let's now take a look at how to get started in portfolio management from both a strategic and a tactical point of view. If you are just beginning this journey, then the best approach is probably to keep it as simple as possible to start with and then develop your approach over time, leveraging input gained from experience. In Figure 9.2 the hierarchical approach is outlined, beginning with your product innovation strategy, followed by the high-level strategic portfolio view, and ending with the tactical portfolio decisions (Cooper and Edgett, 2009).

Step 1 is to address the strategic aspects of the portfolio. As noted earlier, the strategic portfolio is the interface with the product innovation strategy and seeks to define, in concrete terms, how the resources should be split up and into what key arenas. In other words, how much do we need to spend in each area to achieve our goals and objectives? Typically, if management has done a good job of creating and articulating a product innovation strategy, then the focus here shifts to how the business should deploy its product innovation resources (people and funds) and how it should split resources across different project types, markets, technologies, or product categories. By allocating real money and people to support the strategy, it now becomes real and not just a planning exercise.

A common technique used to illustrate and communicate strategic portfolio decisions is a visual portrayal (i.e., charts that outline the

FIGURE 9.2 THE PORTFOLIO MANAGEMENT SYSTEM AND ITS ELEMENTS



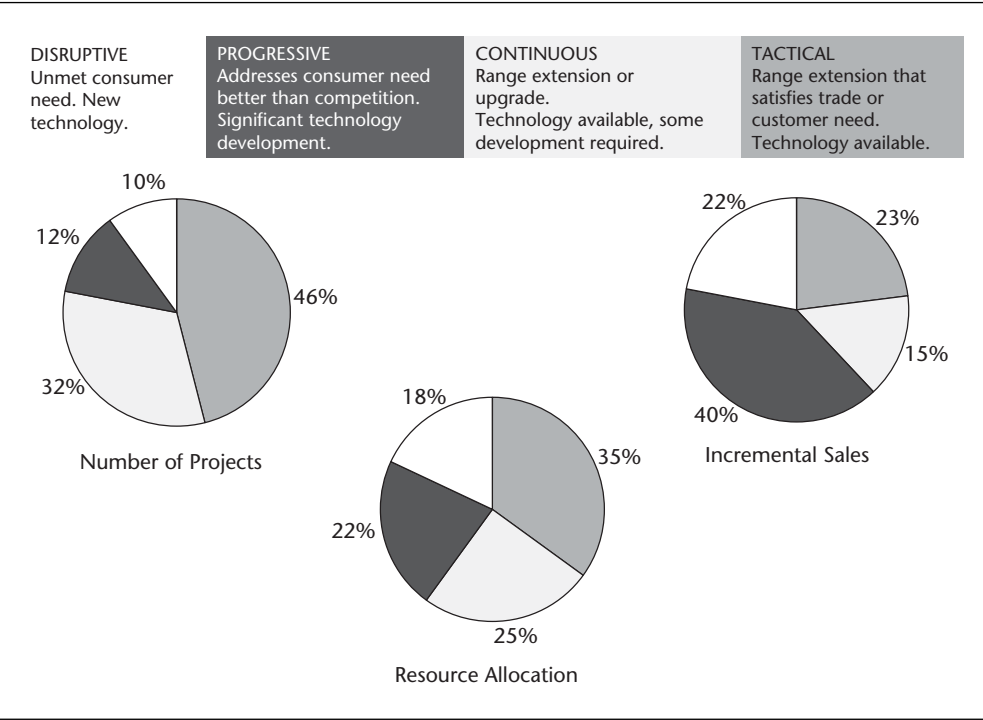
strategic product roadmaps; strategic buckets or arenas) and the total resource commitment necessary to achieve the innovation goals (money and/or people) for each strategic bucket. See Figure 9.3 for an example.

*Companies new to portfolio management should start by keeping it as simple as possible and then develop the approach over time, leveraging input gained from experience.*

## 9.8 Defining Strategic Buckets

When translating the business’s strategy into strategic portfolio decisions, a major challenge is determining the spending breakdown or deployment; that is, where does senior management need to spend its resources when it comes to product innovation—on what types of projects and in what product lines, markets, or technology areas? And how much do they need

**FIGURE 9.3 THREE DIFFERENT VIEWS OF A PORTFOLIO BY PROJECT TYPES**



to spend in each area? The strategic buckets model operates on the simple principle that implementing a strategy equates to spending money on specific projects. Thus, operationalizing the strategy really means setting spending targets within defined arenas.

What dimensions should be used to define these arenas? They should be the dimensions that management finds the most relevant to describe their own strategy. Some commonly used strategic buckets are product types, platforms, market segments, and project types. In the example provided in Figure 9.3, the organization uses a combination of various types of innovation (disruptive, progressive, continuous, and tactical) combined with project numbers, resource allocation, and incremental sales. This illustration follows the typical norm of about three different dimensions combining internal and external views. Try to avoid the common error some companies make of having too many different slices resulting in numerous charts, making it very hard to make any decisions. Having too



many charts often means that there is no clear understanding of what the product innovation strategy is and what has to be monitored to ensure that it is being implemented.

Following the identification of these strategic arenas, the next step is to determine the size of each bucket and how it should be subdivided. Different approaches are used here—for example, determining how much has been spent over the past few years or conducting a review of current allocations, industry benchmarks, and new spending shifts to enable strategy changes. The end goal is to allocate enough resources to each strategic arena to ensure that spending aligns with strategic objectives and that enough resources are being allocated to ensure, at a tactical level, that each subcategory has enough resources to perform successfully while achieving a balance among competing demands.

Unfortunately, there are seldom enough resources to go around and some tough choices need to be made. The first decision is how much resources in aggregate are needed to properly fund the initiatives to ensure a reasonable probability of success in achieving the strategic goals. The second decision is to properly allocate the funds among the different arenas. The process for this will usually require several rounds of allocation that result in a series of prioritization choices being made.

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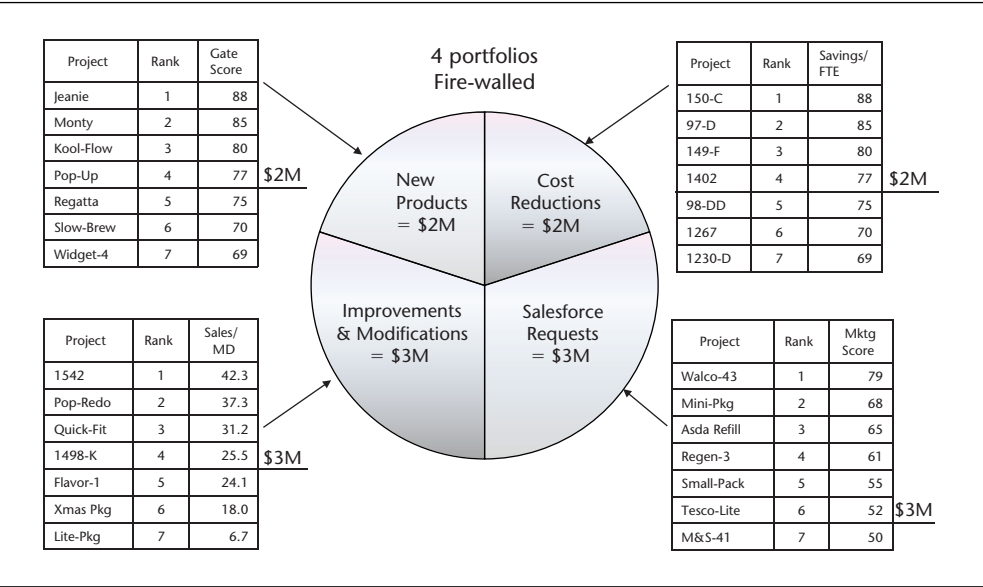
## 9.9 Tactical Portfolio Management

Tactical portfolio decisions focus on the pipeline and the individual project selection within it, but obviously they derive from the strategic decisions. So, the decisions are really about project prioritization. Questions typically addressed are: Are the projects in the pipeline of sufficient value to achieve our goals? Are they the right projects? What priority should these individual projects have? And do we have enough or too many projects in each part of the pipeline?

If your new product development process (Stage-Gate® process<sup>1</sup>) is working well, then the decision points (or gates) should be filtering out the weaker projects and approving the better projects to move forward in the process. Hence, your tactical pipeline reviews should not have to address the issue of whether the projects in the pipeline are good projects or not. Instead, the review will focus more on whether you have the right prioritization and mix of projects (Cooper and Edgett, 2008).

<sup>1</sup>Stage-Gate® is a registered trademark of Stage-Gate International; see [www.stage-gate.com](http://www.stage-gate.com).

FIGURE 9.4 COMBINING STRATEGIC BUCKETS AND PROJECT PRIORITIZATION



There are many different methods and approaches for rating and prioritizing projects. The challenge is create a simple process that allows you to capture the data and portray it in a manner that is easily understood and provides management with the information they need to conduct effective tactical portfolio management or pipeline reviews.

Figure 9.4 provides an illustration of an organization that created a straightforward approach. Note that the pie chart in the center of the figure captures their strategic allocation and bucket definitions. In this case, they have chosen four project types and have allocated a spending budget for each category. For each of these four categories, approved projects are listed in rank order from most to least valuable. Note that each category has its own scoring model or ranking criteria. New products are ranked based on gate scores, while, for example, cost reduction projects are ranked based on a productivity index (savings/FTE days). The category bucket called “new products” has been allocated a budget of \$2M, and the approved projects are rank-ordered based on the most recent gate score they received. All projects above the line are active and funded, while those below the line are approved projects that have been put on hold pending resource availability.

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## 9.10 Conducting Portfolio Reviews

Generally, periodic portfolio reviews are held by senior management two to four times per year to review the portfolio of all projects. Key issues and questions addressed at these meetings typically are:

- Are all projects strategically aligned to fit the business's strategy?
- Does management have the right priorities among projects?
- Are there some projects on the active list that should be killed or perhaps accelerated?
- Is there the right balance and the right mix of projects?
- Are there enough resources to do all of the projects?
- Is there sufficiency, that is, if these projects are done, will the business achieve its stated goals?

Portfolio reviews are holistic. They look at all projects together, but in much less detail than the gate reviews. Ideally, if the gates are working, few major decisions or corrective actions are required at the portfolio review. Some companies indicate that they only consider projects in aggregate at the portfolio review. However, if the gating process is not working well, then the majority of decisions will be made at these quarterly or semiannual portfolio reviews by default.

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## 9.11 Summary

Leading companies have recognized that the product choices made today determine what a business's product offerings and market position will be in the future. Companies are turning to portfolio management as an aid in helping management deal with the tough issue of focusing limited NPD resources while trying to optimize the return received from product innovation investment.

Which approach to portfolio management is right for your organization? This is not an easy question, as there is no single right answer. As you refine your approach to portfolio management, consider how you will ensure that the four key goals are being achieved—strategic alignment, maximization of value, achieving the right balance, and determining the number of projects the pipeline can support. Viewing portfolio management from the two different perspectives—strategic and tactical—is a useful approach to breaking down the different challenges.

The effort to get your portfolio management process working is well worth the effort it will take. Implementing a systematic portfolio management approach that strives to link strategic alignment of projects with their innovation strategies, prioritize and rank projects effectively for value maximization, and achieve the right balance and mix of projects will go a long way toward improving your product innovation performance results.

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Additional resources (articles and data) on portfolio management are available for download at [www.prod-dev.com](http://www.prod-dev.com).

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## CHAPTER TEN

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# IDENTIFYING SIGNIFICANT NEW BUSINESS OPPORTUNITIES: THE MAGELLAN PROCESS

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Deborah A. Mills and Paige Siempelkamp

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### 10.1 Introduction

Throughout its history, Corning has been a technology leader and has invested heavily in the invention and innovation that have made that leadership possible. For Corning, innovation is more than a buzzword, a strategy, or a core capability—it is our identity. From the glass enclosure that made the electric light bulb possible to the substrate for catalytic converters to the optical fiber that took the telecom system worldwide, Corning has built its business by inventing and commercializing high-value solutions to fundamental problems. Our long track record of innovation success is not a series of happy accidents but instead reflects a long-standing cultural commitment and steady investment in research, development, and engineering, including exploratory research—averaging about 10 percent annually, even during hard times. We are among a handful of U.S.-based companies that have operated research laboratories for more than 100 years.

Over the past quarter century we have begun to institutionalize this commitment by building a disciplined, systematic approach to managing innovation and business development—two inherently challenging endeavors. My coauthor, Paige Siempelkamp, is Vice President of Newry Corporation, a management consulting firm that specializes in product

commercialization strategy.<sup>1</sup> Newry has been an active partner with Corning for more than 15 years in devising innovation processes and implementing them rigorously, with a continued focus on markets and customers. This chapter focuses on one aspect of Corning's innovation approach, the Magellan Process, which identifies new business opportunities and evaluates their potential and attractiveness to Corning. Before describing the Magellan Process in depth, we will briefly look at the business context from which it arose.

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## 10.2 Corning's Approach to Innovation

When the telecom bubble burst in 2002, Corning was thrown into a fight for its life. The company had become too dependent on its highly successful optical fiber business, and when that business tanked, so did the performance of the entire company. Determined never to let the failure of a single business threaten the company's future, Corning decided to work on balancing the inputs to the innovation pipeline to create a more balanced output. With more variety and breadth in its early-stage businesses (inputs), Corning would arrive at a more robust and varied business portfolio (outputs), with less reliance on one or two critical businesses. The resulting commitment to research and innovation was stronger than ever. Whereas Corning's research and development group, Corning Science and Technology (S&T), had previously aimed to create one major new business every 10 years, revenue goals as of 2003 called for Corning to build two major new businesses a decade—a huge leap. To step up to this challenge and to improve the innovation hit rate, Corning devised:

1. An "Innovation Recipe" based on an analysis of Corning's historical innovation successes and failures
2. The Strategic Growth Organization (SGO), dedicated to opportunity identification, incubation, and business development.

Both improvements were fundamental in paving the way for the Magellan process to generate more new business ideas to fill the innovation pipeline.

<sup>1</sup>Mel Patrell Furman, Newry's Director of Communications, provided communications support for this chapter.

### 10.2.1 The Innovation Recipe

With the optical fiber market in shambles and its largest, most profitable business decimated, Corning overhauled its technology strategy, analyzing past successes and failures to find a way forward. We looked at six of Corning's major innovations (the glass envelope for the light bulb, the television tube, Corelle® dinnerware, optical fiber, the catalytic converter substrate, and the LCD glass substrate) and found strong commonalities. Each of the products is a *key enabling component* of a larger system (e.g., a catalytic converter substrate is an enabling component of an auto emissions control system). Each product brings together a *unique material* and a *unique manufacturing process*, both linked directly to Corning's core capabilities (e.g., the LCD glass substrate is made from alkali-free glass using a fusion forming process). Each product responds to a *very demanding set of requirements* that were identified only through *deep understanding of a specific technology* and *insight into customers' most difficult systems problems*. And in each case, Corning was able to achieve and maintain strategic control based on the *uniqueness* of the solution, the *intellectual property* associated with its invention, and/or *unique capital investment* (e.g., in large-scale fusion glass production facilities to achieve low unit cost). Where major product development efforts failed, at least one or two of the recipe components were missing.

Armed with this recipe, Corning could readily assess how well a new business idea would fit with its capabilities and strategy. We could also use various elements of the recipe as lenses on the universe of new ideas. Our thinking about innovation was newly informed by key components, core capabilities, and sources of strategic control.

### 10.2.2 The Strategic Growth Organization

Corning created SGO to fuel the corporation's strategic renewal. Staffed with equal numbers of commercial managers and technologists, the organization was charged with:

- Identifying new ideas and opportunities with the potential to become major new businesses, including high-value, complex systems problems that Corning could solve by developing keystone components. Working closely with the research organization, SGO systematically searches for opportunities in newly defined markets and emerging technologies, and evaluates their potential to become major Corning businesses. We also build relationships with industry thought leaders who help fast-track our understanding of unfamiliar technologies and identify potential development partners.

- Growing large new businesses—developing the opportunity into a fledgling business, acting as an incubator, and, where appropriate, continuing to build the business until it can stand on its own or become part of one of Corning’s divisions. We build technical and/or market understanding to establish the viability of these new businesses, test the value proposition and business model with customers, and help the new business create the infrastructure it needs—from manufacturing capability to human resources support.

Part of Corning’s S&T division, SGO reports to Corning’s Chief Technology Officer, alongside the research, development, and engineering functions, all of which help identify and support opportunities as they grow into standalone businesses. Research, in particular, works hand in hand with SGO to assess technical feasibility/difficulty, substitute technologies, performance attributes, and so on.

Governance of most of SGO’s activities is provided by the Corporate Technology Council (CTC), a monthly forum of Corning’s top technical leaders. The CTC ensures that SGO’s efforts are aligned with corporate strategy and investment priorities. SGO also works with the Growth & Execution Council on opportunities that have been vetted by the CTC and require additional championship and, often, investment.

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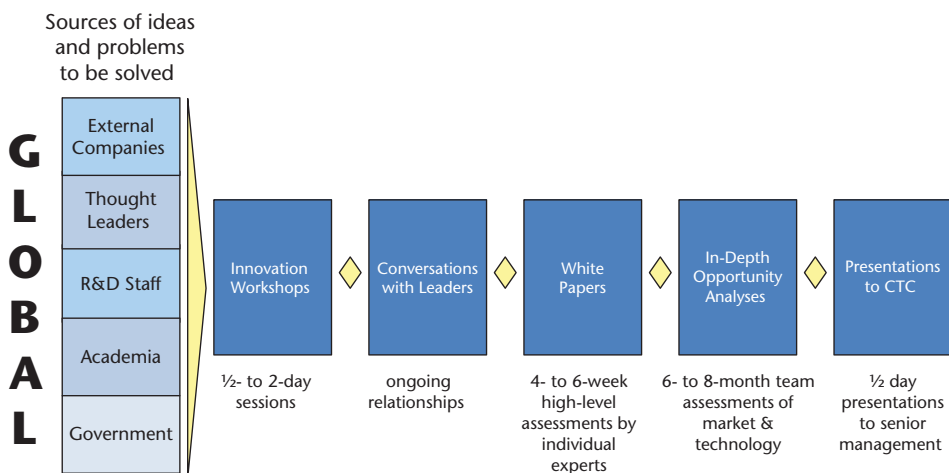
## 10.3 Magellan Process to Surface and Vet New Ideas

To find Corning’s major businesses of the future, SGO developed a process to identify opportunities and evaluate their potential and attractiveness to Corning. The process had to:

- Be systematic and easily replicable
- Cast a broad net to avoid missing areas of opportunity
- Maintain a focus on markets and customer problems rather than existing technologies
- Quickly eliminate ideas with little promise
- Rigorously assess the commercial potential of ideas that might merit research funding.

Working with Newry and other advisors, SGO devised the Magellan Process to meet these requirements (Figure 10.1). An award-winning approach to generating new business ideas based on market needs, Magellan includes five elements:



**FIGURE 10.1 THE MAGELLAN PROCESS**

1. Innovation Workshops
2. Conversations with Leaders
3. White Papers
4. Opportunity Assessments
5. CTC presentations and decision making

The Magellan Process—with its search for important problems to which Corning can provide solutions—is as fundamental to S&T as its large research staff, depth of capability in glass and other inorganic materials, and constant flow of inventions and patents.

In establishing the Magellan Process, we sought to systematically accelerate the pace of idea generation and expand its scope. In the past, customers came to Corning with problems to solve. With the globalization of innovation and the acceleration of information transfer, Corning needed to take the serendipity out of idea generation and proactively search for problems it could solve. Thus was born the Innovation Workshop, which became one of the principal tools in the Magellan Process.

### 10.3.1 Innovation Workshops

A Magellan Innovation Workshop brings Corning scientists and SGO staff together with global thought leaders from academia, government labs, and

industry—in effect, bringing a thought-provoking conference to Corning to reach a wider audience within the research and new business community. Each of these mini-conferences (lasting from one-half to two days) presents a group of speakers who address the future of their area of expertise and the issues their industry or technology will face in the next 5 to 15 years. The workshops are typically well attended, often with 100 or more participants.

Most workshop topics are broad enough to generate diverse ideas but narrow enough that a few experts can highlight the state of the art and principal technical and market adoption issues in a day or less. Some workshops are more focused, designed to get participants up to speed very quickly on a specific emerging technology that could prove interesting to Corning. Occasionally, we offer a two-day Innovation Workshop on a broader industry sector, such as renewable energy or advanced transportation, covering a wide range of technologies and the technical, market, and regulatory issues that are creating opportunities.

Setting up an Innovation Workshop is generally a two- to three-month project, beginning with a week or two of background research to help identify specific areas of interest to Corning (e.g., technical and economic issues, current and potential opportunity areas, and regulatory and social policies), as well as experts who can address them authoritatively. Speakers are vetted, recruited, and briefed on the issues and objectives for the day, and are assisted with presentation development and logistics. Once at Corning, they meet informally with key workshop sponsors, then spend one to two days presenting their perspectives and listening to those of the other speakers. Afterward, the speakers join together in a roundtable discussion and a free-flowing question-and-answer session with the Corning participants. After the workshop, SGO holds a structured brainstorming session to identify areas that should be considered further. These facilitated sessions are not focused on product ideas but rather on problems that are important enough to warrant further investigation. Typically, because of intellectual property (IP) concerns, outside speakers are not involved in these brainstorming sessions.

In 2004, SGO initiated Magellan I, a two-day workshop with a very broad array of topics: energy, the environment, transportation, materials, manufacturing, health care, communications, computing, and buildings. This workshop provided a high-level perspective on many different sectors and generated a large number of ideas for further exploration. Based on this broad exploration, we concluded that one of the most critical problem areas to which Corning could contribute was energy and the environment, and it has remained a major focus of Corning's innovation efforts.

Innovation Workshops have proven invaluable in engaging the Corning community in generating new business ideas. They help us quickly

understand the major market problems, the technical issues, and the potential value of the solution. Workshops afford ample opportunity for interaction and questions, enabling scientists to relate the technical issues to their own research interests and backgrounds—and thus plant the seeds of new ideas.

### 10.3.2 Conversations with Leaders

In parallel with the workshops, Corning frequently conducts targeted sharing sessions with companies that are leaders in their fields. These sessions enable us to identify emerging problems that our technologies might address. Like the Innovation Workshops, Conversations with Leaders help systematize the identification of difficult systems problems. These conversations spring from several sources, including top-to-top meetings—orchestrated, opportunity-related discussions between key Corning executives and their counterparts in global systems companies. These meetings, with customers and noncustomer companies alike, are designed to uncover major technology-related business opportunities. The discussions are often conducted in conjunction with visits to and demonstrations at Corning. They often involve a dozen or more key scientists, scientific Fellows, Strategic Growth participants, and division commercial people. It is not uncommon for Corning's CEO, CTO, and Director of Research to be actively involved in these discussions, which often reveal important long-term opportunities.

### 10.3.3 White Papers

Innovation Workshops, the structured brainstorming that follows, and Conversations with Leaders typically produce hundreds of ideas, many of which merit further exploration. At the end of the workshop cycle, SGO leadership and key research personnel spend half a day ranking the ideas against standard criteria to select the 20 to 30 ideas that will be evaluated further. To make this very large task manageable, we devised the White Paper, a framework for a brief, low-cost assessment of an idea's potential. The objective of a White Paper is to determine whether there is a real problem to be solved in the marketplace and whether it is compelling enough to warrant in-depth analysis. A White Paper is:

- *An opportunity scan rather than a deep “drill-down”*—a top-level view of business and technology issues
- *Decision-oriented*—designed to answer a well-defined set of questions that will support a decision on whether to evaluate the opportunity further
- *Rapid*—completed in three to six weeks

- *Management-ready*—includes a one-page summary, standardized across White Papers and used in communications with S&T and SGO management
- *Consistent in format*—to enable side-by-side comparison with competing opportunities against standardized criteria

White Papers are developed by SGO staff, Corning researchers, or external consultants. Each one begins with an extensive secondary research effort focused on:

- *Macro trends*—demographics, infrastructure, society, culture, energy, politics, economics, globalization, and so on
- *Market characteristics*—large, growing, addressable markets, favorable timing, identifiable customers, and a competitive landscape sufficiently open for market entry
- *Problem identification*—new challenges or problems, suggesting unmet needs and user willingness to adopt new products/technologies
- *Technology assessment*—competing approaches to meeting the needs identified

White Paper authors supplement their research by interviewing a handful of Corning specialists and external experts to get answers to key questions, test hypotheses, or fill in gaps in understanding. As they gather and synthesize information, authors continually evaluate the opportunity's fit with Corning's business and technical capabilities; the Innovation Recipe provides a rough rule of thumb in this regard.

When the research is complete, findings are summarized in a 15- to 25-slide PowerPoint presentation. Typically, multiple White Papers are prepared at the same time and delivered to SGO staff in a one- or two-day meeting, the *bakeoff*, in which they compare the opportunities and select those to be investigated further. Each presentation includes a standardized one-page summary that covers key business drivers, an overview of the problem and opportunity, market size and growth potential, Corning's unique play, key participants in the industry, potential keystone components of the solution, potential customers, and hurdles/barriers to success. In addition, it scores the opportunity on a scale of 1 to 7 against each of eight clearly calibrated criteria designed to uncover the most important opportunities that could leverage Corning's capabilities. The resulting scores are used to select the ideas that merit detailed Opportunity Assessments—though those decisions can nonetheless be controversial

and contentious. By the end of the day, no more than a handful of the 20 or 30 White Papers will be selected for in-depth assessment.

#### 10.3.4 Opportunity Assessments

An Opportunity Assessment is a detailed evaluation of the commercial and technical viability of a new business opportunity, conducted over a period of four to six months. They address many of the same issues as White Papers but in much greater detail and depth; the objective is to support a data-driven decision on whether the opportunity merits investment, based on:

- A more detailed look at the problem to be solved and Corning's potential solution, that is, the component product (or material/product) and the value it provides to the larger system
- A technical profile of the underlying technology versus incumbent and substitute technologies, including capabilities, performance specifications, and cost/pricing implications
- A market overview, including: (1) a current estimate and medium-term projection of the market size (for both the system and key component) in units, with revenue projections based on the technology replaced and the incremental value the new product would create and (2) market segmentation by application, industry, geography, and/or customer group
- An overview of the potential customer base, with attention to current and potential applications, current technology and the potential value of an improved solution, buying processes, unmet needs, current suppliers, and end customers
- A map of the value chain from raw materials to customers, indicating the drivers of the business at each stage, the principal players, and barriers to entry, such as exceptionally high switching costs or long-term supplier contracts
- A description of the competitive landscape, including the market positions, technical approaches, and IP of major players that may block Corning from capturing a substantial share.

To obtain the deepest insight, these assessments involve extensive field interviews with a range of industry participants, such as technical experts, researchers (academic and government), customers, and suppliers. To drill down on specific issues, we employ specialized tools, such as IP mapping, alpha teams to tap researchers' ideas for alternative products and technical approaches, technology roadmaps, and adoption curves.

### 10.3.5 CTC Presentations and Decision Making

For opportunities that appear attractive, SGO presents to the CTC a case for moving forward. The CTC is the governing body for early-stage innovation opportunities; they meet monthly to review, discuss, and direct the pursuit of opportunities. The CTC is chaired by Corning's CTO and includes his staff as well as representatives of Research and the Office of the CEO. The CTC decides whether the opportunity justifies the long-term investment required to pursue it. This forum and its members demand tough, objective analysis and set a high bar for review.

CTC presentations are geared to making a convincing, fact-based business case to a top management audience, addressing questions such as:

- What is the potential opportunity and what is driving it?
- Is there a real problem to solve?
- What can Corning do?
- Can we be unique?
- Is it sustainable?

Following the presentation, the CTC decides among three options:

- Initiate research on the opportunity, sometimes focusing on one segment rather than the technology and market as a whole.
- Do not pursue the opportunity.
- Redirect research efforts to meet a particular need.

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## 10.4 The Magellan Process at Work

Six years after designing the Magellan Process, SGO has had ample opportunity to apply it to real-life ideas and opportunities. Mercury abatement is one example of an opportunity that emerged from the Magellan Process after several iterations of workshop, ideation, and White Papers. We briefly touch on another opportunity—energy storage and conversion—as a second example of the process in practice.

### 10.4.1 Mercury Abatement

Many new business ideas proceed directly and sequentially through the Magellan Process; others, like mercury abatement, follow a more iterative path. In 2004, SGO's two-day, broadly scoped Innovation Workshop pointed us toward energy and the environment as areas presenting significant problems

to be solved. This workshop was designed to involve Corning's research community and build enthusiasm; it included 14 speakers and 11 brainstorming sessions. More than 150 Corning people attended the workshop, and their ideas filled more than 1,000 pages of flip charts. The result was our first round of White Papers and Innovation Workshops focused on the technical problems blocking energy efficiency and environmental improvement.

Given the dominance of coal in power generation, we decided to drill down on clean coal technology and the technical problems blocking its broader commercial adoption. We prepared a White Paper on clean coal technology (both combustion and gasification), which identified many unsolved problems in clean coal process technologies. We revisited clean coal technology in a focused workshop that highlighted these process problems and revealed major unsolved materials problems associated with them; we identified mercury abatement as an important problem with no clear solution, and thus we began an Opportunity Assessment, rigorously testing hypotheses on the drivers of change (e.g., global dependence on coal for power generation, pending global regulations), the nature of the problem (high levels of coal-related emissions, composition of flue gas), the competitive landscape, value created versus investment in development, and Corning's product concept, technical approach, and potential for IP. We concluded that mercury abatement for clean coal technology was an attractive opportunity for Corning to pursue. The CTC concurred, and a research program was launched.

#### 10.4.2 Energy Storage and Conversion

Like many other ideas arising from the energy-focused workshops, the energy storage opportunity is driven by macro concerns about energy security and global warming. According to thought leaders in the automotive industry, concerns over CO<sub>2</sub> and fuel economy will drive electrification of the power train and will require new kinds of energy storage devices. A virtual teardown of the advanced power train revealed that current energy storage devices were too big, too costly, and too short-lived. In addition, the inefficiency of the energy conversion process in automobiles highlighted the need to convert waste heat to electricity. In other realms, such as consumer electronics and medical devices, thought leaders made it clear that the future will demand a whole new generation of batteries, with a step change in power-storage performance. In response to these emerging requirements, Corning launched development of a whole suite of products—ultracapacitors, thermoelectrics, advanced batteries (and critical battery components), among others—to provide solutions to fundamental problems of energy storage and waste heat recovery.

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## 10.5 Results to Date

As a means of systematically increasing the number and rate of early-stage business opportunities entering Corning's innovation pipeline, the Magellan Process has been tremendously successful, as summarized in Figure 10.2:

- More than 15 Innovation Workshops have been conducted, involving more than 100 external experts and thought leaders.
- More than 500 White Paper topics have been proposed, and 100 of them were completed.
- About 40 detailed Opportunity Assessments have been completed through research, field interviewing, and specialized early-stage market and technology analysis.
- With the approval of the CTC, 15 major research projects have been initiated, each of them a Stage I business in Corning's Innovation Process.

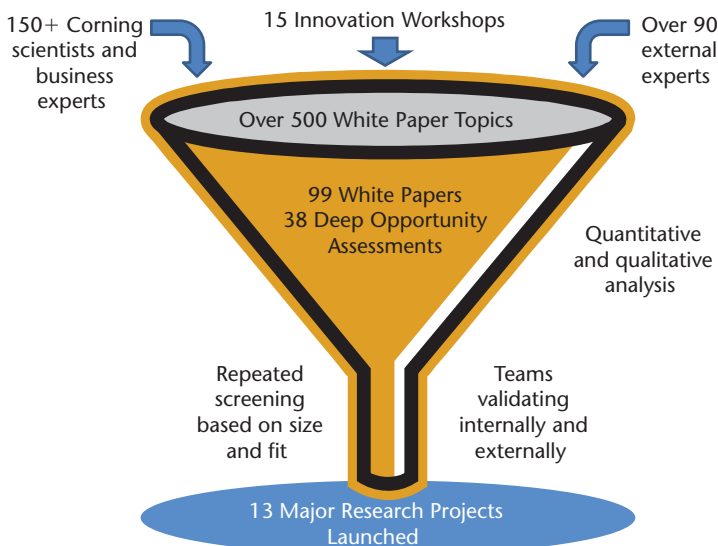
Our seven years of experience with the Magellan Process have also been a significant learning experience for SGO and S&T as a whole. The lessons we learned include:

- *Investment—and patience—are essential.* Success requires a lot of time, effort, and organizational commitment.

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**FIGURE 10.2 MAGELLAN PROCESS RESULTS.**

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- *People make the difference.*
  - The right teams of technical and marketing professionals are critical to vet these opportunities through Opportunity Assessments and extensive interviewing. Our people have great depth and breadth in technology and market understanding.
  - Domain knowledge is particularly important to assessing an opportunity's potential.
  - Senior leadership commitment and championship are essential.
- *Managing the process requires a commitment to following it, a willingness to adapt it as necessary, and an unflagging focus on the long-term outcomes.* For example:
  - Bring in ideas from multiple sources but keep the process the same.
  - Develop hypotheses and rigorously test them.
  - Be willing to abandon projects—but not too early.
  - Trust the process—but keep it flexible and adapt it to the times and the corporation's strategic priorities.
- *Partnerships are powerful.* External consultants and allied companies can provide creativity and critical resources as well as pathways to new customers and strategic partnerships.

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## 10.6 Summary

The front end of the innovation process is critical and often very challenging. The Magellan Process is a proven methodology that addresses this challenge and is continually evolving as we build and manage Corning's innovation pipeline. Our portfolio of products is exceptionally diverse, from “new-new”—totally new products that address markets unfamiliar to Corning—to adjacencies, which adapt Corning's existing technologies and products to new applications and customer needs. While SGO has been unstinting in its analytical rigor, it has been flexible in adapting the Magellan Process to a range of innovation initiatives. This underlying adaptability has made Magellan a prize-winning innovation process and has provided invaluable support to Corning as a world-class innovator.

**Deborah A. Mills** joined Corning in 1977 and is currently Director, Early Stage Marketing, Strategic Growth in Science and Technology, focused on identifying new opportunities to feed the research portfolio. Mills developed the Magellan Process for opportunity identification; it has been identified as a best practice by the Product Development and Management

Association. Formerly, Mills was the Director, Marketing Strategy in Corporate Marketing. Throughout her career at Corning, Mills has held leadership positions in sales, marketing, and strategy for Corning Asahi Video, Life Sciences, Display Technologies, Corning International, and Science and Technology.

Mills holds a Bachelor's degree in Psychology from Adelphi University and a Masters in Business Administration from Carnegie-Mellon University.

**Paige Siempelkamp** is Vice President of Newry Corporation. In her 25 years in management consulting, Paige has focused on innovation and commercialization of emerging technologies, particularly identification of white-space opportunities to drive research investment. Paige's recent client engagements include leading an effort to identify applications and potential customers for a materials manufacturer; drawing on the perspective of industrial designers in consumer products. She has also managed opportunity identification efforts on a range of topics, including green buildings and sustainable construction materials; high-performance glass in appliances, architectural, and automotive applications; and clean coal technologies.

Throughout her consulting career, Paige has planned and facilitated dozens of brainstorming sessions and innovation workshops, bringing together scientists and industry experts in a variety of advanced technologies. She has also played a major role in developing commercialization and business development education for leaders of emerging high-tech businesses, as well as assisted clients on issues of organizational development.

Before joining Newry in 1998, Paige worked with New York Consulting Partners, William Mercer Consulting, the U.S. Department of Housing and Urban Development, and the Dana Farber Cancer Institute. She has a BA in Sociology from Drake University and an MS in Mass Communications from Boston University.



## CHAPTER ELEVEN

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# WE-NESS, KNOWLEDGE SHARING, AND PERFORMANCE IN NEW PRODUCT DEVELOPMENT TEAMS

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Hyunjung Lee and Stephen K. Markham

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### 11.1 Introduction

We introduce a marriage and family therapy (MFT) concept called *we-ness* to help improve new product development (NPD) performance by focusing on relationships between team members. In this chapter, we (1) describe the concept of we-ness, (2) explain the relationship between we-ness and knowledge sharing in NPD teams and its effect on product performance, (3) present a model that explains how more knowledge sharing occurs when we-ness-enhancing actions are taken and how it increases product performance, and (4) suggest how NPD organizations can create more family-like and productive environments.

We-ness is commonly associated within the relational dynamics among immediate family members (Reid, Dalton, Laderoute, Doell, and Nguyen, 2007; Seider, Hieschberger, Nelson, and Levenson, 2009). It is important in social environments because the formation of close relationships involves a partial transformation of the self—a shift from being separate individuals to being joined with others (Reid et al., 2007; Seider et al., 2009). We-ness will help product development managers foster a more productive environment among team members and even between teams inside and outside the organization.

11.2 We-ness Defined

We-ness is defined in various ways: distributed we-ness, collective social we-ness, and family we-ness. *Distributed we-ness* is based on commonalities among people based on group membership (Tajfel, 1982), such as being alumni from the same university (Mael and Ashforth, 1992). Another example is sports fans; they don’t need to interact with or like each other and still consider themselves to have we-ness. One may like people as team members and at the same time dislike them as individuals.

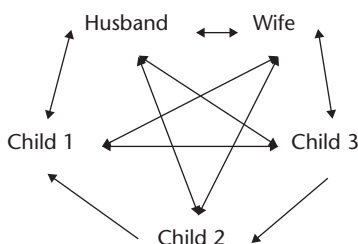
*Collective social we-ness* goes beyond the simple aggregation and commonality among people (Choi, Kim, and Kim, 2000). Collective social we-ness draws on culture, citizenship, ancestral heritage, common customs, and core religious beliefs.

*Family we-ness* does not arise from simple commonalities such as nationality, age, or alumni status. We-ness is derived from an undifferentiated psycho-social identity that gradually emerges from the individuals’ shared experiences and understanding. *Undifferentiated identity* refers to the phenomenon of people drawing so close together that their perceptions and opinions merge. In cases of high we-ness, people share their personal and work concerns, take care of one another, and even sacrifice themselves on behalf of others. Figure 11.1 portrays we-ness as a continuum from self-to-we; it includes going from a set of differentiated individuals to being an undifferentiated group.

MFT researchers study we-ness as a core concept of family relationships (Nye, 1976; Reid et al., 2007; Seider et al., 2009). Family we-ness suggests that families tend to give rather than receive help (Hoyt, Fincham, McCullough, Maio, and Davila, 2005). Nye (1976) pointed out that a family relationship is not a zero-sum game. Family is humanistic in its relationships rather than calculating, independent, and rationalistic (Maio, Thomas, Fincham, and Carnelley, 2008). As a family, we-ness includes spontaneous responsibility and sacrifice for the members. It helps to understand, support, and protect others even if they are in a bad situation. We define we-ness as a sense of togetherness in

FIGURE 11.1 A CONTINUUM OF WE-NESS:  
IDENTITY DIFFERENTIATION.



**FIGURE 11.2 MFT ADDRESSES COMPLEX RELATIONSHIPS.**

terms of psychosocial relationship, which increases trust in and sacrifice for others.

MFT explicitly addresses the whole family system, including husband and wife, parent and child, and child and child, as well as extended family including grandparents, aunts, and uncles. Many motivation, leadership, and team constructs are designed only to address the relationship between the leader and the followers. That corresponds to successfully managing work groups, but success in NPD requires managing a more complex set of interactions between all team members. MFT models and interventions are designed to address the complexity of the multiple people in different roles with different capabilities and responsibilities—such as NPD teams. MFT practices have been applied to a wide variety of situations, such as organizational change, organizational dynamics, and system theory. In fact, MFT is better suited to address the complexity of NPD than most team concepts presently used. MFT, and we-ness in particular, were designed to address complex environments. Figure 11.2 demonstrates the relational complexity addressed by MFT. In the figure, each member is connected to every other member in reciprocal relationships unique to each pair. In reality, the complexity is even greater since relationships could include one or more people on each side of the relationship. One child and one parent could be in a relationship that is engaged in an argument with two other children and the other parent. Coalitions between members constantly form and reform on a variety of issues. While a few team models recognize this complexity, MFT explicitly recognizes it and is designed to diagnose and intervene with all members.

### 11.3 We-ness in NPD Teams

The use of teams is pervasive and systematic in product innovation. Effective NPD teams have been described as groups of people with shared goals and norms of cohesion and performance. Teams are most effective when

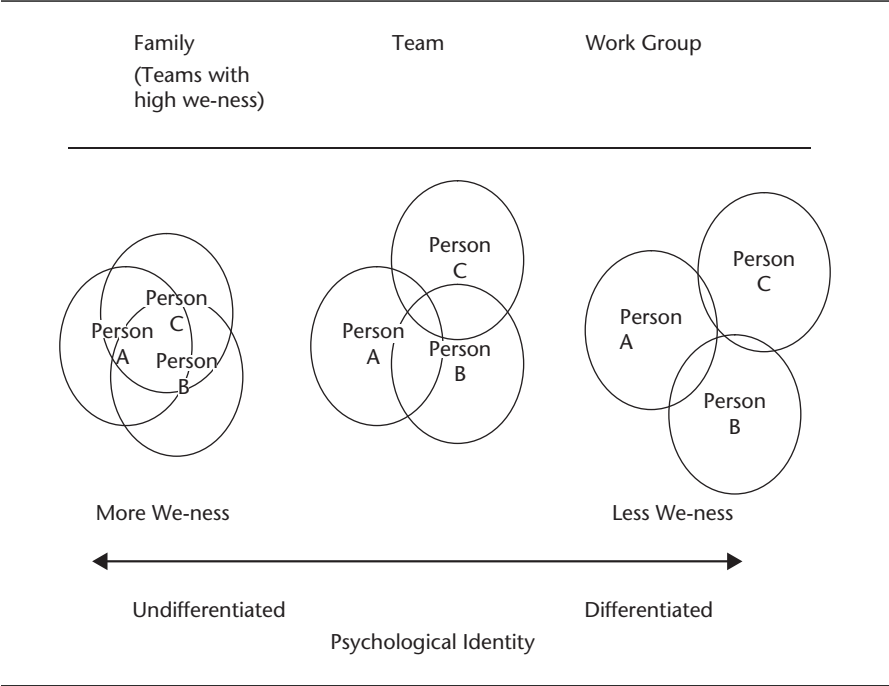
they focus on achieving predetermined goals in an efficient development or production process, but they may not be as effective when deciding what to do. NPD team effectiveness is enhanced with higher levels of family-like we-ness.

*Effective NPD teams are groups of people with shared goals and norms of cohesion and performance.*

Figure 11.3 shows that a higher level of family-like we-ness increases the team members’ psychosocial closeness, creating a team with an undifferentiated identity, as depicted by increasing we-ness between individuals. This creates an environment of free-flowing information sharing conducive to the complexity of NPD.

At the other end of the spectrum are work groups that require lower levels of we-ness in which the individuals may remain differentiated and still function well. It should be noted that while the tasks generally carried out by work groups do not require high levels of we-ness for high performance, these groups can experience high levels of we-ness due to the length of time together, shared experiences, achieving common goals, and overcoming obstacles. As a psychosocial construct, we-ness is gratifying

**FIGURE 11.3 WE-NESS IN TEAMS AND WORK GROUPS**



regardless of the task type; experiencing closeness with other people is intrinsically enjoyable.

The early stage of NPD is considered to be one of the greatest opportunities for improving product performance (Kohn, 2006). As the task of developing innovative new products moves upstream from product development to the front end of innovation, the complexity and richness of information increase. As the information requirements increase, we questioned the validity of the team metaphor for use in the early stage of NPD. Teams may not be the best design to address the front end of innovation, where the tasks may require more information and knowledge sharing. The challenge of this stage requires multiple perspectives, more flexibility, and more ideas.

Work groups are conducive to repetitive tasks of production; establishing highly interactive teams may not be appropriate. This is because the information needed in a production environment does not change from day to day, so high interaction with members is not needed throughout the day. As the task moves from production to development, work groups may not be sufficient to address the complexity of product development, so teams are formed with the necessary flexibility to conduct the less formalized task of development. As the team moves up the development continuum to the front end of innovation, information-sharing requirements exceed the capabilities of a team structure, just as development information-sharing requirements exceed the capabilities of a work group.

A primary difference between NPD and front-end innovation is that NPD teams exist to figure out how to do something, while front-end innovation requires the team to figure out what to do. This is not a subtle difference.

*Front-end teams figure out what to do, while NPD teams figure out how to do.*

Product development systems are very effective at figuring out how to develop a product, but deciding what product to develop is an even more unstructured task. An NPD “family” (a team with high we-ness) is more able to address the complexity of product development, especially unstructured critical decisions made in the front end of innovation. Families are more able to share critical information and solve problems.

Typically, NPD teams push and evaluate members based on their contribution to help the team win. The pressure to win may stifle the sharing of crucial information that might slow the team down. The team metaphor fosters competition and a “win at any cost” norm. Team members legitimately try not to let the team down. As laudable as this sentiment is, it may be counterproductive in complex product development

scenarios when making a correct decision is more important than letting the team down. Thus, team may be the wrong metaphor for front-end innovation.

A family is more likely to resist unrealistic expectations because the team members are more able to share deep knowledge and understanding with one another; they are more able to articulate realistic assessments and estimates to management and provide mutual support to form and hold reasonable opinions (Hoyt et al., 2005; Seider et al., 2009). In addition, teams with high we-ness are more able to disagree and call assumptions into question because family members are more secure about being accepted by the group and are more able to speak freely.

Table 11.1 compares workgroup, team, and family characteristics. By *family*, we refer to teams with high levels of we-ness. Family structures are closer to those of a clan, where there is unconditional acceptance based on identity, rather than those of a team, where membership is contingent on performance. The performance norm for a family is to do the right thing rather than to accomplish an objective. Membership and identity for a we-based team extend beyond the current project. This is particularly adaptive for companies in circumstances where direction is being set, such as deciding which project to pursue. Teams that are formed for the purpose of working on a single project very often promote that project. This leads to a critical norm difference in that families sacrifice for the person rather than the person for the team. Families are by nature more paternalistic. This can lead to more

TABLE 11.1 COMPARISON OF WE-NESS CHARACTERISTICS.

Characteristic	Workgroup	Team	Family
Structure	Hierarchical	Membership	Clan
Representation	Single discipline	Interdisciplinary	Interdisciplinary
Performance norm	Efficiency	Goal attainment	Do the right thing
Sacrifice	Balanced transaction	Individuals sacrifice for the team	The team sacrifices for the individual
Leadership	Supervisor	Team captain	Paternal
Sphere of Influence	Work rules	Project scope	Unlimited
Interaction	Inoffensive	Get along with each other	Be part of the family
Acceptance	Performance based	Mutual support	Unconditional



training and mentoring of new people. Another family norm is that the sphere of influence of the members expands beyond the boundaries of the team project. This again fosters a higher level of knowledge sharing as persons become part of the family rather than just team members. Critical to higher levels of knowledge sharing is the sense that acceptance is unconditional; people will not be thought less of because they deliver bad news.

Of course, with all families, these characteristics can have downsides. Family members can squabble, rebel against paternalistic control, recoil against intrusive involvement in personal matters, and become dysfunctional. People may not want such close relationships with coworkers. Just like real families, NPD families will develop dynamics that may need external mediation to resolve and can seriously degrade performance. The tighter the group, the more difficult it may be to integrate new members. Of course, MFT directly addresses changing parents, siblings, half-brothers, and half-sisters on a routine basis. The point is that the family metaphor offers a structure that is more able to address complex development scenarios than the team metaphor. An NPD manager may not want to facilitate the development of families for simple projects or repetitive work. Table 11.2 recognizes that there are logical limits to and applications of the family metaphor.

The difference between a team and a family is as fundamental as it is profound. Family is a metaphor that evokes more caring, patience, understanding, and information sharing. We-ness suggests a family environment where everyone is involved in, and supportive of, everyone else’s work. Rather than focusing on individual roles of team members, families are willing to drop what they are doing to lend a hand to each other. An imbalance of inputs and outputs is better understood and tolerated in a family. Correction of behavior may also be more direct and effective. Members are sensitive to the needs and feelings of other members and help them wherever and whenever possible. We-ness allows more knowledge sharing, which leads to increased product performance.

TABLE 11.2 EFFECTIVENESS OF FAMILIES AND TEAMS.

	Front End	NPD
Family	Highly effective	Less effective
Team	Less effective	Highly effective

# 11.4 We-ness in NPD Performance

We-ness is applied to in-team, between-team, and between-organization relationships that are critical for knowledge sharing to increase product performance. (refer to Figure 11.4). As Figure 11.4 shows, the model has two parts. The first part explains why we-ness activities increase knowledge sharing; the second part explains how knowledge sharing leads to higher performance.

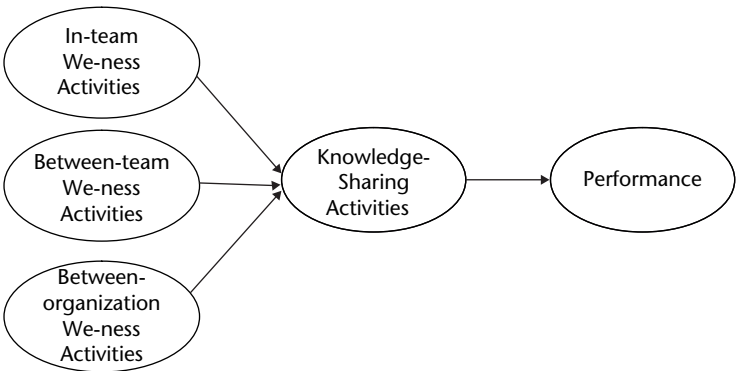
## 11.4.1 We-ness Leads to Knowledge Sharing

We now identify major MFT concepts used to build we-ness in families and then extend/translate these to develop we-ness relationships in NPD teams. The MFT concept is first identified in *italics*, followed by the technique and its potential product development application.

**11.4.1.1 In-Team We-ness.** The following activities will foster higher levels of in-team we-ness, resulting in more knowledge sharing.

1. *Establish Healthy Communications Early/Fast Startup Techniques.* Premarital counseling helps couples create concrete connections that promote we-ness and establish a healthy style of communication. Similarly, for NPD, fast startup as a preworking technique to improve communications promotes members' we-ness and increases knowledge sharing.

**FIGURE 11.4 WE-NESS AND KNOWLEDGE SHARING IN NPD PERFORMANCE.**



2. *Families Share Goals/Clear Team Goals and Objectives.* Families who share common goals have more we-ness and, hence, share more information and achieve deeper understanding. In NPD, clear goals provide a basis for clear communication among members and help promote knowledge sharing.
3. *Relationship Building/Team-Building Exercises.* MFT techniques like providing feedback or behavioral rehearsal have been used to modify family interaction patterns, enhance understanding and information sharing, and increase we-ness. In the same manner, NPD teams that engage in team-building exercises are more likely to experience close, caring relationships, which leads to more knowledge sharing.
4. *Family Togetherness/Team Colocation.* A shared workplace generates common experience, which may lead to greater shared understanding over time. Applying MFT to teams, proximity is an important factor in facilitating close relationships (Jehn and Shah, 1997), which, in turn, results in candid, copious information sharing. An increase in colocation should enhance knowledge sharing in NPD.
5. *Families Incorporate Different Perspectives/Cross-Functional Training.* The processes of incorporating different perspectives enable couples to understand each other and cope with their differences in a constructive manner, thus helping families to change their relationship, becoming closer and sharing more knowledge. Similarly, in NPD, cross-functional training helps team interactions and increases knowledge sharing.

**11.4.1.2 Between-team We-ness.** Product development managers must not only be concerned about high within-team performance but also that different teams function effectively together. This section shows that the MFT concept of we-ness can be applied to relationships between teams. MFT addresses not only nuclear family but also extended family situations such as those involving brothers, sisters, grandparents, and grandchildren. It explicitly includes the complexity of multiple people in multiple different roles. Assuming a reasonable level of goal alignment, the following activities promote between-team we-ness and facilitate an increase in knowledge sharing between teams.

1. *Understanding Other Points of View/Understanding Other Teams.* Older couples have greater levels of we-ness than middle-aged couples because of their longer marriages and have more understanding of other points of view resulting from more experience in dealing with each other. Similarly, ensuring the understanding of other functions in NPD will promote we-ness between teams and increase knowledge sharing.

2. *Families Align Goals/Team Goals Relate to the Business Unit Strategy.* When goals are aligned, not just understood, we-ness is increased and additional information and understanding are shared. As at the team level, we extend MFT to argue that team goals' clear alignment with SBU strategy will result in team members sharing information with other teams. Goals shared by different teams act as the glue that binds them together and facilitates shared understanding and knowledge.
3. *Third-Party Intervention/Interlocking Teams.* Third-party intervention in MFT allows differing parties to share information and understanding with higher levels of we-ness. Just as a therapist might encourage one family member to divulge difficult-to-express information to other members, interlocking teams might need a facilitator to establish patterns to successfully share information.
4. *Therapist Encourages Family Members to Join the Therapy Process/Managers Encourage Their People to Participate.* A therapist's encouragement of family members to join the therapy process increases the family's level of we-ness and the sharing of information and understanding. In organizations, members' participation facilitates the sharing of relevant information, but members may need to be encouraged by their managers to participate.

**11.4.1.3 Between-Organization We-ness.** We broadened the MFT concept of we-ness to interactions beyond organizational boundaries by treating teams from different organizations as partners in a relationship. Assuming a reasonable level of goal alignment, we-ness-creating activities between organizations will result in more knowledge sharing.

1. *Address a Wide Range of Issues/Integrated Project Portfolio Planning.* Sharing information on one topic deepens the dialogue and the perceived level of we-ness. By extension, organizations that work on a variety of projects together rather than on a single project are likely to share more information on all projects.
2. *Families Work Together/Interlocking Concurrent Development Processes.* More affiliated action between couples softens their feelings and deepens their mutual experience and understanding. As a couple works on less volatile issues, trust is built and information is shared. As teams from different organizations work on multiple facets of a project, they should share more information.
3. *Relationship Building by Working on Family Issues/Joint Team Building and Training.* Working on family issues helps members enjoy happier and

more meaningful relationships, thus increasing we-ness. In NPD, for example, joint team meetings or cross-functional teams act to connect individuals across multiple organizations, and these interactions lead to information exchanges between interorganizational teams.

4. *Family Cohabitation/Colocated Teams Across Organizations.* Distance relationships pose challenges to communication within families. Choi and Choi (2001) suggest that “living-in-the-vicinity” is an important component facilitating we-ness. Global virtual teams face the challenge of developing we-ness at great distances in NPD.
5. *Participation and Shared Responsibility/Joint Project Management.* Joint responsibilities help partners communicate knowledgeably and effectively and increase we-ness. Similar to interlocking teams, organizations that share project management responsibilities will benefit from knowing the status of the project, the relative contribution of the parties, and where solutions to problems might be found.
6. *Shared Difficult Experiences/Shared Risk, Reward, and Performance.* One of the things that forges closeness in relationships is facing difficulties and realizing the rewards of overcoming them. The more difficult the shared experiences, the greater the likelihood that we-ness develops in facing them together and share more information. In the same way, NPD teams that encounter significant obstacles between organizations share higher levels of information.

#### 11.4.2 Knowledge Sharing and Performance

In successful NPD teams, members access knowledge from various internal sources as well as external networks. Knowledge sharing helps utilize the partners’ knowledge and expertise, which leads to opportunities for more profitable product performance. We-ness increases the level of knowledge sharing, as measured by these knowledge-sharing activities:

1. *Cross-Team Exchange of Lessons Learned.* Diffusion and sharing of learning with other members facilitate communication processes and information flows. This helps people to understand other members’ routines and stock of tacit knowledge and take advantage of the knowledge for more productive work. This, in turn, leads to more knowledge sharing and enhances performance in organizations.
2. *Product Data Management Systems (PDMS).* PDMS focuses on the effective collection and dissemination of knowledge in product development. It supports the individual’s access to organized knowledge in product development, thus improving the team’s performance.

3. *Knowledge Management Systems (KMS)*. KMS helps to broaden individuals' knowledge scope and develop the contact point with the people who may have the knowledge they are seeking, which increases product performance.

Knowledge sharing increases product performance, as measured by these variables: (1) the degree to which the new product program is a success, (2) reduction of the unit's product development time, (3) the degree to which the program meets performance objectives, (4) new product performance as compared with that of primary competitors during the last five years, (5) the percentage of successful products introduced to the market during the last five years, and (6) the percentage of successful projects in terms of profitability. Each of these variables was significantly increased in the presence of higher knowledge sharing. In turn, knowledge sharing was significantly increased in the presence of we-ness-creating activities.

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## 11.5 Summary

NPD is a knowledge-intensive activity (Ancona and Caldwell, 1992). Organizational members' relationships are closely connected with the level of knowledge sharing. Product development managers may face the challenge of how to encourage members to develop close-knit family-like relationships that promote a deep understanding and critical knowledge sharing. Understanding how to increase we-ness will directly increase knowledge sharing and product performance. Managing we-ness does not involve a change in the team structure. Rather, it concerns how to make the team more family-like and effective in dealing with complex projects when needed.

Using MFT concepts such as we-ness can help create more effective NPD teams. Appealing to MFT as a discipline also opens the door to a whole new set of team development tools. Product development managers can learn much from the practice of MFT.

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## CHAPTER TWELVE

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# VIRTUAL TEAMS IN NEW PRODUCT DEVELOPMENT: CHARACTERISTICS AND CHALLENGES

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Nicholas S. Lockwood, Mitzi M. Montoya, and Anne P. Massey

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### 12.1 Introduction

Globalization, along with rapid technological advances, has led to the widespread use of distributed teams in organizations. These virtual teams allow organizations to pool diverse expertise and cultural perspectives regardless of where individuals are physically located. Such diversity is critical to new product development (NPD), which typically requires cross-functional activities and/or involves customizing products for culturally distinct markets.

One characteristic of virtual teams is their reliance on information and communication technologies (ICTs). Typically, virtual team members use some combination of synchronous technologies (e.g., telephone/audioconferencing, videoconferencing, shared applications, or instant messaging) and asynchronous technologies (e.g., email, voicemail, calendar systems, or shared document repositories). The use of ICTs with little or no face-to-face interactions has long been shown to present both opportunities and challenges for virtual teams (Powell, Piccoli, and Ives, 2004). These opportunities and challenges, with a specific focus on virtual NPD, are explored in this chapter.

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## 12.2 Degree of Virtuality

Traditionally, teams have been conceptualized as either virtual or not. A team's level of virtuality can be defined in many different ways. Often virtual teams are described by the geographic or physical dispersion of their members. It is quite common, however, for team members to be separated by time as well. This may be a consequence of geographic dispersion (i.e., time zone differences), but time differences may also be due to differing work schedules. Even in the context of physical dispersion, not all virtual teams are created equal.

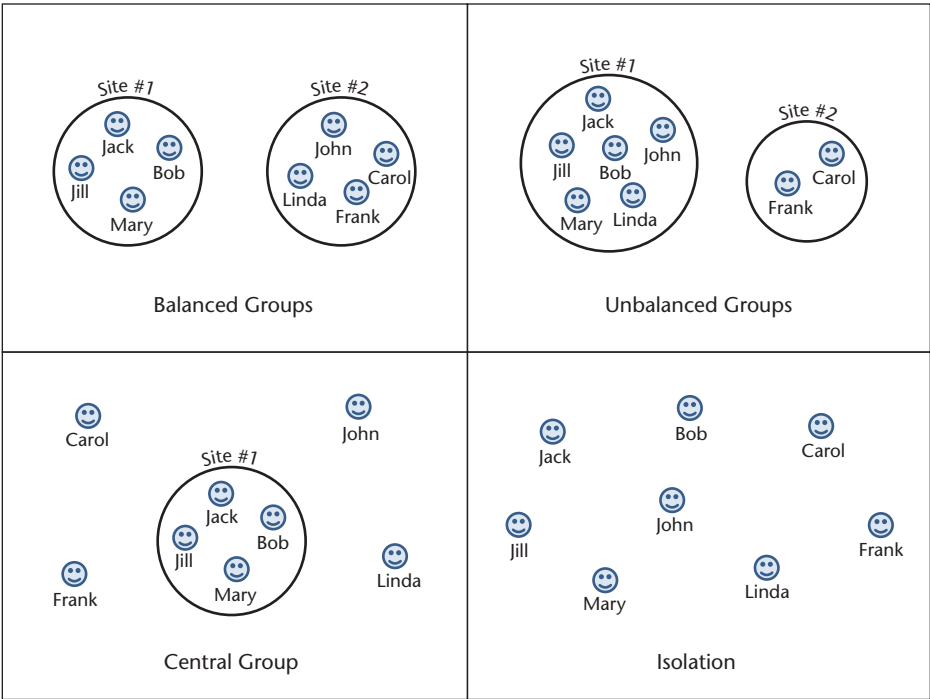
The virtuality of a team is characterized by three dimensions: spatial, temporal, and configurational (O'Leary and Cummings, 2007). *Spatial dispersion* is the most intuitive characteristic of virtual teams and refers to the physical distance separating team members. Traditional colocated team members experience little or no separation and have regular face-to-face interactions, whereas virtual team members may be located hundreds or thousands of miles away from each other. Spatial dispersion does not fully describe the distribution of team members when the number of team members and/or physical locations increases. Specifically, spatial dispersion could refer to the average distance among team members, the maximum distance between members, the distance between the two largest clusters of members, and so on.

*Configurational dispersion* extends the concept of spatiality by describing the arrangement of individuals across physical sites. For instance, team members may work in isolation so that each individual is physically separated from all of the others. Alternatively, groups of team members may be colocated, but each group is physically separated from the other groups. Such groups may be roughly equal in size, or there may be a large centrally colocated group with several smaller dispersed groups or individuals. Any number of different configurations is possible, and each represents a different level and type of virtuality. Refer to Figure 12.1.

Finally, *temporal dispersion* reflects the extent to which team members' work hours overlap. For example, team members may be physically located in different time zones, or they may simply be working different shifts in the same location.

For some teams, it may be possible to change virtuality throughout the life of a project. In an in-depth field study, Lakemond and Berggren (2006) identified the importance of colocating teams at different phases of the NPD process. During the initial project definition phase, colocation can facilitate idea exchange and relationship development. For the

FIGURE 12.1 COMMON CONFIGURATIONS OF VIRTUAL NPD TEAMS.\*



\*Note: circled groups represent colocated team members.

design and testing phases, however, returning members to their respective functional departments can help maximize concentrations of expertise. In addition, team members are often involved in multiple projects, some of which may be interrelated. Becoming too embedded within one particular team or project can then cause coordination issues across the organization. Leading up to the product launch phase, colocation can facilitate rapid problem solving and minimize delays in launching the product. Thus, it may be advantageous, if possible, to colocate teams near the beginning and end of an NPD project.

It is important to note that characteristics of the particular project, such as duration and innovativeness, can also have an impact on the ideal level of virtuality for an NPD team. Colocation for long periods can lead to isolation from the rest of the organization, which can again

cause coordination issues with critical functional departments and interrelated projects. Highly innovative projects may be better served by colocated teams, however, because of their ability to manage functional interdependencies and quickly resolve problems in highly uncertain environments.

*Team virtuality is a function of spatial, configurational, and temporal dispersion.*

### Key Implications

- Team virtuality is a function of spatial, configurational, and temporal dispersion.
- Colocating teams at the beginning and end of a project, if possible, may increase productivity.
- Project characteristics, such as duration and innovativeness, can impact the ideal level of virtuality.

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## 12.3 Communication

Due to their virtuality, communication in virtual NPD teams is different from that of face-to-face teams. Numerous communication technologies are available for use by virtual NPD teams, and many teams rely on a combination of technologies. These ICTs can be broadly categorized based on their richness and synchronicity. *Richness* refers to the type and number of cues transmitted through a particular communication medium. Lean ICTs transmit relatively simple cues such as text (e.g., email and instant messaging), while rich ICTs can also transmit noncontent cues such as tone and speed of voice, facial expressions, and gestures (e.g., audio- and videoconferencing).

*Synchronicity* refers to the nature and speed of bidirectional communication through a particular medium. Synchronous communication can be thought of as real-time communication in which individuals are interacting concurrently. One example of a synchronous ICT is telephone or audioconferencing. For audioconferencing to work, individuals must be using the technology at the same time. *Asynchronous communication* can be thought of as lagged-time communication in which individuals are not necessarily interacting concurrently. With email, for example, the receiver of a message does not necessarily need to be sitting at his or her computer while the sender is sending the message. The email message is instead stored on a server and is retrievable at a later time by the receiver.

The availability of ICTs (rich versus lean, synchronous versus asynchronous) may be limited by a team's degree of virtuality. For example, teams that are separated by temporal dispersion have to use asynchronous ICTs for communication. The use of different ICTs can also impact various team processes and outcomes, such as social/relational development, coordination, and performance. These impacts are discussed in the following sections.

### **Key Implications**

- Virtual NPD teams can use a wide variety of ICTs.
- ICTs are often described by their ability to support rich versus lean and synchronous versus asynchronous communication.

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## **12.4 Social/Relational Development**

Interpersonal relationships and trust are an integral part of any team's well-being. Virtual teams, however, face considerable challenges in social/relational development due to a lack of shared norms, beliefs, and experiences (McDonough, Kahn, and Barczak, 2001). These challenges have been supported by research showing that physical proximity among NPD team members increases interpersonal trust (Dayan and Di Bendetto, 2010). Given enough time, though, virtual NPD teams can develop stable communication patterns. Stability reduces uncertainty and facilitates shared contexts, which then lead to trust. Many ICTs help lower the psychological barriers to communication, actually increasing the communication potential over face-to-face interactions. These ICTs can also reduce social status differences and other biases. The nature and frequency of communication can then increase team trust, commitment, social integration, and the feeling of connectedness (Badrinarayanan and Arnet, 2008).

Characteristics of the team itself, such as cultural diversity, can also impact team cohesion and trust. Moderate levels of diversity offer broad intellectual perspectives and innovative thinking, which increase synergistic interactions among team members. Too much diversity, on the other hand, can cause feelings of competition and isolated subgroups that weaken interpersonal trust. Depending on the ICTs used, diversity may also simply impede communication due to differences in language and customs.

Resource commitment and leadership can increase team cohesion (Salomo, Kleinschmidt, and de Brentani, 2010). Sufficient resource

availability will reduce the potential for interpersonal conflict. Resource allocation also signals the legitimacy of NPD activities, increasing the likelihood of members' commitment to the team. Strong leadership involvement can serve as a signal of legitimacy as well. Leaders can serve to provide shared understandings of project goals and keep team members actively engaged in project tasks.

Relationship conflict—resulting from a lack of communication, too much diversity, insufficient resources, and so on—can be particularly detrimental to virtual NPD teams (Bierly, Eric, and Kessler, 2009). Interpersonal conflict directs attention away from substantive tasks, reducing the efficiency of a team's work. Conflict can also increase the likelihood of disruptive actions by team members due to distrust or motivations for retaliation. Because communication in virtual NPD teams takes place through ICTs, the opportunity to quickly resolve interpersonal conflict is somewhat inhibited. Communication itself requires coordination, possibly involving delays, and will typically filter out social cues that are integral to conflict resolution.

### **Key Implications**

- The nature and frequency of communication can impact social/relational development.
- Moderate levels of diversity, adequate resource commitment, and strong leadership can increase team cohesion and trust.
- Relationship conflict can be more detrimental to NPD teams in a virtual setting.

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## **12.5 Coordination**

Effective NPD depends on a team's ability to coordinate its efforts throughout a project. Managing an NPD project requires a focus on core product activities—like identifying customer needs and technical product development—as well as general management activities—like developing goals, keeping on schedule, and staying within budget (McDonough et al., 2001). As coordination within a team deteriorates, so will its performance.

Given the communication challenges in virtual teams, it can be difficult to coordinate project activities, particularly for complex projects (McDonough et al., 2001). While colocated teams can easily have frequent face-to-face interactions, virtual team interactions require the use of ICTs. Simply setting up those ICT-based interactions requires a certain amount

of coordination. Scheduling conflicts due to temporal dispersion may prevent the use of synchronous technologies. Many asynchronous technologies are text-based, so communicating requires the additional effort of typing out messages instead of using natural verbal and nonverbal communication. Thus, the frequency of communication in virtual teams is often much less than that of colocated teams. A lack of communication can prevent team members from agreeing on project goals, scheduling, budget requirements, and so on. Communication that does occur is often performed through relatively lean ICTs, which can limit the ability of team members to develop shared understandings of concepts or quickly resolve complex technical issues.

Virtual NPD teams have at least three coordination techniques available (Pérea, Mothe, and Brion, 2011). *Standardization* involves clearly defining each team member's role in the project. Members may act independently, and their actions are governed by formal rules and procedures. *Planning* is another formal technique that involves separating tasks and subtasks at the beginning of a project and defining how/when functional departments will interact. Much like standardization, planning requires considerably less communication and coordination effort throughout a project. *Mutual adjustment*, however, involves dynamic coordination in which team activities are adjusted based on task changes. This technique is recommended for situations in which mistakes or misunderstandings may occur regularly.

Limiting the need for coordination through standardization and planning seems most appropriate for virtual teams because of the communication challenges they face. However, research has shown that successful virtual NPD teams make use of mutual adjustment coordination (Pérea et al., 2011). This technique is particularly important for NPD activities, which are characterized by a great deal of uncertainty and cross-functional interdependence. Misunderstandings and unexpected problems are the norm in NPD, so it is reasonable to assume that adjustments in the activities of the team will be required. Too-frequent adjustments will increase coordination costs, though, which can decrease the efficiency of the team. It is suggested that teams attempt to plan the activities of a project as much as possible but remain agile enough to make changes as needed.

Mutual adjustment coordination can be made more efficient by selecting the appropriate ICTs for a given task. For example, solving problems related to engineering design may be best supported by computer-aided design (CAD) software. More generally, rich synchronous ICTs like audio- and videoconferencing are well suited for tasks that require quick

responses and mutual understanding of issues. Asynchronous ICTs are well suited for tasks that require considerable thought, such as overcoming complex technical challenges. Mutual adjustment can also be facilitated through an intermediary, who might be the project leader or a designated team member. An intermediary can disseminate and filter information as well as anticipate bottlenecks or errors. Since much of the coordination effort is undertaken by this person, other team members are free to focus on core project tasks.

### Key Implications

- Communication is often less frequent and leaner in virtual NPD teams, creating coordination difficulties.
- Dynamic coordination techniques allow teams to be agile in uncertain environments.
- Too many changes made with dynamic coordination will result in inefficiencies.
- Careful ICT selection and the use of intermediaries can reduce coordination problems.

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## 12.6 Performance

Virtual NPD team performance can be assessed in many different ways. An overview of the primary dimensions of performance is provided in Table 12.1, arranged roughly in order of team activities. Early in a project, *opportunity identification* reflects how well the team is able to identify windows of opportunity in the form of new products/technologies, new markets, new processes, and so on. While the team is working on an NPD project, there are several measures of performance with respect to team-work. *Decision quality* reflects how well the team is able to make correct technical and market decisions, and *decision speed* reflects how quickly those decisions are made. *Team learning* refers to the integration of knowledge and expertise across team members and is crucial to decision quality and speed. *Goal attainment* is the team's ability to reach the milestones set out for them, and *resource efficiency* describes how much time, effort, and money were spent reaching those milestones. The ultimate outcomes of a project are *launch time* and *product success*. These refer to the lead time required to get the product to market and the commercial success of the product once it is on the market, respectively.



TABLE 12.1 DIMENSIONS OF VIRTUAL NPD TEAM PERFORMANCE.

Performance Dimension	Description
Opportunity Identification	Identifying windows of opportunity, such as new technologies, markets, etc.
Decision Quality	Making correct technical and market decisions
Decision Speed	Making decisions quickly
Team Learning	Integrating knowledge and expertise across team members
Goal Attainment	Attaining the goals set for the team
Resource Efficiency	Utilizing resources efficiently to attain goals
Launch Time	Achieving a short product-to-market lead time
Product Success	Developing commercially successful products that fulfill customer needs

The level of geographic dispersion within virtual NPD teams can impact opportunity identification (Salomo et al., 2010). For one, geographic dispersion allows companies to utilize the most talented employees from each functional area, regardless of their location. As dispersion increases, team members are also likely to represent progressively more diverse cultural backgrounds and perspectives. For NPD initiatives that require customizing a product or marketing campaign to local markets, geographic dispersion is key. Diversity can also spark creative discussions and constructive conflict, which lead to innovative new ideas. The impact of geographic dispersion on opportunity identification becomes more pronounced as dispersion expands from a national to a global level, where team members from different countries experience the greatest cultural differences.

Social/relation development within virtual NPD teams can have a significant impact on teamwork and performance (Badrinarayanan and Arnett, 2008; Dayan and Di Bendetto, 2010). Team commitment and trust can increase team members’ motivation to cooperate with each other. Feelings of connectedness and social integration can increase communication activity, which leads to greater knowledge sharing. These things, in turn, lead to positive outcomes such as increased decision speed, decision quality, team learning, and, eventually, product success (Badrinarayanan and Arnet, 2008; Dayan and Di Bendetto, 2010). Trust also allows individuals to complete their own work without expending resources to monitor and evaluate other team members.

As teams carry out NPD activities, coordination is crucial to success. Coordination challenges in virtual NPD teams have been shown to decrease several dimensions of performance, including teamwork and

outcomes (McDonough et al., 2001; Zenun, Loureiro, and Araujo, 2007). These challenges, discussed in the previous section, cause problems with decision agreement and knowledge transfer, leading to slow, suboptimal progress toward goals. In some teams, coordination challenges may not impact decision quality or product success but instead simply increase the time and resources required to launch a product. Indeed, as virtuality increases, teamwork quality plays a stronger role in driving team performance (Hoegl, Ernst, and Proserpio, 2007).

### **Key Implications**

- Virtual NPD team performance can be measured in many different ways.
- Geographic dispersion can increase opportunity identification.
- Social/relational development and effective coordination drive virtual NPD team performance.

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## **12.7 ICT Selection**

As discussed previously, most virtual teams utilize some combination of ICTs for communication and collaboration. Consequently, much of the research on virtual NPD teams has not focused on specific technologies. The research that has, though, provides evidence that ICT selection matters. For instance, virtual teams that use lean, asynchronous ICTs make better decisions than face-to-face teams (Schmidt, Montoya-Weiss, and Massey, 2001). This is because lean media do not transmit many social cues, reducing the likelihood of social influences within the team. Instead, team members focus on task-oriented information and are able to make more objective decisions. In addition, leaner asynchronous ICTs do not put as much of a cognitive load on team members as richer synchronous ICTs. This may be because individuals do not have to mentally process as many cues with lean media as they do with rich media. Finally, the asynchronous nature of the ICT provides individuals with plenty of time to think about what they want to communicate and process the messages that others have communicated.

Conversely, richer synchronous media transmit many social cues, increasing the likelihood of social influences. For instance, communication via videoconferencing has been shown to decrease decision quality compared to audioconferencing in an NPD scenario (Lockwood and Massey, 2011). However, that scenario involved persuasive messages

in which the communicator sought to influence the decision maker to make an incorrect decision. In alternative situations, social cues may be desirable. Using videoconferencing for communication—as opposed to audioconferencing—has been shown to increase trust in a communication partner (Lockwood and Massey, 2012). Richer synchronous media may then be appropriate for developing relational ties among team members. For teams that are unable to meet face-to-face, rich media could be used as a face-to-face substitute during the early and late stages of an NPD project.

Past research suggests that the optimal ICT is largely determined by the type of task in which a team is engaged. Through a survey of NPD teams, Montoya, Massey, Hung, and Crisp (2009) provide practical guidelines for selecting ICTs to support particular task requirements. An overview of these guidelines is provided in Table 12.2. In general, synchronous ICTs—especially those that transmit audio and visual cues—are useful for social/relational development and making decisions on complex issues. Asynchronous ICTs are useful for sharing information and performing basic coordination activities, like scheduling and project updates.

There are several important things to note about the guidelines in Table 12.2. First, team members must agree on the ICT(s) that will be used for communication and be committed to utilizing those ICTs regularly. Making an ICT available does no good if some team members never use it. Second, ICT selection is based on a number of factors other than task requirements. Organizational culture/norms and individual work practices can impact which ICT is viewed as most desirable. In addition, teams may develop unique communication practices over time, causing a misfit with the guidelines in Table 12.2. Third, the use of ICTs can and probably will change over time. Richer synchronous ICTs may be more relevant for earlier and later stages of an NPD project, when social/relational development and rapid decision making are vital. During the core development phases of NPD, however, leaner asynchronous ICTs may be sufficient for information sharing and coordination. Ultimately, the selection of ICTs must be customized to the particular work environment and will likely take into account virtuality, task/project phase, and culture.

### **Key Implications**

- ICT selection is based on many factors, including team virtuality, task, and culture.
- Lean, asynchronous ICTs may reduce social influences and lead to a greater task focus, but rich, synchronous ICTs can be useful for social/relational development.

TABLE 12.2 GUIDELINES FOR SELECTING ICTS  
TO SUPPORT VIRTUAL NPD TEAMS.

ICT	Task Requirements
Telephone/Audioconferencing	Real-time interactions Interactions among multiple distributed individuals Complex problem solving Addressing team effectiveness and functioning Interpersonal issues
Videoconferencing	Real-time interactions Interactions among multiple distributed individuals Complex problem solving Addressing team effectiveness and functioning Interactions requiring visual social cues
Voicemail	Information sharing Scheduling and project management
Email	Lagged-time interactions One-to-one or one-to-many communications Project updates Searchable archives of contributions
Document Repositories	Lagged-time interactions Sharing documents or other information Information storage and retrieval Project updates Collecting comments

Source: Adapted from Montoya et al. (2009).

- ICTs serve no purpose unless team members are committed to using them.
- ICT usage may change over time due to changes in task, project phase, or a team’s communication patterns.

12.8 Summary

The use of virtual teams represents a great opportunity to leverage expertise, cultural diversity, and efficiency in the NPD process. However, managers looking to create virtual NPD teams must consider their unique characteristics and design and lead the teams accordingly.

Rapid technological change has led to a wide variety of ICTs available for use by virtual teams. Lean ICTs—such as email—can increase task focus and coordination efficiency, but rich ICTs—such

as videoconferencing—can improve team members' social/relational development and conflict resolution. Teams must be willing to adapt, as ICT usage tends to change over time. It is also important to note that virtual teams typically use a combination of ICTs and all team members may not be equally "virtual"—some may be distributed, while others may be colocated, requiring different ICTs.

Other factors crucial to the success of virtual NPD teams include frequent communication, dynamic coordination, adequate resources, and strong leadership. The work processes of a virtual team are driven largely by the team's culture. Team members must be willing to work together, resolve conflicts, and make use of the ICTs available to collaborate effectively and efficiently.

Virtual teams offer a great deal of flexibility, but their unique and diverse characteristics can seem daunting to managers. Successful virtual NPD teams are designed with specific project requirements and team members in mind. Careful planning and a willingness to adapt will greatly improve the performance of these teams and provide a distinct advantage for organizations in their NPD initiatives.

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## SECTION THREE

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# PROGRESSING

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*To keep progressing, we must learn, commit, and do—learn, commit, and do—and learn, commit, and do again.*

STEPHEN R. COVEY (1932-2012), AMERICAN AUTHOR AND CONSULTANT





## CHAPTER THIRTEEN

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# OBTAINING CUSTOMER<sup>1</sup> NEEDS FOR PRODUCT DEVELOPMENT

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Abbie Griffin

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### 13.1 Why Your Development Team Must Understand Customer Needs in Depth

Products and services that don't solve people's problems, or don't solve them at a competitive cost, fail. Motorola discovered this with Iridium. Iridium's main function was to enable wireless communication worldwide. However, in developing a solution to this problem, potential users were not asked about the details of or the specifics for what that meant. Thus, the technology solution chosen—satellite delivery to a bulky phone requiring a large antenna that could only be used outdoors and was very expensive to buy and make phone calls—did not achieve the physical functionality customers wanted simultaneously with the communications functionality.

*The most successful new products match a set of fully understood consumer problems with a cost-competitive solution to those problems*

<sup>1</sup> *Customer* in this chapter refers to current customers, competitors' customers, potential customers, and all others who have unsolved problems and unmet needs. Customers can be individuals interested in solving their own needs or people in firms trying to solve business needs. They can be seeking either product or service solutions to their problems.

The vast majority of customers were willing to give up coverage in some very remote places for smaller, lightweight phones. The result was predictable: the demise of Iridium, with an \$8 billion technology development write-off.

The most successful product development efforts match a set of fully understood customer problems with a cost-competitive solution to those problems. “The devil is in the details,” as they say. Palm’s first Palm Pilot was so successful because the development team interacted extensively with potential users to understand the details of both form and function. Functionally, they identified that managers were using a combination of computer- and paper-based organizing and memory tools, with the mix changing depending on whether they were at or near their computer or away from it. The solution to these problems was to create an organizing system with both computer-based and remote capabilities rather than just a standalone product that did not connect to the computer. The development team determined the frequency of use of each of the organizing capabilities (address book, memos, calendar, etc.) and designed the product so that those most frequently used were the easiest to access. Finally, they thought about how people might want to carry the remote device around. As men frequently carry date books and other notes in pockets, especially shirt pockets, they designed the Palm to fit in the smallest shirt pocket made—which happens to be the pocket on Brooks Brothers shirts. The result of their development efforts was a wildly successful product that changed the way people organized their lives.

New product success can be obtained by two paths. On one path, the firm first captures a complete understanding of the complex set of needs surrounding a problem for which a set of customers would like a better solution. They then develop a product or service that solves the set of problem. This is the path the Palm team took. Alternatively, firms can develop products that do new things, are based on new technology, or have new features and then see if they solve enough problems for people to buy at the price the firm can afford to charge. Motorola developed Iridium using the second path. Although teams can be successful this way, it is a riskier path to success.

On the one hand, firms that ignore customers, or only talk to them in general terms, risk wasting money developing solutions to problems that do not exist or for which potential customers already have an adequate solution. On the other hand, interacting with and talking to customers can be misleading if firms ask them for information that they inherently are not able to provide. The key is to observe customers in context and talk

to them using methods and asking questions in a form that customers can answer based on facts, and that can provide information useful for developing new products. This chapter presents information and qualitative market research methods to help product development teams understand customer needs.

### **13.1.1 Information Customers Cannot Provide**

Although customers can easily give firms direction about how to evolve their products incrementally, they generally cannot tell firms exactly what products to develop, especially breakthrough products or radical innovations. They cannot provide the details of exactly what the future blockbuster product for your firm should look like, the features it should have, or the technologies it should contain. If you find someone who can, hire that person! He or she is doing the job your development team should be doing. That is, this person understands the customers' problems fully and has the technical capability to translate their needs into yet-to-be-developed technologies and forecast the features that will meet those needs effectively in the future.

Customers also cannot provide reliable information about anything they have not experienced or with which they are not personally familiar. By definition, therefore, customers are not familiar with technologies that have not been commercialized. They cannot be familiar with a new product the firm may be thinking of developing and thus generally cannot provide reliable information when asked to react to a concept or prototype. This is especially true for radical or new-to-the-world products. They will, of course, provide answers to questions (most people want very much to be helpful). In reacting to product concepts without experiencing them, some customers may try to imagine how they think they will feel. Others will just tell us what they think we want to hear. Information derived from unknowledgeable customers is at best inaccurate and at worst is an irrelevant fantasy. To act upon it is extremely risky.

### **13.1.2 Information Customers Can Provide**

Customers can provide reliable information about the things with which they are familiar or which they directly have experienced. They can provide the subset of needs information that is relevant to them in an overall area of customer problems. They can articulate their own problems and needs. They can discuss the products and features they currently use to

meet their needs, indicating where these products fall short of solving their problems and where they excel. The only way that a full set of customer needs for a product area can be obtained is by coming to understand in detail the needs of a number of customers, each of whom contributes a piece of the needs information.

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## 13.2 Basic Principles for Obtaining Customer Needs

The objective of this chapter is to define and present techniques for obtaining the qualitative customer needs necessary to start product development. These needs can be used for quantitative market research later in the project (see Chapter 15). More importantly, this information provides the detailed understanding of the functional nuances to the development team that will dictate the engineering trade-offs they make during product development. The techniques presented focus on producing rich, detailed, context-specific information and ensuring that this information is transferred completely to those who need it: the development team.

*Current customers and potential users can provide reliable information about the problems and needs they experience, those that are relevant to them. For each person, this is a subset of the full set of information needed for effective product development.*

### 13.2.1 Defining Customer Needs

Customer needs are the problems that a product or service solves and the functions it performs. They describe what products let you do, not how they let you do it. General needs and problems are fairly stable; they change only slowly, if at all, over time. For example, many people want to “read for enjoyment and pleasure wherever I am.”

Features deliver the solutions to people’s problems. Features are the ways in which products function. Nearly 1,000 years ago, the hand-copied Anglo-Saxon Chronicles and illuminated manuscripts provided the ability to read for pleasure. Although these were the solution in the distant past, they are not a particularly feasible solution today. Today, a printed book or a magazine may deliver a partial solution to the problem of being able to “read for enjoyment wherever I want.” However, more complete solutions

currently may be provided by e-readers or the iPad. As this example demonstrates, solutions and features change more rapidly than general needs.

Customers have general problems that need solutions and that relate to the overall product function. For example, an e-reader must “let me see what I am reading.” Rather than having physical pages containing the printed content, as books have, e-readers have screens that allow me to read, changing the print that I see as I move through the book.

Customers also have very specific needs or details of the overall function that a successful product also must solve. Most detailed needs are specific to the particular contexts in which the product is used. E-readers are used in many different venues. Some of the detailed needs include “let me read . . . on my couch in the morning,” “in my bed,” “on an airplane at night,” “in a hotel room,” and my personal favorite, “while sitting next to the ocean.” There is great controversy over which type of screen, the Kindle e-ink gray-tone screen or the iPad LED-backlit screen, is the better solution to the problem overall. The Kindle solution works very well in bright light by the pool or ocean. However, because the Kindle is not easily readable in the dark, its owners can be seen reading it with a portable book light illuminating their screen on airplanes at night. iPad screens, on the other hand, work very well in low light but tend to wash out in strong light—like next to a pool or the ocean.

Customer problems generally are very complex, and frequently different needs conflict. At the same time that I want to be able to read in all those different venues, I also want to be able to keep reading for a long time without recharging—such as on an overseas flight. The Kindle’s e-ink solution sips battery power, giving days of power, compared to the iPad’s LED-backlit screen, which may give 8 to 10 hours of use between charges. The development team thus needs to have a good understanding of the relative importance of all the contexts and ways in which their products will be used, misused, and abused to select the most appropriate feature sets for their product. It is first uncovering and understanding these detailed needs, and then providing a solution to them, that differentiates between product successes and failures.

As the Kindle and iPad examples clearly show, no product is perfect. Each product is a compromise, only partially meeting the complex set of customer needs for any function. Products consist of sets of features that deliver extremely well against some needs, adequately against others, and not at all against still others. I was an early adopter and happy Kindle user. However, as different firms develop new technologies and features, product compromises shift across the set of customer needs. While the Kindle

was great for reading books, the graphic support for reading magazines like *Business Week* and *Fortune* was awful. Basically, there were no graphics. Thus, I was still carrying my hard-copy versions of these magazines with me when I traveled. In 2011, however, I shifted to an iPad for my reading, giving up reading easily in bright light and extended battery time for the ability to read my business magazines in full graphic glory electronically (and with many added audio bonuses).

Because of both technology and competitor evolution, customer needs tend to be far more stable than specific features offered in products. I still want to be able to read for pleasure and enjoyment wherever I am. Providing product development teams with a rich understanding of the complex and detailed customer needs and problems prepares them to select the best technology and feature set compromises in the future to continue delivering successful products for the firm.

So, how should the project team define what constitutes useful statements of customer needs? There are four C's of good statements of customer needs and problems:

- *Customer Words:* They are not the voice of the team and do not contain company-specific or technical jargon.
- *Clear:* They are easily understandable by all over time. Some teams even create dictionaries with detailed definitions of specific terms and phrases.
- *Concise:* They are not wordy. They contain only the words necessary to describe the need.
- *Contextually Specific:* They include all contextual references and provide situational details. For example, "let's me read when I'm by the pool."

*Understanding features leads to today's dominant products; understanding needs leads to tomorrow's dominant products*

### 13.2.2 From Whom to Obtain Needs

Many teams embarking on a voice of the customer (VoC) project call their salespeople and ask them for customer contacts. When this is how customers are identified to interact with, the team generally is put into contact with the "usual suspects" —the customers who have solid relationships with the salesperson. However, if you only watch or talk to your firm's own customers, you are only interacting with people who already like the products



you are marketing (at least somewhat). The real benefit in doing a VoC project comes from obtaining information from individuals who are not your customers but who still have or experience the general category of problems you are trying to understand. Some of these consumers will be customers of your competitors. Others may have jury-rigged their own solution. Still others may just be suffering along, with no solution at all. These are the people who can provide you with information you do not currently have.

Experts also may not be the best individuals to talk to or watch. Experts will use and interact with products in a much different manner than either the average user or (especially) the novice. One medical device company goes out of their way to avoid understanding the needs of experts. Their position is that if you make a device that only the experts can use, then the target market is much more limited than if you make one for the clumsy doctor or technician. Thus, in deciding who to talk to and watch, the development team should focus on understanding the needs of a heterogeneous set of people within the overall target market.

Only the people involved with the details of how a problem affects the day-to-day way they perform their job or live their life can provide you with their needs. And only the people who interact with, use, or are affected by the operation of a particular product can provide you with the details of how that product excels at and fails to solve their problems. A purchasing agent cannot identify the logistical and physical problems that a grocery clerk has in operating a point-of-sales scanner system. Nor can he or she help you understand the difficulty of the procedure the general manager of the grocery store must go through to produce a daily income statement or rectify the store's inventory position at the end of the month with the software associated with the scanner system. Similarly, a mother cannot provide adequate information about the athletic protector her son needs for playing baseball or concrete details about the feminine hygiene needs of her newly adolescent daughter. The details of customer needs and problems must be gathered directly from the people who have them.

**13.2.2.1 Special Considerations in Business-to-Business Markets.** Gathering detailed information generally is more difficult in business-to-business markets because most products affect multiple groups of people. Because people cannot provide accurate information about something they don't actually experience, several different groups must be investigated to obtain complete information about the detailed issues surrounding a function (McQuarrie and Coulter, 1998). Grocery store general managers only partially understand the customer needs of their clerks. They have general

information, but not the details that will help firms differentiate between acceptable and superior products. The need to investigate multiple groups’ needs increases the cost and effort associated with obtaining good, complete product development market research for business-to-business markets. However, spending this money is worthwhile, as it will increase a new product’s probability of success.

### 13.3 Techniques for Deeply Understanding Customer Needs

Firms can obtain a detailed understanding of customer needs through at least three market research techniques:

- Be an involved customer with those needs and problems.
- Critically observe and live with customers who have those needs.
- Talk to customers with needs.

Table 13.1 summarizes the main aspects of these techniques.

*Different techniques for understanding needs produce different kinds of information. No one technique is sufficient to produce a full understanding of customer and potential user needs.*

TABLE 13.1 SUMMARY OF NEEDS-OBTAINING TECHNIQUES

Needs-Uncovering Techniques	Information Obtained	Major Benefits	Major Drawbacks
Be a User	Tacit knowledge Feature trade-off impacts on product function	Obtain knowledge in depth Generate irrefutable belief in identified needs	Hard to transfer knowledge to others Time and expense
Watch Users Critically	Process knowledge Tacit knowledge	Learn customer language Find unarticulated needs	Time and expense Must translate observations into words
Interview Users for Needs	Large number of details Context-specific needs	Speedy information collection Information breadth	Cannot elicit reliable tacit and process needs “Marketing’s job”

### **13.3.1 Be a User: Be an Involved Customer of Your Own and Competitors' Goods and Services**

**13.3.1.1 What to Do and Keys to Success.** An enormous amount of customer needs knowledge and understanding can be gained by putting all development team members in situations where they are customers actively involved with the problems your firm is trying to solve. Also, when your firm already has a product commercialized in a particular functional area, encourage team members to use your products and all competitive products routinely in everyday as well as extraordinary situations.

At Procter & Gamble (P&G), both men and women work on the product development team for feminine hygiene pads. Teams at P&G are known for the lengths to which they go to try to fully understand and identify with customer problems. The entire team personally tests their own and competitors' current and new products. Male and female team members have worn pads underneath armpits and in shoes to test chafing and smell-elimination characteristics. They also have worn these pads in the anatomically appropriate area, with and without having doused the pads with liquid to simulate various normal-use conditions.

Team members at another firm in the point-of-sales scanner system market work full shifts as checkout clerks several days a year in different kinds of local stores. Store managers readily agree to cooperate because they do not have to compensate them and because they hope to get improved products. By working full shifts, development personnel learn about shift startup and close-out, as well as the effects of different payment modes, breakage, and fatigue, and they are exposed to a random day's worth of the strange things that can happen in a checkout line that can affect the operator and the system. Operating a system in a laboratory setting just does not provide the same breadth of interaction experience.

While routine continual personal gathering of customer information is not feasible for all product areas, with a little imagination it is possible to do far more than many firms encourage development teams to do.

**13.3.1.2 What Kind of Information Is Obtained.** Having employees become actively involved customers is the best way, sometimes the only way, to transfer "tacit" information to the product development team. Tacit information is knowledge someone has but cannot articulate, or cannot articulate easily. It is the intuitive aspect of the knowledge a person has about his

or her needs. Becoming a routine customer for all of the various products in the category also may be the most efficient way to drive home to development teams the trade-offs firms have made in their products and the effects these trade-off decisions have had on product function.

General Motors (GM) misses out on an inexpensive way of imbuing their employees with a great deal of competitive and daily ownership information by some of their policies. GM requires any employee traveling on business for the firm and renting a car to rent a GM car. Development team members miss out on great opportunities to learn inexpensively how other firms' design differences affect performance. In addition, GM provides managers with new cars and then assumes responsibility for maintaining those cars. Because of this policy, senior people at GM lose an appreciation for how recalls and the need to maintain a car over time cause problems for customers—especially those who are very short on time.

**13.3.1.3 Codicils.** Although being a customer is a good technique to bring rich data to the product development team, it is only one of several techniques that should be used because of several inherent problems:

- The firm must learn how to transfer one person's experience and knowledge to others. A means of codifying experiences must be found.
- If experiences are not well documented, retaining personal knowledge becomes a critical problem if team members frequently shift product areas or end markets or leave the firm.
- Project management must ensure that individuals do not think that their own needs are representative of the market. They will differ from the average customer in both predictable and unexpected ways.
- Encouraging team members to be customers takes time, money, and personal effort. Obtaining cooperation from team members requires management support and example.

*By actively using products, developers are exposed to needs that are tacit and difficult to extract verbally from customers.*

## 13.3.2 Critically Observe and Live with Customers

**13.3.2.1 What to Do.** Product developers who cannot become customers may be able to live with customers, observing and questioning them as

they solve a set of problems. Developers of new medical devices for doctors usually cannot act as doctors and personally test devices on patients. However, they can observe operations, even videotape them, and then debrief doctors about what happened and why they took particular actions later, with or without viewing the videotape simultaneously.

Sometimes observing customers in their natural setting leads directly to new products or features (Lilien, Morrison, Searls, Sonnack, and von Hippel, 2002). Development team members at Chrysler observed that many pickup truck owners had built holders for 32-ounce drinks into their cabs. When asked, drivers told the team that they drank “big gulps, not Perrier water in tiny bottles.” So, starting in 1995, Ram truck cup holders could accommodate 32-ounce drinks. In other instances, observation only points out the problem. The team must still determine whether the problem is specific to that person or applies across the entire target market, and if so, develop an appropriate solution. Another Chrysler engineer had watched the difficulty his petite wife had wrestling children’s car seats around in the family minivan. It took him several years to convince the firm that his solution—integrating children’s car seats into the car’s seating system—would solve a major problem for a large number of customers. It did.

**13.3.2.2 Keys to Success.** Critical observation, rather than just casual viewing, is the key to obtaining information by watching customers. Critical observation involves questioning why someone is performing each action rather than just accepting what he or she is doing.

The best results are achieved when team members spend significant time with enough different customers to be exposed to the full breadth of problems people encounter. They must spend enough time observing customers to uncover both normal and abnormal operating conditions. In addition, using team members from different functional areas is important because people with different types of training and expertise see and pay attention to different things.

**13.3.2.3 What Kind of Information Is Obtained.** Living with customers is an effective way to identify tacit information and learn the customers’ language. It is also the most effective means of gathering work-flow or process-related information. These customer needs are particularly important for firms marketing products to other firms. The products and services they develop must fit into the work flows of those firms, which

means that the work flows must be understood fully. For example, the Palm team did not just talk to executives; they also watched how they worked while managing information and remaining organized. Even when questioned in detail, people frequently forget steps in a process or skip over them. Although forgotten or unimportant to the customer, these steps may be crucial to product design trade-offs.

*When new products must fit into work flows or customer processes, critically observing customers is crucial to effective development.*

**13.3.2.4 Codicils.** Observing and living with customers is not especially efficient. Its problems include the following:

- Gathering information broadly requires significant team time and expense. Actions unfold slowly in real time.
- Observation or even unobtrusive videotaping may change people's behavior; natural actions are not captured.
- The team again has to turn actions into words, reliably capturing customer needs.

### 13.3.3 Talk to Customers to Get Needs Information: Capturing the Voice of the Customer

**13.3.3.1 What to Do.** By talking to customers, development teams can gather their needs faster and more efficiently than by emulating or observing them. A structured, in-depth probing, one-on-one situational interview technique called *voice of the customer* (VoC) can uncover both general and very detailed customer needs (Griffin and Hauser, 1993; Zaltman and Coulter, 1996). The way questions are asked in this method differs significantly from standard focus group qualitative techniques in four ways. VoC:

- Is grounded in reality. Customers only talk about situations and experiences they actually have had. This keeps customers from fantasizing inaccurately about things they know nothing about.
- Uses indirect rather than direct questions. Thus, rather than asking customers "What do you want?" directly (as happens in focus groups),

VoC indirectly discovers their wants and needs by leading customers through the methods they currently use to find and utilize products and services to fulfill particular needs.

- Asks questions from a functional orientation, not a product or feature orientation. For example, one study asked customers about the various ways they transported food they had prepared at home to another place and stored it for some period of time before later consuming it. This is the general function that picnic baskets, coolers, and ice chests fulfill. Asking about the function rather than a product yields information about many different and unexpected products that customers use to perform this function, including knapsacks and grocery store bags. Detailed probing draws out the specific functions, needs, drawbacks, and benefits of each product. Most important is delving into why various features of the products are good and bad. What problem does each of these features solve? At the same time, does a particular feature cause any other problems? Probing the reasons why uncovers the needs.
- Inquires about multiple situations or contexts in which the customer faced a particular problem, because the information desired is the breadth and depth of needs details.

In addition to these differences, research has found that one-on-one in-depth interviews are more cost effective than using focus groups.

One advantage of interviewing is that many different use situations can be investigated in a short period of time, including a range of both normal and abnormal situations. Each different use situation provides information about additional dimensions of functional performance that a customer expects. A good way to get started is to ask each customer to describe the last time he or she used a product that fulfilled the function. The food transporter study began: "Please tell me about the most recent time you prepared food in your home, to be shared by you and others, then took the food outside your home and ate it somewhere else later." By asking customers to relate what they did, why they did it, and what did and did not work well, both detailed and general customer needs are obtained indirectly.

After customers relate their most recent experience, they are asked how they fulfilled the function in a series of other potential use situations. These use situations are constructed by the team to attempt to cover all the performance dimensions within which customers will expect the product

to function. For example, customers were asked about the last time they took food with them:

- On a car trip
- To a football or baseball game
- On a bike trip
- Canoeing or fishing
- To the beach
- On a romantic picnic
- Hiking or backpacking

*Buried in consumers' stories about specific use instances are the nuggets of detailed needs that a superior product must deliver.*

Customers also were asked to relate the most disastrous and marvelous times they ever took food with them. Although no customer had experienced all situations, the food transporting and storing needs resulting from each situation were also fully uncovered by the time 20 people had been interviewed (Griffin and Hauser, 1993).

**13.3.3.2 Keys to Success.** Although VoC is not difficult, it gathers needs differently than traditional focus group or other qualitative market research techniques. It results in a much larger list of far more detailed and context- or situation-specific needs, because the objective is to obtain a level of detail that enables teams to make engineering trade-offs during product development. There are several keys to being successful in obtaining the VoC.

First, it is critical to ask customers about functions (what they want to do), not features (how it is done), because only by understanding functional needs can teams make the appropriate trade-offs in technologies and features as they become feasible in the future. It is the continual probing about why something is wanted or works well that uncovers underlying needs.

Second, the VoC should cover only reality. If someone has never been on a romantic picnic, she cannot be asked about what she would like in this situation, because she does not know. What she would relate is pure fantasy.

Finally, it is vital to ask detailed questions about specific use instances. General questions produce general needs. General needs are not as useful in designing products and making trade-offs over features as are the details of problems. Customers are capable of providing an excruciating amount of detail when they are asked to relate the story of specific situations that occurred during the last year.



**13.3.3.3 What Kind of Information Is Obtained.** Both the details of customer problems as well as more general functional needs are obtained with VoC. Through indirect questioning, customer needs that relate to technical design aspects can be obtained, even from nontechnical customers. For example, by relating how her car behaves in various driving situations (flooring the accelerator at a stop sign, traveling at city speeds of around 35 mph, and traveling at interstate speeds), an elderly woman can provide information that helps a car company determine the gear ratios governing the speeds at which an automatic transmission shifts gears, even though she may have no idea of how the company's transmission works.

**13.3.3.4 Codicils.** The development team obtains a better understanding of a full set of detailed needs if the team interviews customers personally rather than outsourcing this function to a market research group.

- Some customers are completely inarticulate. Getting them to converse is like pulling teeth. Indeed, it always seems that one of the first two customers the team interviews will be inarticulate.
- Extreme care must be taken to maintain the words of the customer and not immediately translate one problem into a solution before understanding the full set of needs.
- Tacit and process-related needs may not be complete.

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## 13.4 Practical Aspects of Gathering Customer Needs

Regardless of which technique is used to gather customer needs, the development team will be interacting with customers, which always involves some risk. By structuring and planning the interactions carefully, firms can increase the probability that both the team and the customer will benefit. This will increase the likelihood that a particular customer will agree to work with the firm in the future.

### 13.4.1 How Best to Work with Customers

The most basic principle behind working with customers is that they should be involved only so that the firm can learn from them. If they are involved for any other reason, such as to provide an excuse to delay decisions about a project, the firm is probably wasting its money. If product features have already been defined, and customer needs are gathered after

that has been done to “prove” that the team has specified the “right” product, the firm is also wasting money. Gathering customer needs makes sense only if the task is completed before the product is specified.

Customers will be most willing to interact with the development team if they see how they can benefit. For most household markets, this generally means that customers receive money for interviews or observation periods. Development teams investigating business-to-business markets may find that they can provide benefit to customers by helping them gain an understanding of their own end customers. Gathering customer needs proceeds more smoothly when the interaction becomes a two-way conversation rather than a grilling.

Most firms have a portfolio of products that they have already commercialized. If the product development team collects customer needs themselves rather than contracting with a market research firm to gather the data anonymously, most or all of the customers interviewed will be familiar with at least some of their current product line. Some customers, especially in business-to-business markets, may spend the first 10 to 15 minutes of an interview venting their anger and frustration at current products. The team needs to be careful not to get defensive during this tirade but to listen to what the customers say and try to find out why these items bother them. Once customers understand that the team is talking to them to try to serve them better in the future by developing better products, and once they have vented their immediate anger, they generally calm down and gladly answer questions.

### 13.4.2 Pitfalls to Avoid When Interacting with Customers

There are several pitfalls to avoid when gathering information from customers. The first is to avoid selling the company’s products. The interview team is not there to sell, even if it includes a salesperson. They are strictly on a fact-finding mission. Selling will both use up the limited time scheduled with customers and erode their willingness to interact.

The second pitfall to avoid is not talking to enough customers to obtain a complete set of needs. Observing only one firm’s business processes or talking only to your firm’s people as surrogates for actual customers is almost more dangerous than not interacting with any customers. No one customer provides a full set of customer needs for any product area. Interaction with about 20 customers is required to obtain about 90 percent of customer needs (Griffin and Hauser, 1993). Interviewing 30 customers produces about 97 percent of customer needs. Unfortunately, the most

important needs are not always those customers cover first; they trickle out of customer mouths at the same rate as the unimportant needs.

The third pitfall is to avoid ignoring the results the team has obtained. Several steps must be taken to ensure that these results are used because information that does not affect the product development effort wastes the time and energy of the team as well as the firm's money. Results are more likely to be used when the information users were involved in the data gathering. Both technical specialists and managers find the data more believable if they have assisted in collecting the information. Data that are in a usable form also are more likely to be used in the product development effort. Data that are buried in a report are less likely to be used than those that are pasted all over the walls of the development area. Reminders of what was learned can never hurt.

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## 13.5 Summary

No one technique provides all the customer needs that product developers seek. Tacit needs are best conveyed by being a customer. Process-related needs are best identified by critical observation of customers. In-depth interviewing is the most efficient means to obtain masses of detailed needs, but it may not provide the tacit and process-related information required. Unfortunately, few projects can afford the time and expense of fully implementing all these processes. When personnel are fairly stable, management may be able to implement an ongoing customer need-generating process that works to provide product developers continuously with customer interactions. Otherwise, it is best for development teams to use the most appropriate customer need-generating technique(s), given the informational requirements, budget, and time frame for their project.

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## CHAPTER FOURTEEN

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# USER RESEARCH FOR PRODUCT INNOVATION: QUALITATIVE METHODS

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Gary R. Schirr

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### 14.1 Introduction

What could be more valuable to a new product development (NPD) effort than insightful information about user needs or results of users' efforts to customize and improve the product for their own use? The value of the voice of the customer is well known to product innovators. By now, nearly everyone is also familiar with the *crowdsourcing* models of firms such as Threadless, in which customers design and select new t-shirt designs, and Innocentive, which runs technical crowdsourcing efforts for large business-to-business (B2B) and business-to-consumer (B2C) companies including pharmaceutical and consumer packaged goods companies. This chapter explores an array of qualitative research methods used to uncover deep user needs, information, and ideas for innovation.

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### 14.2 Deep Understanding and Sticky Information

The terms *sticky*, *tacit*, and *contextual*, describing knowledge or information, convey the difficulty of transferring useful knowledge relating to a specialized activity. Even within firms where trust has been established and there

are clear incentives to cooperate, it is hard to convey exactly what makes an operation more productive. Firms must often transfer teams to a factory that excels and allow them to observe and communicate for several months to understand what the innovations really are (Szulanski, 2003). When soliciting customers' ideas, firms generally don't have the time or permission to spend months at the client's site, but they must still strive to go beyond sending out surveys and collecting suggestions to uncover deep information.

An example from the author's research, a case study of a small team developing a new online information system for settlement of exchange-traded financial instruments, illustrates the elusiveness and importance of sticky information (Schirr and Page, 2010). A client who can be referred to as "Alice" had been extremely cooperative with this team. She had shared her frustrations with her current vendor, who was the market leader, and had given the team a detailed view of how that competitor's service worked. Alice and the development team were finishing breakfast when a marketing person asked her what one feature they could incorporate to make her life easier. When she gave an "incremental" answer—"make settlement a little cheaper"—a programmer on the team asked if the team could return with her to her office and watch how she started her day. It turned out that Alice spent half of her day (1) printing out settlement statements from her vendors, (2) entering the data into three different in-house programs for accounting, settlement, and risk analysis, and (3) error-checking her reports for any input problems. With less than one day's effort, the programmer was able to implement straight-through processing (STP) so that the data from the new service were automatically entered into the firm's three programs before Alice even came to work in the morning—reducing errors and eliminating nearly four hours of boring, repetitious work each day!

Alice had been very cooperative with the team, genuinely trying to help. She knew what she did each day, and she was familiar with the concept of STP, but she didn't imagine that the team could so readily apply it to the mundane daily tasks that she had been performing for years. By watching her work and questioning her in the context of her daily activities, the team uncovered a need that led to a breakthrough benefit in the eventual service offering. That insight came from one-to-one interviewing at the customer's site while she used the service. Sticky information takes time and effort to uncover, but it is worth it! And there are several approaches available to uncover it.

## 14.3 Qualitative Methods for Deeper Understanding

Qualitative research was developed in anthropology and sociology to better understand culture and human interaction (Glense and Peshkin 1992; Mason, 2002) and has been adapted to marketing research. Compared to quantitative methods, qualitative research involves a deeper understanding of a phenomenon as well as smaller and more focused groups of research subjects, and relies on the researchers to carefully observe and understand the phenomenon being studied. Qualitative researchers for marketing and innovation employ many of the tools of the anthropologist immersed in a foreign culture. Understanding the context is key: a qualitative researcher for product innovation will focus on the words of a single subject or a few subjects and will often observe the client at the worksite using the products or services that are targeted for improvement.

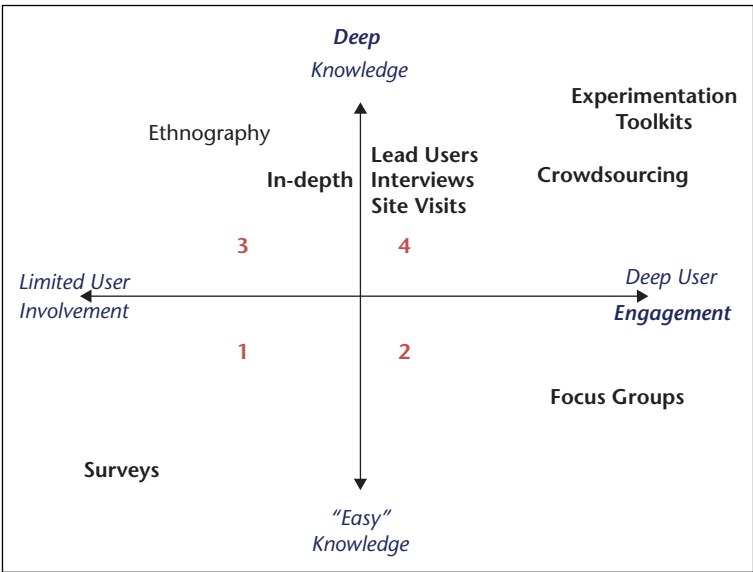
Since the role of the researcher is essential to the collection of data and to the analysis, an issue with doing such research is whether to use outside experts to conduct the research or to train employees in the skills needed to be effective as a qualitative researcher. Firms often hire anthropologists to oversee ethnographic studies and trained moderators to oversee focus groups, but they may train customer service sales or marketing staff to collect valuable user data and interview key subjects at their worksites. Experts may be more skilled in using the qualitative methods, but organizational insiders have useful relationships and product knowledge to better understand the context of a complex situation.

The remainder of this chapter focuses on qualitative user research methods that have proven effective in NPD—ethnography, site visits and in-depth individual interviews, crowd-sourcing, customer toolkits, lead users, and experimentation. Figure 14.1, adapted from a working paper on innovation (Schirr, 2012), classifies these user research methods by (1) ability to uncover deep information, and (2) engagement by the user.

*Qualitative research methods, including interviews at user sites, open the window on deep user needs, which are vital to NPD.*

Deep information is the primary focus of this chapter but engagement is also relevant, as it leads to stronger relationships with the users that may correspond to more business, more involvement in future innovation efforts, and more transparency of the process.

FIGURE 14.1 KNOWLEDGE-ENGAGING MAPPING.



14.4 Ethnography

Ethnography is the study of a culture or phenomenon through immersion in the setting being studied. In an ethnographic study the researcher may actually become part of the culture or phenomenon under investigation. A seminal marketing article that observed how market research was being conducted in a computer firm (generally site visits by engineers) used ethnographic techniques to understand NPD in a leading computer firm (Workman, 1993). At one time, anthropologists stressed the importance of being unobtrusive or invisible so as not to affect the culture under investigation, but modern practitioners note that the act of observing always has an effect and that active participation can actually enhance a researcher’s understanding of the situation. Hence, side-by-side collaboration with users on a problem can be considered qualitative user research.

Consumer products firms and firms entering new cultures and geographical areas have used ethnographic techniques to better understand



the culture of a subset of users and how that culture affects the way they use and perceive the products. Some examples: Nokia employed anthropologists to study cell phone use in China and sales in open-air marketplaces; Nike employed ethnographic researchers to study the inner-city teenage culture, which is frequently the fashion setter for expensive shoes; Proctor & Gamble (P&G) studied how consumers use laundry detergent in the developing world and the United States. Two *BusinessWeek* articles cited the use of ethnography by companies as diverse as GE, P&G, Lenovo, IBM (which has over a dozen anthropologists on staff), Marriott, Sirius, AMD, and Intel (Ante, 2007; Berner, 2006). “It used be that design features were tacked on to the end of a marketing strategy,” says Timothy deWaal Malefyt, an anthropologist who runs “cultural discovery” at the advertising firm BBDO Worldwide. “Now what differentiates products has to be baked in from the beginning. This makes anthropology far more valuable” (Ante, 2006, p. 98). According to Berner (2006, p. 1): “The new core competency is ethnography. Companies use it to gain insights into the culture and behavior of their customers.”

Although use of ethnography in NPD has received publicity recently, its usefulness has been known for some time. Cooper (1999) listed the use of ethnographic methods to uncover customer needs as one the “invisible success factors in product innovation.” True ethnographic research requires the researcher to immerse him- or herself in the work at the user’s site to understand how the product is used. Researchers trained in anthropological techniques must generally be hired for the task. Ethnography will often yield unexpected insights into how a product or service is used, though rarely as dramatic as the well-known cases indicating that (1) rural villagers would buy mobile phones for communal use or that (2) bug spray buyers wanted to see cockroaches suffer and die because female users identified cockroaches with useless boyfriends.

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## 14.5 Netnography

With the rise of the Internet and social media, there are myriad consulting firms providing analytics and tracking of customer tweets, “likes,” blogs, and complaints. Most of these efforts are quantitative data-mining exercises measuring things like “buzz” and “negatives.” Logically, there should also be deep information stored in user comments, blogs, and messages. Robert Kozinets and other researchers are pioneering a promising new

form of ethnography that they call *netnography* to gather deep insights from rich data on social media.

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## 14.6 Site Visits and Individual Interviews

The earlier anecdote about Alice and her need for straight-through processing for securities settlement illustrates the power of context—NPD staff observing and questioning a user at her workplace, performing her tasks, and using a firm's or a competitor's product. B2B firms often send marketers, R&D personnel, designers, or factory personnel on visits to customers to obtain marketing research data for product development (McQuarrie, 1991). On site, the best way to gather data is through one-to-one discussions with the user of the product or service, as discussed in "The Voice of the Customer" (Griffin and Hauser, 1993). Griffin and Hauser (1993) and McQuarrie and McIntyre (1986) showed that individual interviews were more effective in gathering product ideas than group ideation efforts, even group qualitative techniques such as focus groups; individual interaction and interviews produce more ideas and uncover deeper needs.

Site visits and one-to-one interviews about the use of products and services and user needs are usually conducted by the firm's own employees. Firms, sometimes with the aid of consultants, train their front-line employees—salespersons and customer service representatives—to observe and question users at their workplaces to gather customer needs and ideas for improvements. The starting point, as in the earlier example of straight-through processing, is to understand in depth how the customer uses the service or product. Front-line staff should be alert for determining the right time to invite NPD staff with the understanding and context to see innovation opportunities (Griffin and Hauser, 1993; McQuarrie and McIntyre, 1986). Workman (1993) showed how engineers at a computer firm drove innovation through workplace discussions.

*User insights are valuable to NPD. Develop a user innovation network to collect ideas for innovation. Encourage and train boundary-spanning personnel, such as customer service, sales, and engineering staff, to collect information for innovation.*

User input is vital to continued innovation. Companies may find it harder to access user input as markets mature and become more

competitive: why should a user grant your company her time and wisdom instead of one of your competitors? It is important to forge and maintain strong relationships through customer engagement. Ideally, a positive feedback loop is formed such that the involvement of the customer in the innovation strengthens the relationship and makes future engagement more likely. In order to access user input, it may be necessary to actually *be a customer* (Griffin, 2004, p. 217). For example, a janitorial supply company bought a cleaning operation to have unlimited access to user insights.

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## 14.7 Crowdsourcing

Threadless hosts exhibits of potential t-shirt design submissions from users, allows users to vote on the best ones, and then produces and sells the winners. Design and selection are usually done by users, who then have a stake in the new shirt. Awareness of the designs and the winners comes from the judging on the website, so in effect, the users handle much of the marketing as well. Not every firm can turn over the NPD function totally to users, but every firm should be humble enough to acknowledge that users have knowledge and expertise that can be put to use. Crowdsourcing may sometimes consist of open innovation not involving users: A difficult problem can be sent out to experts wherever they are. Eli Lilly and the National Aeronautics and Space Administration (NASA) have sent technical problems to Innocentive for research help; Netflix held a contest for an algorithm to suggest movies to subscribers based on their past viewing. Innocentive offers fees for the best solution, while contests generally offer prizes. The fees do not have to be high; sometimes recognition alone will work. Often, as in the Threadless example, users comprise the target community. Several statistical software firms and game producers let users post new routines on their websites for other users to study or use and then incorporate the best ones into their next release, giving the innovators some credit for the enhancements. This is NPD that results from harvesting user innovations.

*User engagement in innovation strengthens customer relationships.*

Another great benefit of crowdsourcing—and of most of the other qualitative techniques discussed in this chapter as well—is increased loyalty from customers and users who participate in NPD efforts, as shown

by engagement in Figure 14.1. Users, lead users, and cocreators not only provide access to their deep needs and often help by providing ideas to meet them, but also, from engaging in the process, *develop a stronger relationship with your firm*. Innovating is fun and challenging: The user has invested time and talent in the innovation and has an emotional stake in its success.

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## 14.8 Lead Users

Lead users are uniquely positioned to benefit from advances in the product or service and are therefore motivated to push producers to innovate and perhaps actually engage in the product or service innovation themselves (von Hippel, 1986). In NPD practice and research, a three-tier categorization of innovation is often used: incremental, more innovative, and radical or disruptive (Garcia and Calantone, 2002). The average user envisions innovation in predictable or incremental ways. Lead users, because of their interest in rapid innovation, have been proven to be helpful in more innovative NPD efforts.

Lead users can be identified by their motivation: Are they truly in a position to uniquely benefit from a supplier's product innovation? Alternatively, they can be identified by their actions, that is, by whether they have been engaged in modifying and advancing products and services to meet their needs. Simply harvesting the innovations already underway by lead users can advance an NPD effort. Lead users are not necessarily the most demanding or exacting customers: Firms should be wary of users who want customizations that don't really advance the capabilities of the product or service. A firm must be careful about patent and intellectual property (IP) issues, but true lead users are often so motivated to improve a key supplier's products and services that they will freely share innovations in order to speed up development. These lead user innovations can truly advance products, as has been shown in industries as different as scientific instruments, statistical software, and extreme sports equipment.

Customers may have difficulty understanding the potential of a new technology or a totally new product. Von Hippel suggested contacting lead users of the technology as well as lead users of the products. 3M Corporation and other firms have identified lead users and engaged them in cocreation of new products with documented success (Lilien, Morrison, Searls, Sonnack, and von Hippel, 2002)

### 14.8.1 Lead Users or “Emergent Nature” Users?

A recent article in the *Journal of Marketing Research* proposed engaging “emergent nature” users for NPD efforts. Emergent nature users were defined as those having “the unique capability to imagine or envision how concepts might be further developed so that they will be successful in the mainstream marketplace” (Hoffman, Kopalle, and Novak, 2010, p. 855). Using a trait scale to identify emergent users with that capability, the study found better results using emergent users rather than lead users for NPD ideas. These results are interesting, but there are caveats: The study was focused on B2C situations. It does not apply as clearly to B2B and it is a single study in a laboratory setting with theoretical ideas, while the use of lead users has been tested in multiple studies including those involving real-world product development. A B2C firm might try using the emergent nature measure to screen some cocreating customers and compare them to traditional lead user choices, while a B2B firm could compare the usefulness of individuals within a lead user firm based on the scale.

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## 14.9 Customer Toolkits

As noted, one way to identify lead users is to find users who have personally improved a firm’s product or service, and simply harvesting such innovations can be valuable to a firm. How can a firm *facilitate* user innovation? Customer toolkits, “opening up” the product or service to enable the customer to make significant changes (von Hippel, 2001), facilitates user innovation. Software firms may open some or all of their source code to allow user tinkering. More often the firms will create an application programming interface (API), or standard gateway, to the main functions of the software allowing users to modify or create new functionality on top of their programs. The apps written for iPhones have led that product innovation.

Software and online services may have the easiest toolkits to visualize, but with some imagination, firms that produce goods can also empower users. For example, Coca-Cola has hundreds of soda machines that contain multiple flavors and permit users to experiment with new combinations of

*Empower your customers to innovate with your products and services and monitor their innovations.*

flavors. These machines are a form of mass customization for customers (e.g., Strawberry-Vanilla Coke), but Coke also tracks the combinations and looks for common or recurring combinations as new product ideas.

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## 14.10 Real-Time Market Validation: Experiential Learning Through Experimentation

Sometimes an innovation is so radical that existing users can't envision its benefits without actually using the new product or service. A product that is truly new to the market or has fundamentally changed due to a new technology or business model is referred to as *radical*, *disruptive*, or *new to the market*. The only possible way to obtain user feedback is to get the product into the user's hands. At first, this seems like a chicken-egg dilemma since a firm may need user input to come up with an effective design. Rapid prototyping or experimentation is a tactic used to gather iterative feedback from users about an evolving product or service (Thomke, 2003). The author prefers the term *experimentation*, as it conveys the idea that the process is not simply rapid evolution; each iterative prototype is carefully designed to incorporate the input from the last version and to test other ideas about the innovation.

The concept of iterative experimentation has been applied in many different markets: In software it has been called *agile* (or *extreme*) *programming*; in high-tech products it is labeled *Probe and Learn* (Lynn and Morone, 1996) or *rapid prototyping*; and for entrepreneurs it is called *effectuation* (Sarasvathy, 2001) and is central to *lean startups*. Through these processes, innovators engage users in cocreation and multiple experiments applying real-time market feedback from the users of prototype products. The experimental process is simple and is depicted below:

1. Build a "minimum viable product" to take to market in a controlled experiment.
2. Measure the results of the experiment.
3. Learn from the experimental results.
4. Iterate with follow-up experiments.

Step 1 can be a controlled release to beta users or can be a full release to the market, depending on the circumstances in the firm's market. Google, for example, still claimed to be a beta release after the search engine had been out for over three years and was used by millions of users

daily! It is important that market results and user feedback are carefully collected and analyzed. The next product iteration must reflect the feedback and test some additional features or capabilities: Each release should be a carefully designed experiment to advance the product or service. For this process to work, flexibility must be built into the design of the product or service, the NPD process itself, and product support.

It is easy to see how a software firm or a Web-based service can run these real-time market experiments. However, this concept works for tangible products as well. Probe and Learn was discovered by researchers studying NPD for high-tech goods (Lynn and Morone, 1996). The high-tech firms provided access and instruction on how to customize the product. The author studied an established newspaper publisher who introduced a tabloid paper for younger urban readers. Flexibility and feedback were built into the tabloid launch, including surveys, observers on the subways, and varied formats on different days of the week. Within six months the ultimate version of the new newspaper was dramatically different than the initial launch in length, content, sections, and even the revenue model; it was a terrific success.

*Real-time experimentation requires detailed planning to facilitate the flexibility and user feedback for multiple iterations of the product.*

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## 14.11 Summary

An effective NPD program will use qualitative research methods to uncover key user needs, unleash user creativity, and engage customers. Customer and user interviews, workplace visits, ethnographic study, toolkits, and lead users may uncover the needs, or a firm may engage in real-time experimentation as well. Planning and training are essential. Flexibility must be built into NPD, and employees must be trained to gather and understand deep user information. Each of these qualitative methods is demanding. An organization would be wise to enlist its front-line employees—the sales force and customer service representatives—by training them on what to observe and what to ask, as well as how to identify users who warrant a visit from the firm's NPD staff or specialized qualitative researchers.

The return on the effort to uncover deep user needs and information can be great. Engaging users and customers in innovation will benefit an organization by improving customer relationships and creating buzz

or word of mouth. Engage and innovate! Build flexibility and iterative capability into prototypes and product launch. The result will be superior knowledge of one's customers and markets, resulting in a succession of products that better meet customer needs.

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## CHAPTER FIFTEEN

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# MARKET ANALYTICS

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Brian D. Ottum

The objective of this chapter is to provide an overview of some of the most useful market analytics for new product development (NPD).<sup>1</sup> Market analytics are sophisticated tools that rely on quantitative (numerical) data in order to reach conclusions. This chapter complements other chapters on qualitative research, since both qualitative *and* quantitative insights play a critical role in NPD. Research shows that a focus on customer and market insights is a key reason top innovators keep winning (Christiansen, 2011; Cooper, 2011; Jeruzelski and Dehoff, 2011). However, qualitative and quantitative data are quite different, each having its own strengths and weaknesses (see Table 15.1).

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### 15.1 The Market Analytics Process

The four key steps in market analytics are (1) designing the questions that will elicit the customer answers sought—usually in a survey of some sort, (2) collecting the data, (3) analyzing the results, and (4) reporting. The most critical step is the first one. It takes training and experience to write a survey that is clear, unbiased, precise, and of appropriate length and difficulty. For example, a survey that asks “How much are you willing to pay for this new widget?” is undoubtedly going to get upwardly biased

<sup>1</sup>Throughout this chapter, the word *product* refers to either a physical product or a service, sold to end users or to businesses.

TABLE 15.1 THREE DIFFERENT TYPES OF CUSTOMER DATA.

Qualitative	Hybrid	Quantitative
Words and images	Word counts	Numbers
“Soft” data	“In-between” data	“Hard” data
Exploratory	Still exploratory	Confirmatory
Great for understanding unmet needs	Make use of the vast volume of words in existence	Great for optimizing the new product’s appeal
Analyzed by looking for themes and deeper meaning	Analyzed by counting the frequency of words, looking for trends	Analyzed using statistics

answers. On the other hand, an experienced market researcher will use one of several indirect techniques that have been shown to be much more accurate in measuring value (one of which is conjoint analysis, covered in this chapter). A quantitative study cannot recover from a poorly written survey.

There are several ways of collecting the data. The lowest-cost but most problematic is the mailed survey. The biggest problem with using the mail is the very low response rate (0.5–4 percent is common). Do you really want to base your new product decisions on the tiny minority of customers who took the time to fill out the survey? They certainly aren’t representative of the entire customer market. A second problem with mail is a lack of control. You really don’t know who filled out that survey. For these reasons, mailed surveys are going the way of the dinosaur.

In-person intercept data collection has declined in use but remains a good method for certain companies. Recruiting costs are low because the data collection is done where the respondents are located (they are “intercepted”). For many consumer markets, this is in the shopping mall. For business-to-business markets, this is at the conference, trade show, or industry meeting. If a company’s customers are present in good numbers in a certain location and have the time to respond, the in-person intercept method is a good one.

*Each data collection method has its own strengths and weaknesses.*

A related data collection method is also used in person but in the customer’s native environment. For consumer markets, this interviewing takes place in the home. For business-to-business markets, it occurs in the office.

Going to the respondent's location makes data collection very expensive. However, the quality of the responses is usually excellent.

Telephone interviewing has taken a beating lately. Direct marketers selling credit cards, mortgage refinancing, and windshield replacement have "poisoned the well." "Do Not Call" lists are a strong response to unwanted telemarketing. Unfortunately, the backlash has also hit the market research companies that merely gather consumer opinions (and do not sell anything). Sales and political calls have hampered the ability of legitimate survey data collection. Costs have risen because a greater number of people need to be called in order to complete each survey. However, telephone interviewing remains a quick and cost-effective tool for brief surveys (especially for business-to-business interviewing when the phone numbers are available).

The fastest-growing data collection method is Web-based surveys. The speed of data collection is blindingly fast. Web-based surveys can show pictures and videos in addition to text. Customers can respond from any digital device, including their smartphones and tablets. Unlike the in-person and mail methods, a monetary incentive often is not needed. Many websites allow neophytes to easily program and launch surveys by themselves. (However, the quality of the data is determined by the quality of the questions asked.) Confidentiality is another concern, because it is possible for competitors to get a copy of the survey. Security can be improved by using the latest copy-protection software, by carefully controlling who is allowed to participate, and by wrapping up the data collection as fast as possible. Because Web-based surveys usually use email invitations, they are negatively affected by the rising tide of spam (junk email). The backlash, much like that against telemarketing, has caused the cost of Web-based surveys to increase. (See also the sidebar article on "Web-Based Market Analytics.")

The third step in the market analytics process is data analysis. If a nondigital collection method is used, then someone needs to enter the data into a file. Once the data are in the computer, statistical analysis software is used to create averages, count frequencies, and cross-tabulate the results among important groups of customers. Microsoft Excel has gotten powerful enough to do most of the key data analysis. Sophisticated questionnaires usually require the use of specialized software like SPSS, SAS, StatPac, Statistica, NCSS, Minitab, or Wincross. Importantly, many Web-based services have emerged to allow first-timers to analyze their data without having to learn a specialized statistics package at all.

Reporting the findings is the final step in the market analytics process. Years ago, this was a heavy three-ring binder report that few people read. During the 1990s, the Microsoft PowerPoint presentation emerged as the preferred way to communicate the key findings of a study. Today, such presentations are often conducted over the Web. A live presentation allows listeners to ask questions of the researcher and gain greater understanding. Some companies have started using a workshop instead of a data-dumping final presentation. This workshop is typically held very soon after the end of data collection. The analyst presents just the initial findings, and the group discusses what they mean. Questions arise, enabling the analyst to do further work and get highly actionable insights. The final report is therefore much more useful to the NPD team.

## 15.2 Three Questions Market Analytics Can Answer

Successful NPD requires data-based decision making. Research has shown that lack of customer insight is one of the top barriers to innovation (Boston Consulting Group, 2006). Market analytics help answer three critical questions about customers:

- Who are my customers?
- What do they really need?
- What is the most promising new product?

These three questions are listed in the chronological order in which they occur during NPD.

Table 15.2 shows these questions, and the market analytics tools that help answer them. These are the quantitative tools that are being used by

**TABLE 15.2 QUESTIONS AND RESULTING TOOLS.**

NPD Question	Market Analytics Tool to Use
Who are my customers?	Segmentation Data mining Perceptual mapping
What do they really need?	Needs ranking
What is the most promising new product?	Concept testing Conjoint analysis

the most innovative companies in all industries—consumer and business-to-business, product and service, and low- and high-tech industries.

Due to chapter length constraints, the objective of this chapter is not to delve deeply into each tool. Instead, this chapter reviews several analytical tools, including where to best apply them, their strengths and weaknesses, and their do's and don'ts.

### **Web-Based Market Analytics**

The Web has emerged as a dominant data collection location due to its speed, reach, and flexibility. However, the Web-based method is just another data collection technique (added to telephone, mail, and in-person techniques). The analytics tools presented in this chapter allow for *any* data collection technique.

What is revolutionary about Web-based quantitative market research is that it allows the NPD practitioner to do the research without the help of others. Many companies sell the ability of the practitioner to design the survey questions and the answer scales, send out solicitations, capture the results, and even analyze the answers. The costs saved by eliminating the market research middleman are considerable. However, a lot of low-quality surveys result from this “do-it-yourself” research:

- Too long and tedious
- Leading or biased questions
- Poorly worded questions
- Unbalanced or illogical response scales
- The wrong respondents

When preparing a Web-based quantitative research survey, one should adhere to the principles of “netiquette.” These include (Dimetrosky, Khawaja, and Degens, 2001):

- Give something back (for example, instant results of a question or two).
- Give permission and opt-in (offer the choice).
- Don't send spam (know who you are sending to).
- Don't abuse the patience of respondents (infrequent surveys, please!).
- Don't sell the respondent's name (market research is *not* sales).
- Make the survey interesting (and possibly even fun).

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## 15.3 Question One: Who Are My Customers?

It seems obvious, but successful NPD demands customer intimacy. Unfortunately, the business press is filled with stories of large companies that have lost touch with their customers (Christensen, 1997). Market analytics paint a numerical picture of customers by answering these questions:

- How many are out there?
- What do they buy?
- How and when do they buy?
- What are their demographic (consumer) or firmographic (business customer) profiles?
- What do they think of current products?

*Segmentation* is a market analytics tool for placing customers into “buckets” of similarity so that the company can start to answer the question “Who are my customers?” This is important because one product seldom appeals to the entire spectrum of customers. Companies find it useful to identify a target customer segment for NPD efforts. For example, the Marriott Corporation has successfully targeted its various products to distinct segments of the market:

Marriott Suites—permanent vacationers

Fairfield by Marriott—travelers on a budget

Residence Inn—extended-stay travelers

Courtyard by Marriott—business travelers

The first step in segmentation is to have many customers. Kraemer (1987) suggests that 300 to over 1,000 should complete a survey. The survey can be very simple, depending on the type of segmentation desired. The following list gives some segmentation types, ranked from least to most useful:

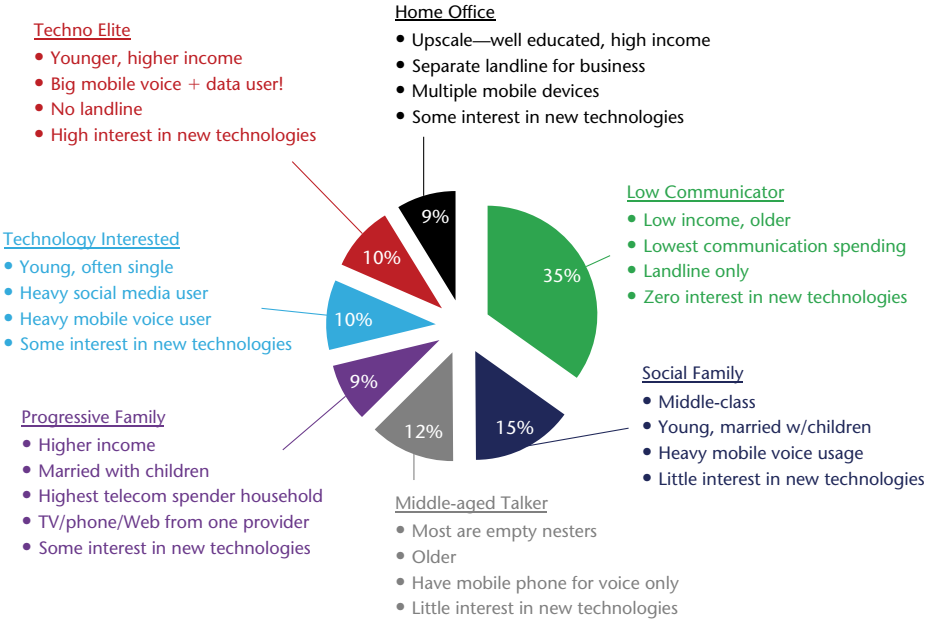
Demographic—dividing customers by age, family type, income, geography, and so on

Firmographic—dividing business customers by NAICS code, geography, dollar sales, number of employees

Purchases—dividing customers by heavy users/light users, brands used, price paid

Benefits sought—dividing customers by what’s important to them (price, performance, customer support, reliability, etc.)

FIGURE 15.1 EXAMPLE SEGMENTATION OF THE TELECOMMUNICATIONS MARKET.



Once the survey data are collected, segmentation buckets are created by using a statistical clustering routine. Each segment is then profiled by its defining demographics/firmographics so that the company can find them for future research or marketing efforts.

Figure 15.1 shows a hypothetical segmentation scheme for the consumer telecommunications market. Each segment is profiled by both its demographics and attitudes toward technology. This type of segmentation is powerful for NPD because each bucket behaves quite similarly in regard to different new product ideas. The “Home Office,” “Techno Elite,” and “Technology Interested” (together representing over a quarter of households) would be the target market for an expensive cutting-edge device. On the other hand, the “Progressive Family” and “Social Family” would be the target market for new voice plans using their current mobile phones.

Companies that use segmentation understand the diversity of their market better, specifically identifying the most promising customers



### Segmentation Do's and Don'ts

#### DO

- Segment your customers based on the benefits they seek from products.
- Target your NPD efforts to customers who have the most need for what you can uniquely offer.

#### DON'T

- Rely on just demographics or firmographics.
- Create fewer than three segments or more than eight.

for their NPD efforts. Segmentation teaches new product developers that not all customers think or behave the same way. Also, segmentation provides more focus for NPD efforts. One pitfall of segmentation is that it is too

easy to start believing that customers are more different than they really are. The buckets always overlap to some degree. Also, the statistics can be misapplied to give elegant but useless results. Finally, segments can shift over time, so the entire market segmentation needs to be updated.

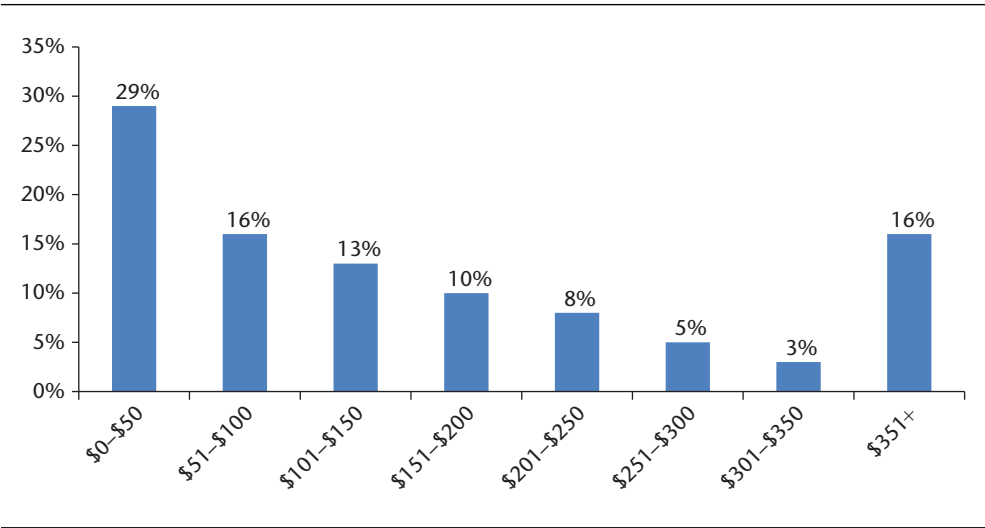
*Data mining* is considered a market analytics tool, but actually it is market segmentation using existing data. Unlike most market segmentation projects, no new data collection is required. Data mining is the transformation of existing corporate databases into business intelligence. Data mining is rapidly increasing, because the size of customer datasets is rapidly growing. During NPD, data mining is often a first step because companies already have vast amounts of data ("big data"). The only cost is the analyst's time needed to use statistical tools to crunch the numbers.

A pertinent example of data mining involves direct marketers of women's clothing. They send catalogs in the mail and take consumers' orders via phone or over the Web. They want to offer new products to increase profits, but they start by trying to understand current buyers. The goal is to understand buying patterns and determine who are their most profitable customers.

The first step was the selection of all sales data, aggregated by customer, over the past couple of years. The analyst used pivot tables in Excel to find

*Market segmentation is one of the most useful theories in marketing.*

**FIGURE 15.2 FREQUENCY DISTRIBUTION OF INDIVIDUAL CUSTOMER SALES.**



that there is a huge disparity in the amount of sales per customer; some customers spend a lot, others very little. Figure 15.2 shows this bimodal distribution.

As a further step in data mining, the analyst combined not only customer sales but also the number of separate clothing orders. An analysis using Orange data mining software revealed that there were three different types of catalog buyers (see Figure 15.3). The largest group, unfortunately, was the “Disloyal,” who bought just once and spent less than \$100. These customers cost a lot to acquire and were least profitable. The smallest group was the “Loyal,” who ordered frequently and in large amounts. The “Loyal” accounted for a disproportionate amount of sales. In fact, each “Loyal” customer was 10 times as valuable to the company as the average customer. The direct marketer used this data mining exercise to fund a project to understand the “Loyal” customers even better.

*Perceptual mapping* is another market analytic tool for understanding customers by showing how customers think of your products versus alternatives. This is a “mind map” of customer perceptions. Much like a roadmap, it shows which products are considered close to each other and which are far apart. Companies can target their new products to customers with certain perceptions.

FIGURE 15.3 CATALOG BUYERS.

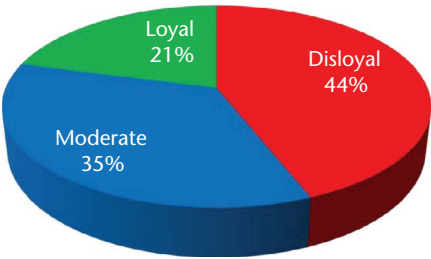


TABLE 15.3 EXAMPLE PERCEPTUAL MAPPING QUESTIONS.

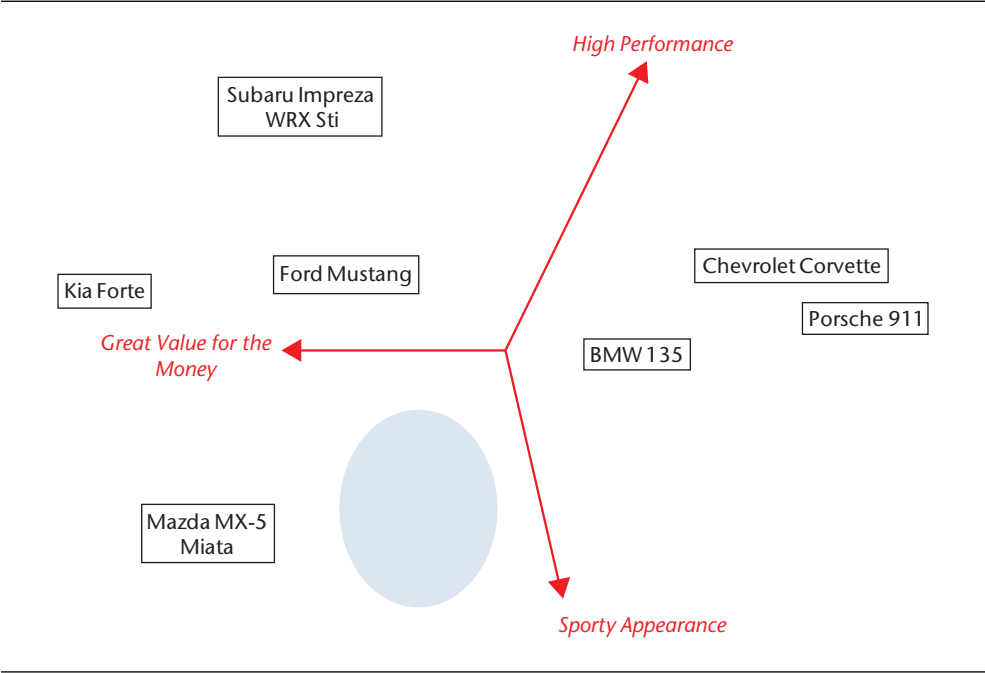
	Poor	Fair	Good	Very Good	Excellent
How would you rate the Kia Forte for appearance?	1	2	3	4	5
How would you rate the Kia Forte for performance?	1	2	3	4	5
How would you rate the Kia Forte for value?	1	2	3	4	5

Perceptual mapping works by having customers take a simple survey that asks them to rate their impression of current products on various attributes (no more than about 10). Table 15.3 shows an example for sports cars.

The same three questions would be asked for the Porsche 911, BMW 135, Mazda MX-5 Miata, Kia Forte, Ford Mustang, Subaru Impreza WRX Sti, and Chevrolet Corvette. Statistical tools such as multidimensional scaling, factor (principal component) analysis, multiple discriminant analysis, or correspondence analysis are used to boil the many ratings down to a simple graphic. The resulting sports car perceptual map (WRC Research Systems, 1996–2012) could be the one shown in Figure 15.4.

The perceptual map shows that the Kia Forte is the value leader (located way out on the “value” scale arrow). The Mazda MX-5 Miata does very well for “appearance” *and* “value.” The Porsche 911 does very well

FIGURE 15.4 PERCEPTUAL MAP OF SPORTS CARS.



for “performance” and “appearance” but poor for “value” (it’s located far away from “value”). A new product developer could use this map to see that there is a gap between the BMW 135 and the Mazda MX-5. This gap provides an opportunity for a new car that has more performance (at a greater cost) than the Mazda. This gap also provides an opportunity for a new car that has slightly less performance (at less cost) than the BMW 135.

The key deliverable from a perceptual mapping project is a visual that shows where “holes” exist in the current market that can be exploited with new products. It is nice to have a one-page summary of what customers think of current products. Also, the visual is better than a big table of numbers for most managers. However, perceptual mapping does have some drawbacks. There is inherent distortion when collapsing many dimensions of a product down to a flat perceptual map. Therefore, it is not 100 percent precise for all products and dimensions. Also, a complex map demands a lot of explanation.

### Perceptual Mapping Do's and Don'ts

#### DO

- Use a perceptual map to find out what customers think of current products before trying to develop new ones.
- Identify gaps in the market.

#### DON'T

- Make the survey too long or tedious; build in breaks.
- Use more than about six products and eight ratings for each.

## 15.4 Question Two: What Do My Customers Really Need?

The second key market analytics question seeks to find out the underlying, often unspoken, customer needs. Uncovering customer needs requires true customer intimacy. This intimacy can only be achieved through direct person-to-person interaction. Therefore, uncovering needs is a *qualitative* activity. The output from a qualitative customer insights project is often a tentative list of unmet needs. Market analytics come into play to quantify, rank, and sort the tentative list to confirm the truly critical unmet needs. Once a critical unmet need is found, new product developers have a clear focus for their efforts.

Qualitative tools help uncover customer needs, but they do not tell which needs are most important to meet. Typically, contextual interviews or ethnography can yield a set of 20–40 raw customer needs. However, the team does not know which needs are most critical. And they need to know the top needs to be able to focus their efforts. A *needs-ranking survey* is simply a way of having customers rank the importance of a list of needs.

*Customers cannot directly rank a long list of their needs, but other survey methods help.*

Survey respondents have a tough time ranking the individual items in a list of more than about five items. Given 20–40 customer needs, a normal *rating* survey is also too long and tedious. No one likes to see a full page of questions with “strongly disagree”

to “neutral” to “strongly agree” Likert scales. These “death grids” result in low response rates and bad data from those fatigued respondents who actually complete the survey. A second problem with conventional rating surveys is that *all* the customer needs tend to be rated as important. That does not help the team prioritize its efforts.

The Web allows for a very streamlined approach that provides a much greater spread between the most and least important customer needs. First, customers read all the need statements (preferably just one simple sentence) and click on the ones that seem important to them. The next Web page shows just the needs that were clicked. It is customary to instruct customers to click on a specific number of needs, such as five. Customers are then asked to allocate 100 points across the smaller list, giving more points to needs that are more important to them. Programming allows for the use of a calculator to show how many points have been allocated so far and how many still remain to be allocated.

Needs ranking explicitly tells the NPD team the customer needs on which they should focus. This approach is quick and results in a good spread between the most and least important needs. The method is very good for identifying which customers emphasize which needs.

Needs ranking is limited by the fact that customers are very literal. If a need is not expressed clearly, the importance score will suffer. Therefore, these types of surveys are highly dependent on the quality of the writing.

Figure 15.5 shows the typical results of a needs-ranking survey. The 30 needs are ranked in order of those getting the most points.

The importance of a need is critical to product developers, but sometimes more information is required. The most promising needs are those that are both critical *and* unmet. Therefore, the best needs-ranking surveys

### **Needs Ranking Do's and Don'ts**

#### **DO**

- Use the Web if you can.
- Pretest the need statements to ensure that they are clear.

#### **DON'T**

- Test more than 40 needs (cut out the obvious weak needs beforehand).
- Forget to cross-tabulate the results by customer segment.

FIGURE 15.5 IMPORTANCE OF NEEDS.

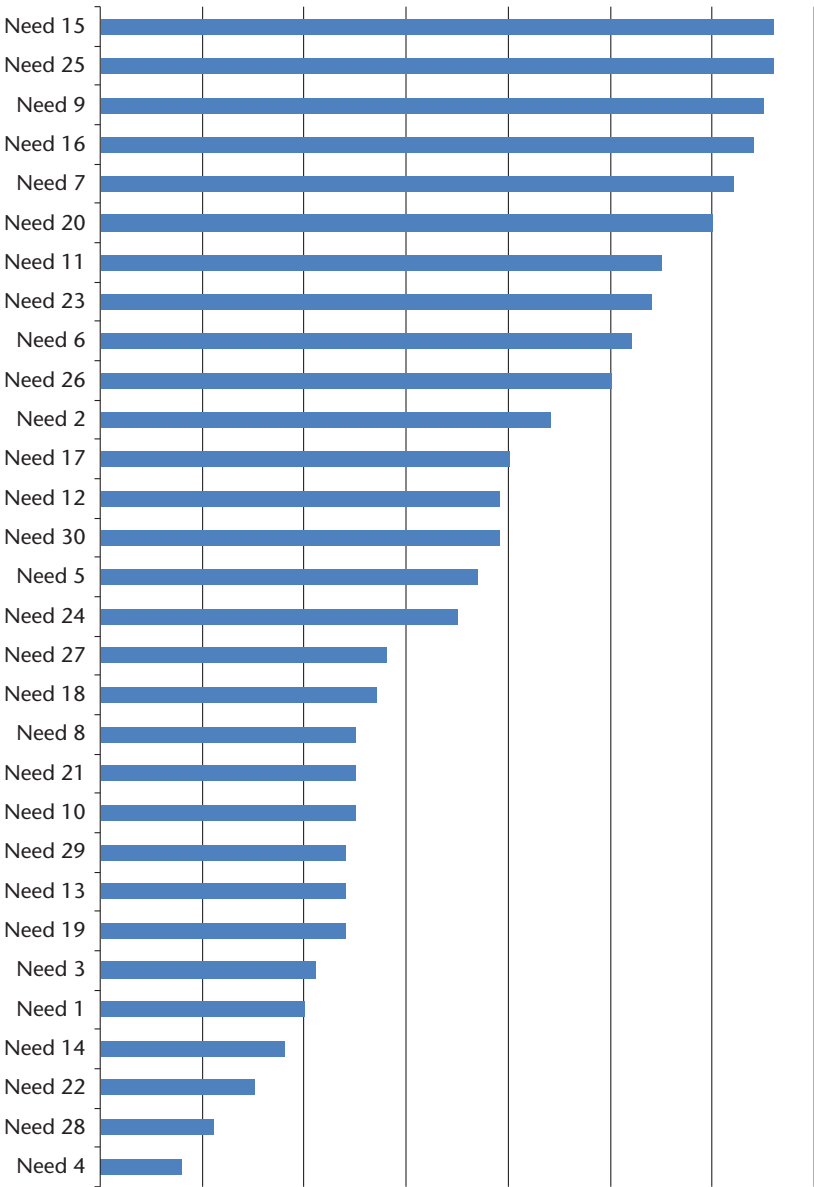
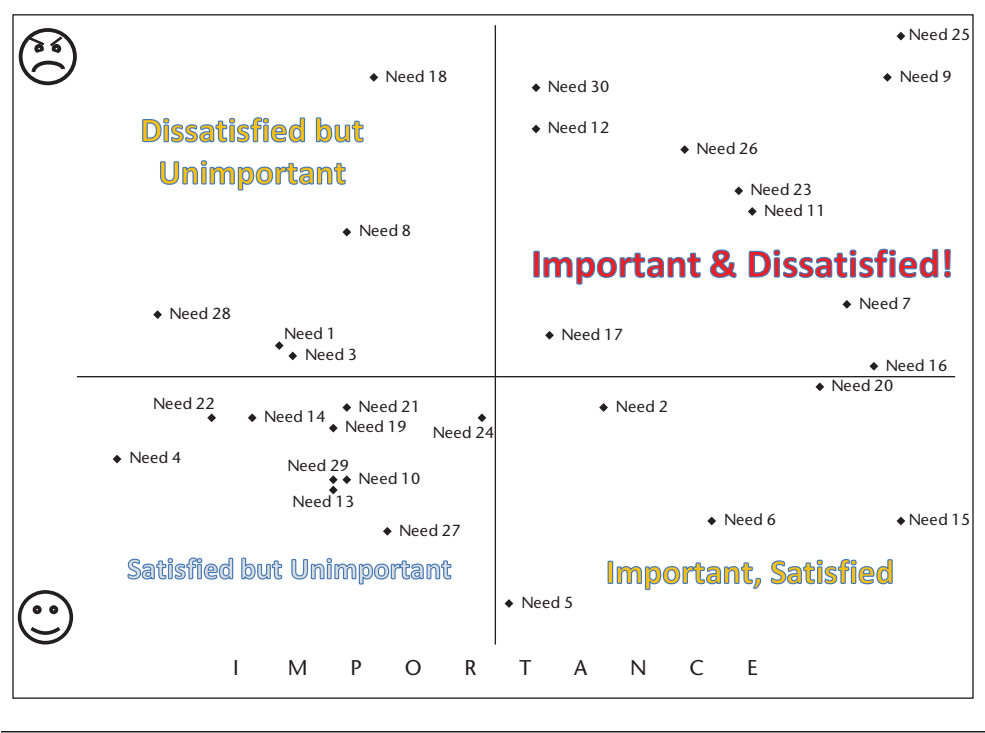


FIGURE 15.6 QUADRANT MAP OF NEEDS.



also ask respondents to rate their satisfaction with the same list of needs. The same procedure is used. First, respondents are instructed to see the full list and select the five needs that give them the most dissatisfaction. Second, they should allocate 100 points across the five. When both importance and satisfaction are measured, a highly actionable quadrant map can be produced. Needs that fall within the “important & dissatisfied” quadrant are those that must be targeted for innovation. See Figure 15.6 for an example.

15.5 Question Three: What Is the Most Promising New Product?

Many companies use a haphazard and incomplete process for picking the new product ideas they will develop into new products. A better way is to test *all* of the company’s wild and crazy ideas in an inexpensive and quick manner. This ensures that no potential winner is discarded.



A *concept* is a statement about anticipated product features that will yield selected benefits relative to other products already available (Crawford and DiBenedetto, 2010). Any company—whether business-to-consumer or business-to-business, selling physical products or services, high tech or low tech—can transform its raw new product ideas into full concepts. Concepts are usually 100–150 words long and contain a simple picture or drawing. Figure 15.7 shows a good template for formatting concepts.

It is usually a good idea *not* to put a price on these early ideas, because the goal of concept testing is to get a read on customer interest in the general idea. If the idea tests well, there's plenty of time later to investigate price. (And better tools are available; see the later discussion of conjoint analysis.)

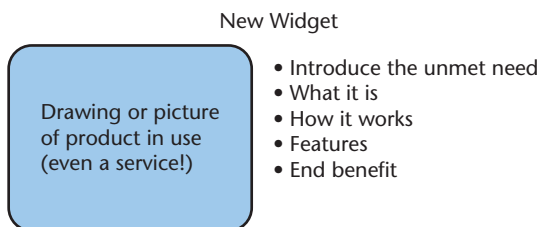
Once 10–30 concepts are created, it is time to get them in front of customers to see their reaction. The questions to ask are on the order of “If you could buy/use such a product, how likely would you do so?” A 5-point scale is usually used:

- Definitely not buy
- Probably not buy
- Might or might not buy
- Probably buy
- Definitely buy

Other diagnostic questions help provide understanding of the total customer reaction: uniqueness, believability, superiority to current products, and need for such a product.

Concept-testing data can be collected in many ways: Web-based, in malls, and at conferences or trade shows (excellent for business-to-business concepts).

**FIGURE 15.7 CONCEPT-WRITING TEMPLATE.**



Using concept testing, managers will know which of their new product ideas have the most promise, as well as some ways to improve them. The ones liked best are often a surprise to the companies doing the research. Concept testing improves the odds that the eventual new product will be a success.

*Concept testing is the tool to use when ideas are in their early rough form.*

As in all other market research, the answer you receive depends on the question you ask. Concepts that have nicer graphics, more flowery language, or fewer typographical errors tend to get rated higher (regardless of the quality of their raw idea). Also, concept testing only gauges the relative appeal of the concepts tested (and therefore does not give any volume forecast).

### **Concept Testing Do's and Don'ts**

#### **DO**

- Test as many ideas as possible (at least 50 per year).
- Test ideas prior to investigating any of them for feasibility (to keep from prematurely eliminating potential winners).

#### **DON'T**

- Be inconsistent in concept formatting.
- Test highly futuristic ideas alongside those that are more modest.

Once a specific product idea is selected, the development process can begin. A difficult process during the development process is setting the final product specifications. This involves deciding which features the new product will include and at what performance level. *Conjoint analysis* is excellent for this task. It also helps set the price.

*Conjoint analysis is one of the most sophisticated market analytics tools available.*

Conjoint analysis is a technique that uncovers how important component parts of the product are to customers by offering many different scenarios and observing what the customer does. In a way, it exemplifies

the old saying that “You don’t know how important something is until it’s gone.” The first step in conjoint analysis is deciding which features to include in the study. The second step is deciding what performance level will be tested within each feature. Approximately 12 to 16 total performance levels (added across all the features) is usually the limit of conventional conjoint analysis. After that, more sophisticated versions of conjoint analysis that “learn” customer preferences and customize the interview are required.

After determining the exact features to be tested, an experimental design is chosen from either software or books. Not every possible combination is tested, usually just a carefully chosen subset (so that all the main effects can be estimated). The next step is to gather the data via the Web, in person, by mail, or by telephone. Finally, the results are analyzed with highly sophisticated statistics to identify the optimal bundle of features. The price sensitivity curve is often also defined, which can be coupled with cost data to help identify the optimal profit point.

The following illustration shows two questions (out of 16 total) from a conjoint analysis study designed to find the optimal bicycle. In this situation, the features to be tested are brand name (well known or not), bike design style (mountain bike or hybrid), shock absorbers (both wheels, just the rear wheel, or none at all), weight (25, 30 or 35 lbs) and price (\$300, \$450, \$600). There are a total of 13 different performance levels (two brand names, two designs, three shocks, three weights, three prices).

Here is a description of a new bicycle:

- Well-known brand name
- Rugged mountain bike design with wide, knobby tires
- Has shock absorbers on both the front and back
- Weighs 35 lbs
- Price is \$600

If you were in the market for a new bike, how likely would you be to buy this one?

☐ Definitely   ☐ Probably   ☐ Might   ☐ Probably   ☐ Definitely  
Not Buy                      Not Buy                      Buy                      Buy

Here is a description of another new bicycle:

- Well-known brand name
- “Hybrid” design with medium-width tires

- No shock absorbers
- Weighs 35 lbs
- Price is \$450

If you were in the market for a new bike, how likely would you be to buy this one?

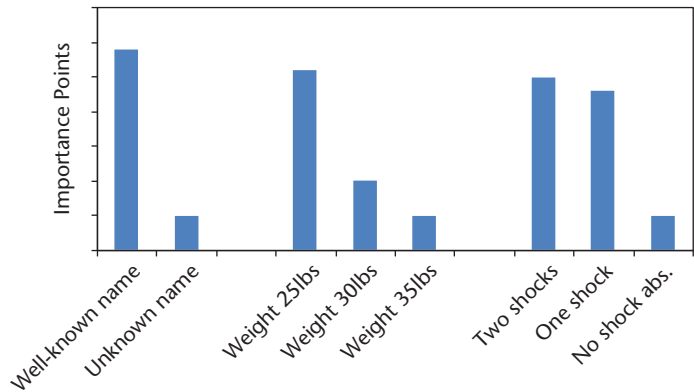
☐ Definitely Not Buy    ☐ Probably Not Buy    ☐ Might Buy    ☐ Probably Buy    ☐ Definitely Buy

Figure 15.8 illustrates some hypothetical results from the bicycle con-  
joint analysis for three of the product features.

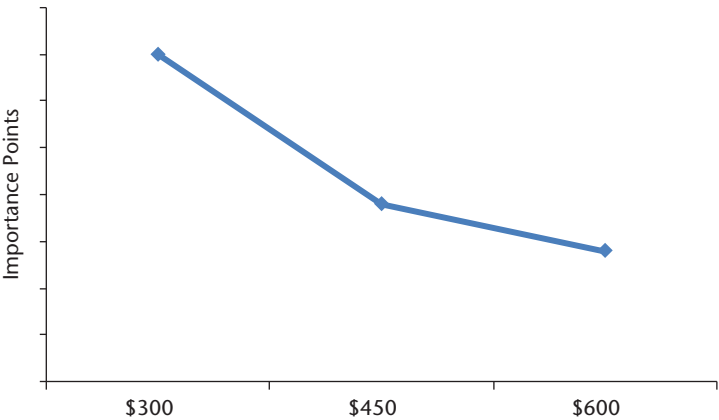
These results tell us that having a well-known brand name is the most important product-related feature. Weight and shock absorbers are a bit less important, but there are definite preferences. The customers want the lightest-weight bike, with 5 lbs extra being not very acceptable. However, customers seem to feel that one shock absorber is nearly as good as two. Figure 15.9 shows the price sensitivity curve. Customers prefer the lowest price (no surprise!), but not a lot of customer interest is lost when going from \$450 to \$600.

These results can be used to create a predictive model of bike pref-  
erences, with new product developers exploring “what if?” scenarios to predict customer reactions. For example, it would be possible to fore-  
cast the customer reaction to a bike weighing 32 lbs and costing \$500

**FIGURE 15.8 WHAT’S MOST IMPORTANT IN A BICYCLE?**



**FIGURE 15.9 BICYCLE PRICE SENSITIVITY CURVE.**



(an intermediate price within those actually tested). If the costs are known, such a model can be used to optimize profits.

Thus, the main deliverable from conjoint analysis is a highly accurate view of the trade-offs customers are willing (and not willing) to make. Conjoint analysis is an excellent tool for finding the version of the product that customers like best. It can also help show how much more customers are willing to pay for incremental features. Finally, conjoint analysis is great for getting a rough estimate of sales at various prices.

**Conjoint Analysis Do's and Don'ts**

**DO**

- Use it to optimize the product design.
- Use it to help set the price.
- Use it to get a rough estimate of sales and cannibalization.

**DON'T**

- Forget to create a “what if” spreadsheet to help interpret the results.
- Test just one or two scenarios when you can use conjoint analysis to predict all possible scenarios.

Unfortunately, conjoint analysis is not easy to learn or use. Errors can be made during the design phase that can severely impact the final results. The analysis requires highly sophisticated statistics. Off-the-shelf software helps, but it has a steep learning curve.

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## 15.7 Summary

Market analytics can provide excellent guidance in answering the three key NPD questions: who are my customers?, what do they really need? and what is the most promising new product? This chapter has illustrated analytics tools that can be used to answer each question and thereby reduce the risks inherent in NPD.

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## CHAPTER SIXTEEN

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# FORECASTING NEW PRODUCTS

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Kenneth B. Kahn

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### 16.1 Introduction

Forecasts are an elemental part of the new product development process because most, if not all, go/no-go decisions during the process require some kind of forecast on which to base these decisions. New product forecasting therefore cannot be avoided or ignored. Still, many companies often overlook the requirements of the new product forecasting effort and instead simply accept as fact that any new product forecast will be characteristically inaccurate due to uncertainties related to market acceptance, technical feasibility, and company capability to bring the new product to fruition. Successful new product forecasting is possible, though. Those companies that have been more successful with their new product forecasting effort manifest such success by employing appropriate techniques and using a cross-functional, systematic process. These successful companies also focus more on generating meaningful new product forecasts versus a preoccupation with accuracy.

In this chapter, the topic of new product forecasting is outlined along with how a company may achieve a better, more meaningful new product forecast. The chapter begins by establishing a definition for the parameters of the new product forecasting effort. These include the forecasting objective, type of forecast desired, forecasting time horizon, forecasting interval, and forecast form. Next, the linkage between new product forecasting and the product development process is discussed. Various techniques

available and considerations surrounding the decision to use one particular technique versus another are then presented. The chapter concludes with new product forecasting strategies and guidelines for new product forecast accuracy and a successful new product forecasting process.

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## 16.2 Establish the Forecasting Parameters

The first step toward successful new product forecasting is to establish the forecasting parameters. Among the more important parameters, clear definition is needed concerning the forecasting objective, type of forecast desired, forecasting time horizon, forecasting interval, and form in which the forecast will be provided.

The forecasting objective should be determined outright to clarify the questions that need to be answered. The type of forecast to be made, the forecasting level at which the forecast will be applied, the forecasting time horizon, the forecasting interval, and the forecasting form can then be properly derived. The forecasting objective thus serves to clarify the purpose and intent of the forecast so that a meaningful forecast can be made—meaningful in the sense that the forecast is presented in a usable, understandable form and addresses the needs of the company. Without a clear objective, an innumerable set of forecasts can be developed, leading to confusion over which forecast(s) should be employed.

*The first step towards successful new product forecasting is to establish the forecasting objective.*

Choosing the type of forecast to be generated is another important consideration. Several types of new product forecasts are possible and can be broken down in terms of *potential* versus *forecast* and *market* versus *sales*. *Potential* represents a maximum attainable estimate, whereas *forecast* represents a likely attainable estimate. *Market* represents all companies within a given industry marketplace, whereas *sales* pertains to only the respective focal company. The following new product forecast definitions are provided:

- *Market Potential*: the maximum estimate of total market volume reasonably attainable under a given set of conditions
- *Sales Potential*: the maximum estimate of company sales reasonably attainable within a given market under a given set of conditions



- *Market Forecast*: a reasonable estimate of market volume attainable by firms in that market under a given set of conditions
- *Sales Forecast*: a reasonable estimate of company sales attainable within a given market under a given set of conditions

During the new product forecasting effort, one or all of the above may be of interest. The key is to clarify through the objective what is needed at particular points during the new process development process.

Once what is to be forecast is established, this forecast needs to be further defined in terms of level, time horizon, interval, and form. *Forecasting level* refers to the focal point in the corporate hierarchy where the forecast applies. Common levels include the stock-keeping unit (SKU) level, stock-keeping unit per location (SKUL) level, product line, strategic business unit (SBU) level, company level, and/or industry level. *Forecasting time horizon* refers to how far out into the future one should forecast. New product forecasts could correspond to a single point in the future or a series of forecasts extending for a length of time (the latter is more common). Examples include a 1- to 2-year time horizon, which is typical for most fashion products; 2 to 5 years for most consumer product goods; and 10 or more years for pharmaceutical products. One reason for the longer time horizon for pharmaceuticals is the consideration of patented technology and length of term for the respective patent. *Forecasting time interval* refers to the granularity of the forecast with respect to the time bucket as well as how often the forecast might be updated. For example, a series of forecasts can be provided on a weekly, monthly, quarterly, or annual basis. *Forecasting form* refers to the unit of measure for the forecast. Typically, new product forecasts early on are provided in a monetary form (e.g., US\$) and, later in the process, are provided in terms of unit volume for production purposes. Some new product forecasts also can be in the form of narrative scenarios that describe a future event.

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## 16.3 Forecasts During the New Product Development Process

Like decisions, forecasts will differ across the different stages of the new product development process. Early on in the process the forecasting focus will be market potential. Such forecasts are normally in dollars and are used to answer the question “Is this is a good opportunity to pursue?”

Marketing and finance departments play key roles in establishing forecasts at this early stage.

During concept generation and pretechnical evaluation stages, forecasts investigate sales potential in answering the question “Is this is a good idea for our company to pursue?” Again, forecasts at this point are normally in the form of dollars and provided by the marketing and finance departments.

Entering technical development and launch phases, unit sales forecasts become critical in order to plan for the launch and ensure an adequate product supply through the channel. At this point, operations and the supply chain department play a key role in developing these sales forecasts to drive operational decisions. Specific testing, like product testing during technical development and market testing during commercialization, help to qualify key assumptions and better estimate unit demand and sales revenues from such unit demand.

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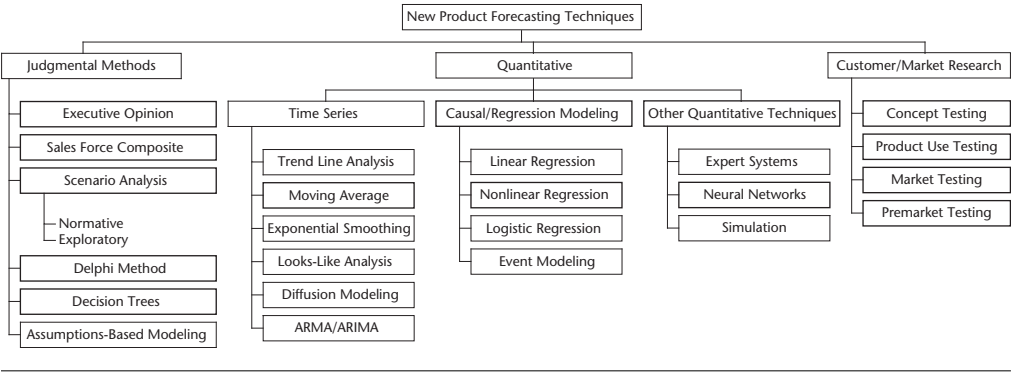
## 16.4 Forecasting Techniques

Numerous forecasting techniques are available. Among the multiple ways in which to categorize these techniques, one way is to organize them into three categories: judgmental techniques, quantitative techniques, and customer/market research techniques. Albeit showing only a sample of the techniques, Figure 16.1 presents the more popular techniques associated with each of these three categories.

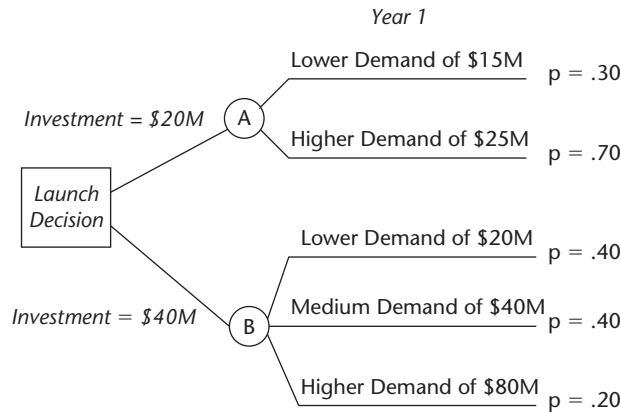
Judgmental techniques attempt to turn experience, judgments, and intuition into formal forecasts. Six popular techniques within this category include Jury of Executive Opinion, Sales Force Composite, Scenario Analysis, Delphi Method, Decision Trees, and Assumptions-Based Modeling:

- *Jury of Executive Opinion*: a top-down forecasting technique in which the forecast is arrived at through the ad-hoc combination of opinions and predictions made by informed executives and experts.
- *Sales Force Composite*: a bottom-up forecasting technique in which individuals (typically salespeople) provide their forecasts. These forecasts are then aggregated to calculate a higher-level forecast.
- *Scenario Analysis*: an analysis involving the development of scenarios to predict the future. Two types of scenario analysis exist: exploratory and normative. Exploratory scenario analysis starts in the present and moves out to the future based on current trends. Normative scenario analysis

**FIGURE 16.1 A SAMPLE OF NEW PRODUCT FORECASTING TECHNIQUES.**



**FIGURE 16.2 FORECASTING USING A DECISION TREE APPROACH.**



**Expected Return After Year 1**

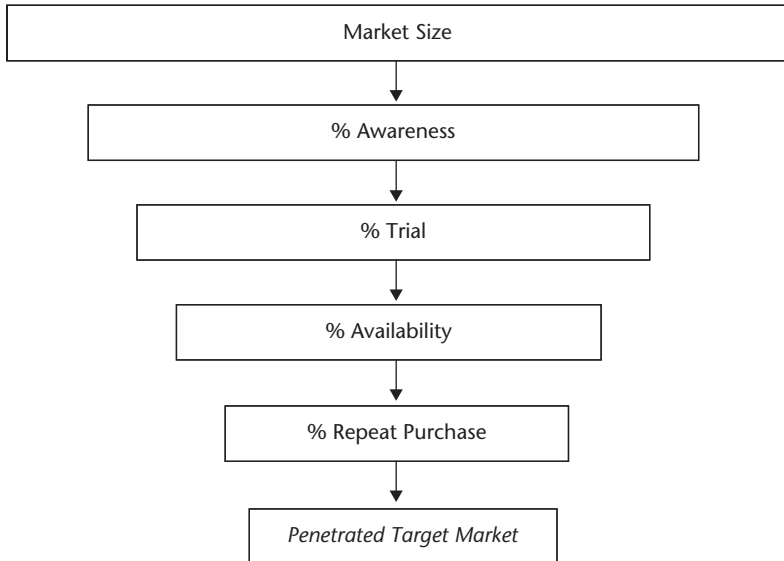
$$E[A] = (.30 \times \$15M) + (.70 \times \$25M) - \$20M = \$22M - \$20M = \$2M$$

$$E[B] = (.40 \times \$20M) + (.40 \times \$40M) + (.20 \times \$80M) - \$40M = \$40M - \$40M = \$0$$

leaps out to the future and works back to determine what should be done to achieve what is expected to occur.

- *Delphi Method:* a technique based on subjective expert opinions gathered through several structured anonymous rounds of data collection. Each successive round provides consolidated feedback to the respondents, and the forecast is further refined. The objective of the Delphi method is to capture the advantages of multiple experts in a committee while minimizing the effects of social pressure to agree with the majority, ego pressure to stick with the original forecast despite new information, the influence of a repetitive argument, and the influence of a dominant individual.
- *Decision Trees:* a probabilistic approach to forecasting in which various contingencies and their associated probability of occurring are determined—typically in a subjective fashion. Conditional probabilities are then calculated, and the most probable events are identified. The example in Figure 16.2 shows two scenarios under consideration: option A and option B. A has two demand scenarios with their associated probabilities of occurrence; B has three demand scenarios with their associated probabilities. Using a decision tree approach, option A looks

**FIGURE 16.3 AN EXAMPLE OF ASSUMPTION-BASED FORECASTING: THE ATAR MODEL.**



Formula

$$\text{Unit Sales} = (\text{Market Size}) * (\% \text{ Awareness}) * (\% \text{ Trial}) * (\% \text{ Availability}) * (\% \text{ Repeat Purchase}) * (\# \text{ Bought Per Period})$$

$$\text{\$ Profit} = (\text{Revenue} - \text{Unit Cost}) * \text{Unit Sales}$$

more attractive because the forecast for expected revenue is \$2 million, versus no revenue in the case of option B.

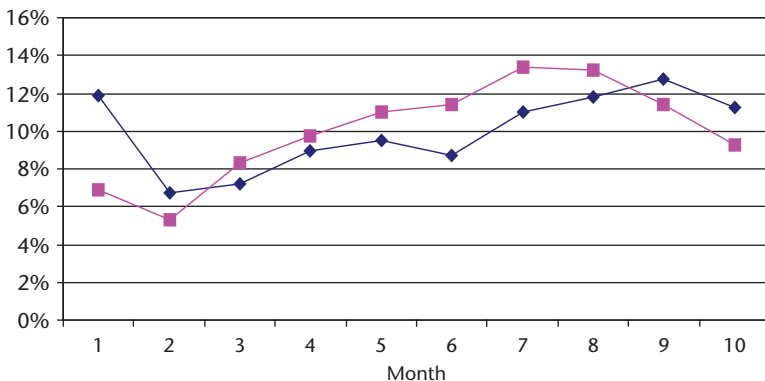
- *Assumption-Based Modeling*: a technique that attempts to model the behavior of the relevant market environment by breaking the market down into market drivers. Then, by assuming values for these drivers, forecasts are generated. These models are also referred to as *chain models* or *market breakdown models*. Figure 16.3 illustrates the ATAR model, which stands for the drivers of Awareness, Trial, Availability, and Repeat Purchase, and is commonly used to forecast consumer packaged goods (see Kahn, 2007, 2011). As illustrated, the ATAR model begins with an

overall market size and uses these drivers to break down the market size proportionally.

Quantitative techniques are broken into the three subcategories: time series, causal/regression modeling, and other quantitative techniques. Time series techniques analyze sales data to detect historical sales patterns and construct a representative graph or formula to project sales into the future. Time series techniques used in association with new product forecasting include:

- *Trend Line Analysis*: a line is fit to a set of data. This is done either graphically or mathematically.
- *Moving Average*: a technique that averages only a specified number of previous sales periods.
- *Exponential Smoothing Techniques*: a set of techniques that develop forecasts by addressing the forecast components of level, trend, seasonality, and cycle. Weights or smoothing coefficients for each of these components are determined statistically and are applied to “smooth” previous period information (see Makridakis, Wheelwright, and Hyndman, 1997; Mentzer and Bienstock, 1998).
- *Looks-Like Analysis (Analogous Forecasting)*: a technique that attempts to map sales of other products onto the product being forecast. Looks-like analysis is a popular technique applied to line extensions by using sales of previous product line introductions to profile sales of the new product. Figure 16.4 shows a product line’s sales curves for two prior product launches, proportioned by month across the first 10 months

**FIGURE 16.4 LOOKS-LIKE ANALYSIS.**



of sales. An average sales curve would be extrapolated from these data and used to forecast sales for the next line extension.

- *Diffusion Models*: models that estimate the growth rate of product sales by considering various factors influencing the consumer adoption process. Considerations taken into account include the rate at which mass media (the coefficient of innovation) and word of mouth (the coefficient of imitation) affect lead users, early adopters, early majority, late majority, and laggard customer segments. Different types of diffusion models exist. The Bass model, Gompertz curve, and logistic curve are examples of popular diffusion models. Diffusion models are also referred to as *technology S-curves* (see Lilien, Rangaswamy, and Van den Bulte 1999; Mahajan, Muller, and Wind, 2000; Morrison, 1996).
- *Autoregressive Moving Average (ARMA)/Autoregressive Integrated Moving Average (ARIMA) Models*: a set of advanced statistical approaches to forecasting that incorporate key elements of both time series and regression model building. Three basic activities (or stages) are considered: (1) identifying the model, (2) determining the model's parameters, and (3) testing/applying the model. Critical in using any of these techniques is understanding the concepts of *autocorrelation* and *differencing*. ARMA/ARIMA models are also referred to as *Box-Jenkins techniques* (see Makridakis et al., 1997).

Causal/regression modeling techniques use exogenous or independent variables and, through statistical methods, develop formula correlating these variables with a dependent variable. The term *causal* is very loosely used because these models are predicated on correlational relationships, not on true cause-and-effect relationships. Four popular techniques within this subcategory include:

- *Linear Regression*: a statistical methodology that assesses the relation between one or more managerial variables and a dependent variable (sales), strictly assuming that these relationships are linear in nature. For example, price may be an important driver of new product sales. The relationship between price and the quantity sold would be determined from prior data on other products within the product line and then used to predict sales for the forthcoming product.
- *Nonlinear Regression*: a statistical methodology that assesses the relation between one or more managerial variables and a dependent variable (sales), but these relationships are *not* necessarily assumed to be linear in nature.

- *Logistic Regression*: a statistical methodology that assesses the relation between one or more managerial variables and a binary outcome, such as purchase versus nonpurchase. A logistic regression model calculates the probability of an event occurring or not occurring.
- *Event Modeling*: often a regression-based methodology that assesses the relation between one or more events, whether company-initiated or not affiliated with the company, and a dependent variable (sales). For example, a promotion used with prior product launches would be analyzed and the bump in sales caused by this promotion statistically determined. The expected bump in sales would be correspondingly mapped to the sales of the new product.

The other category contains those techniques that employ unique methodologies or represent a hybrid of time series and regression techniques. A sample of these forecasting techniques includes:

- *Expert Systems*: typically computer-based heuristics or rules for forecasting. These rules are determined by interviewing forecasting experts and then constructing “if-then” statements. Forecasts are generated by going through various applicable “if-then” statements until all statements have been considered.
- *Neural Networks*: advanced statistical models that attempt to decipher patterns in a particular sales time series. These models can be time-consuming to build and difficult to explain. In most cases, they are proprietary.
- *Simulation*: an approach used to incorporate market forces into a decision model. “What-if” scenarios are then considered. Normally, simulation is computer-based. A typical simulation model is Monte Carlo simulation, which employs randomly generated events to drive the model and assess outcomes.

Customer/market research techniques include those approaches that collect data on the customer/market and then systematically analyze these data to draw inferences on which to make forecasts. Four general classes of customer/market research techniques include:

- *Concept Testing*: a process by which customers (current and/or potential customers) evaluate a new product concept and give their opinions on whether the concept is something that they might be interested in and



would likely buy. The purpose of concept testing is to proof the new product concept.

- *Product Use Testing*: a process by which customers (current and/or potential customers) evaluate a product's functional characteristics and performance. The purpose of product use testing is to proof the product's function.
- *Market Testing*: a process by which targeted customers evaluate the marketing plan for a new product in a market setting. The purpose of market testing is to proof the proposed marketing plan and the "final" new product.
- *Pre-Market Testing*: a procedure that uses syndicated data and primary consumer research to estimate the sales potential of new product initiatives. Assessor and BASES are two proprietary new product forecasting models associated with pre-market testing. BASES is commonly employed in the consumer products goods industry.

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## 16.5 New Product Forecasting Strategy

While a number of forecasting techniques are available, it is important to realize that not all of them are appropriate for every forecasting situation. Qualitative techniques are quite adaptable but very time-consuming; they would therefore not be appropriate in situations where a severe time constraint exists. Quantitative techniques require data and rely on the critical assumption that current data will correspond to future states; if this situation does not exist, quantitative techniques would not be meaningful. Customer/market research techniques are time-consuming and expensive to apply. Budget constraints could seriously limit the degree of customer/market research that may be applied. A toolbox approach is therefore recommended for applying new product forecasting techniques.

To assist in making decisions related to new product forecasting, a variation of the product-market matrix is tailored to reveal four new product forecasting situations (refer to Figure 16.5). Mapping market uncertainty and product technology uncertainty on the two dimensions of current and new reveals four cells, each of which

*While a number of forecasting techniques are available, it is important to realize that not all of them are appropriate for every forecasting situation.*

FIGURE 16.5 NEW PRODUCT FORECASTING STRATEGY.

		Product Technology	
		Current	New
Market	Current	<b>Sales Analysis</b> <ul style="list-style-type: none"><li>- Cost Reductions</li><li>- Product Improvements</li></ul>	<b>Product Line/ Life Cycle Analysis</b> <ul style="list-style-type: none"><li>- Line Extensions</li></ul>
	New	<b>Customer and Market Analysis</b> <ul style="list-style-type: none"><li>- New Uses</li><li>- New Markets</li></ul>	<b>Scenario Analysis (What-If)</b> <ul style="list-style-type: none"><li>- New-to-the-Company</li><li>- New-to-the-World</li></ul>

is represented by one of the following new product forecasting strategies: sales analysis, product line/life cycle analysis, customer and market analysis, and scenario analysis.

Sales analysis is associated with a current market and current product technology, where the uncertainties of market and product technology are lowest. Cost reductions and product improvements would populate this cell. The nature of these products means that sales data would be available because the product has previously existed. Analysis would focus on looking for deviations and deflections in sales patterns based on previous cost reductions and improvements in the product. Quantitative techniques such as times series and regression could be quite useful and provide objective forecasts.

Product line/life cycle analysis is associated with a current market and new technology. Line extensions are associated with this cell and represent higher product technology uncertainty. Because of understanding of the current marketplace, analyses would attempt to overlay patterns of previously launched products in the product line on the new line extensions. These patterns would characterize a launch curve or life cycle curve using looks-like analysis or analogous forecasting.

Customer and market analysis would be necessary in the case of current technology and a new market due to higher market uncertainty. The purpose of this forecasting strategy would be to understand the new market and therefore reduce such uncertainty and achieve greater understanding of the new market. Various customer and market research studies might be used along with assumption-based models in an attempt

to specify market drivers, which would be validated by the customer/market research performed. Products in this cell would include new use and new market products.

A scenario analysis strategy would correspond to the situation of a new market and new product technology, representing high market and product technology uncertainties akin to new-to-the-company (new category entries) and new-to-the-world products. Scenario analysis would be employed to paint a picture of the future and future directions to be taken. Note that a scenario analysis strategy should not be confused with just the use of scenario analysis; rather, the intent of forecasting in this situation is to develop various scenarios on which to base the new product development decision. Given a lack of data, potential difficulty in identifying the specific target market, and questions regarding technology acceptance, subjective assessment techniques would play a major role here.

It should be recognized that forecasting techniques have applicability in each of the cells in Figure 16.5, depending on the specific situation. Customer and market research could greatly benefit market understanding related to cost reductions, product improvements, and line extensions. Subjective assessment techniques can be readily applied to all types of new products. The issue is to recognize the resources necessary and the outcome desired; for example, subjective assessment techniques may not provide enough detail to forecast next year's sales of a product improvement. Hence, the intent of the proposed framework is to offer a strategy to facilitate new product forecasting by suggesting the application of those techniques that appear to be most appropriate. In no way should techniques be viewed as exclusive to only those cells indicated.

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## 16.6 New Product Forecasting Benchmarks

Even with a plethora of techniques and keen strategy, new product forecasting is characteristically associated with low accuracy (high forecast error). As shown in Table 16.1, the overall average accuracy across the six types of new products was 58 percent, with cost improvements generally 72 percent accurate; product improvement forecasts 65 percent accurate; line extension forecasts 63 percent accurate; market extension forecasts 54 percent accurate; new category entry (new-to-the-company) forecasts 47 percent accurate; and new-to-the-world products 40 percent accurate. Note that these mean values of new product forecasting accuracy were collected by asking respondents to indicate the average forecast accuracy

TABLE 16.1 PERCENT ACCURACY AND TIME HORIZON FOR NEW PRODUCT FORECASTS.

Type of New Product	Average Percent Accuracy Achieved	Forecast Time Horizon
Cost Reduction	72%	21 months
Product Improvement	65%	20 months
Line Extension	63%	21 months
New Market/New Use	54%	24 months
New Category Entry	47%	35 months
New-to-the-World	40%	36 months

Source: Kahn (2002).

achieved one year postlaunch (refer to Kahn, 2002). These low accuracies reaffirm that newer markets are more troublesome to forecast (i.e., market extensions, new category entries, and new-to-the-world products) than those situations where a current market is being served (i.e., cost improvements, product improvements, line extensions).

The overall average forecast time horizon for these forecasts is approximately 26 months. As shown in Table 16.1, the average time horizons for cost improvements, product improvements, line extensions, and market extensions were below this average (21, 20, 21, and 24 months, respectively), while the average time horizons for new category entries and new-to-the-world products were above this average (35 and 36 months, respectively). These results suggest that forecasts for new category entries and new-to-the-world products are characteristically longer-term in nature and, correspondingly, more strategic in nature than forecasts for the other types of new products.

*New product forecasting is characteristically associated with low accuracy.*

In terms of process characteristics, benchmarking research suggests that in almost two-thirds of companies the marketing department is responsible for new product forecasting. Even if it is not responsible, the marketing department is heavily involved in the new product forecasting effort, with the departments of sales, sales forecasting, and market research also having an appreciable level of involvement. In terms of technique usage, companies typically use more than one new product forecasting technique—on average,

two to four. The purpose of using multiple techniques is to ascertain a good baseline for the new product forecast by reconciling the forecasts derived by each forecasting technique. Research, though, suggests that using several techniques used does not necessarily lead to higher new product forecast accuracy or greater satisfaction with the new product forecasting process. Therefore, simply increasing the number of forecasting techniques employed does not result in successful forecasting; as previously noted, up to four forecasting techniques appears to be sufficient.

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## 16.7 The New Product Forecasting Process

While applying an appropriate forecasting technique will benefit the new product forecasting effort, there are further considerations. Various uncertainties inherent in the new product should be accounted for, including potential cannibalization effects and market penetration to be achieved, along with finding pertinent data and having the time to perform the necessary analyses to address these and other uncertainties. The way successful companies have done this is through a process perspective—specifically, by creating a structured, systematic new product forecasting process. Such a process builds on experiences from prior new product forecasts, cross-functional communication (especially with the marketing department), and customer feedback; together within a process, these enable organizational learning and understanding on which to make a credible and realistic forecast.

Assumptions management is an important part of the new product forecasting process. The process would clearly specify assumptions and make them transparent so that there is company-wide understanding of what underlies these assumptions. After launch, successful forecasting companies would then implement tracking systems that closely monitor and control these assumptions to determine if the forecasts will prove to be accurate or whether a deviation is occurring. Transparency of assumptions is particularly valuable for clarifying whether the forecast is based on sound rationales or simply on optimism.

Successful forecasting companies also realize that new product forecasts should be range forecasts, not point forecasts. These ranges typically become more narrowed as the product approaches and enters the launch phase. For example, pessimistic, likely, and optimistic cases could be connected with the monitoring and control of assumptions to determine which scenario is playing out.

Lastly, best-in-class companies are constructing databases to collect, track, and reflect on new product rollouts, especially in the consumer packaged goods industries. Such databases are crucial to the validation of new product forecasting assumptions, as well as for documenting new product forecasting accuracy. Tying this internal database with syndicated data, market share data, and competitor data may be used to enable more robust analyses. The database also enables other sophisticated analyses related to brand preference, price elasticities, and geographic rollout scenarios. The issue is having the discipline to establish and keep up with maintenance of the database with data feeds on new product launches.

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## 16.8 Summary

New product forecasting is certainly not easy, and there is no silver bullet for this process. However, companies that employ appropriate techniques coupled with a well-structured new product forecasting process show a greater propensity for new product forecast success. Techniques play the key role of establishing a sound initial baseline forecast. The new product forecasting process then refines and augments this baseline forecast. Together these elements help to provide the best possible, most meaningful new product forecast on which to drive new product decisions.

*Companies that employ appropriate techniques coupled with a well-structured new product forecasting process have a greater chance of achieving new product forecast success.*

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## CHAPTER SEVENTEEN

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# SOCIAL MEDIA AND NEW PRODUCT DEVELOPMENT

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Amy Kenly

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### 17.1 Introduction

Social media are changing our personal interactions, with an unprecedented rate of adoption that outpaces the adoption rate of previous innovations such as the radio, telephone, television, and even the iPod. These tools are used intuitively and allow people to share information, collaborate, discuss common interests, and build relationships. With this trend well underway, businesses are beginning to explore how social media can help them grow and improve profits, not just with common practices such as outbound marketing, but to enhance business interactions as part of the innovation and product development process.

An increasing number of companies are trying to make sense of Web 2.0, Enterprise 2.0, social media applications, and social computing technologies. They are looking for ways to align their innovation and strategic product development priorities with social networking initiatives. How can companies improve their product innovation by leveraging this fundamental communications shift in society?

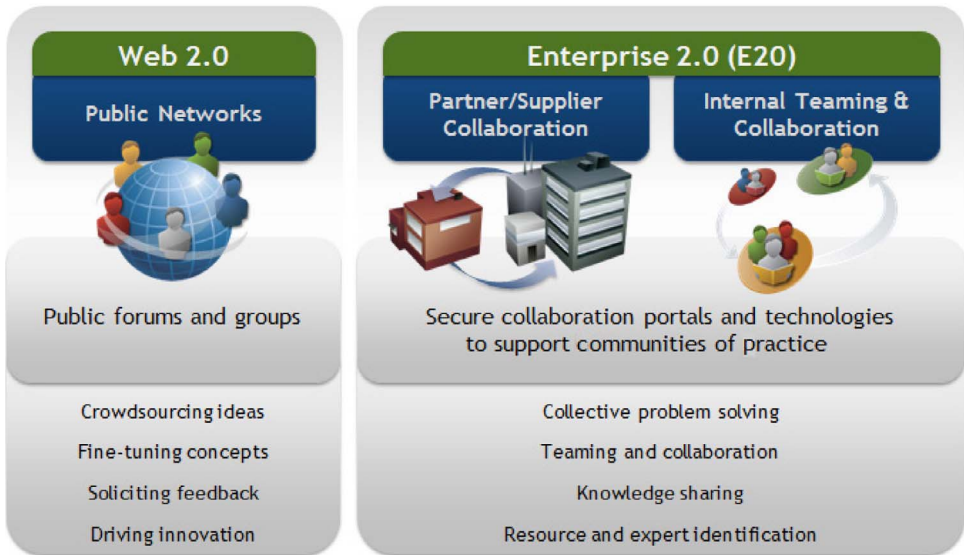
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### 17.2 Definitions

Even writing about and defining social media is a challenge. The pace of change is extreme, with new buzz words, acronyms, platforms, features, and use cases emerging daily. It's hard enough to keep up with the



FIGURE 17.1 DEFINITIONS OF WEB 2.0 AND ENTERPRISE 2.0.<sup>1</sup>



personal social media trends in Facebook, Google+, Twitter, and all the others. For new product development professionals who prefer to rely on time-tested strategies and processes, and who tend to use hefty, feature-rich, enterprise-level software packages, social media are even harder to embrace. Despite this, here are some basic definitions we can work from, as well as the links between these terms and the world of product development and innovation (see Figure 17.1):

- Social Media:* A set of applications that allows the creation and exchange of user-generated content in a collaborative community setting
- Social Product Innovation:* The practice of leveraging social media principles and technologies to support innovation and product development processes

Within these definitions, there are two main categories of social media where companies can take advantage of social processes and technologies to support innovation and product development.

<sup>1</sup> A Kenly and B. Poston, B., *Social Media and Product Innovation: Early Adopters Reaping Benefits Amidst Challenges and Uncertainty* (Beachwood, Ohio: Kalypso, 2009).

*Web 2.0*: Internet-based social networks, forums, and groups that are focused outside of the organization. Examples include external Wikis and blogs, traditional media sites, crowdsourcing sites, and custom-built innovation portals.

*Enterprise 2.0 (E20)*: Secure networks, forums, and groups that are typically used inside the organization or with an extended group of partners and suppliers. Examples include intranets, social product development tools, shared workspaces, electronic whiteboards, and collaboration portals like SharePoint 2010.

The current trend toward an open innovation model is supported by Web 2.0 and Enterprise 2.0 strategies and technologies. According to Henry Chesbrough, a professor and executive director at the Center for Open Innovation at the University of California, Berkeley, “Open innovation is a paradigm that assumes that firms can and should use external ideas as well as internal ideas, and internal and external paths to market, as the firms look to advance their technology.”<sup>2</sup> In short, open innovation is a product or technology development model that extends beyond the boundaries of a firm in collaboration with others. Much of this activity can rely on various forms of social media to empower people to come up with ideas or solve critical problems. In today’s resource-constrained environment where hiring is not always possible, sometimes the experts you need don’t work for you. They might be customers, consumers, academics, or smart people from other industries or specialties. Web 2.0 includes solutions that help you tap into these external resources to help solve problems and create solutions with others. For many companies, it’s difficult to know who within the organization or extended enterprise might be able to help with a problem or new idea. Enterprise 2.0 includes solutions that help companies identify and connect in-house resources and experts and give them a virtual “place” to work together. This chapter will focus on using social product innovation to help bring new ideas into the organization and augment the internal cooperation aspects of open innovation.

*Web 2.0 and Enterprise 2.0 (E20) are two main categories of social media where companies can take advantage of social processes and technologies to support innovation and product development.*

<sup>2</sup> H.W. Chesbrough, *Open Innovation: The New Imperative for Creating and Profiting from Technology*. (Boston: Harvard Business School Press, 2003), p. xxiv.

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## 17.3 Leveraging Social Media in the Product Life Cycle

While many companies are familiar with using social media for outbound marketing and communication efforts, leveraging social media for product development and innovation is a new concept for most. There are several emerging areas where leveraging social principles and technologies to support innovation, business goals, and product development processes—called *social product innovation*—make the most sense and hold the most potential.

In Figure 17.2, we see Business Strategy and Innovation Roadmaps at the top because successful social product innovation must link to these high-level business elements. The product life cycle process is shown in the center, moving from the front end of innovation, through product development, and into in-market. It is in these product life cycle processes that social product innovation adds value. Let's look at these three areas in more detail.

*Front End of Innovation:* Next to marketing and communications, the front end of innovation (FEI) is the area where the potential of social product innovation is most clear. FEI is all about filling the pipeline with new ideas and supporting that effort with a process that helps validate the opportunities and convert ideas into business value. Traditional product innovation methods like focus groups and formal market research can be time-consuming because of the large amount of strategy and planning involved. Using social media to supplement these activities can save time and money. Companies have had success using social principles and technologies for idea generation, analysis, and management during the FEI process. This includes collecting new ideas and requirements, community commenting and voting, and reporting and measuring capabilities to help identify and select the best ideas to promote to the innovation pipeline.

*Social Product Development:* After the best ideas have been chosen from the FEI process, social media have huge promise in their ability to enhance communication and collaboration during product development. Companies are using social models and technologies to create “communities of practice” around various product or functional teams, supporting the way these teams work today and making it easier and faster to collaborate, solve problems, and share knowledge. In some cases, the technologies that support social product

**FIGURE 17.2 LEVERAGING SOCIAL MEDIA ACROSS THE PRODUCT LIFE CYCLE.**



development are integrated into product life cycle management (PLM) solutions that are already in place, providing a modern, flexible environment that product development teams enjoy using.

*In-Market Support and Sentiment Analysis.* This is another business process that can be enhanced by social technologies and can help companies listen, collect, gauge, and measure feedback on in-market products. Sophisticated sentiment analysis tools are also available that help analyze customer sentiment, identify opportunities for new products or features, and incorporate this feedback into the innovation pipeline. Another great example is warranty teams sharing service-related insights or product fixes with service professionals to improve in-market support.

## 17.4 Common Concerns and How to Overcome Them

Like any new business initiative, incorporating social product innovation strategies and technologies into existing innovation and product development processes is likely to encounter resistance and lack of support.

Despite the potential benefits, there are real challenges and uncertainties that companies must overcome. The most common challenges fall into five main categories: strategy, people and culture, business processes, technology, and sustainability.

*Strategy:* Using social models and technologies for product development and innovation is not straightforward; there are no time-tested industry practices to turn to as a guide. Many companies are experimenting, but very few have a defined strategy and plan in place. In an emerging space, it's a good idea to stay flexible, so it's not necessary to plan every action and step; however, those companies that develop an overall social product innovation strategy that aligns with their business and innovation goals will be a step ahead. This alignment can also help justify the business value of the initiative and address strategic concerns like intellectual property protection.

*People and Culture:* This is undoubtedly one of the most daunting areas to address. With all the myths about the use of social networks in the enterprise and the general lack of understanding, it's often easier for people to resist the idea than to support it. The corporate cultures that equate all social media with Facebook (which they block) can be very difficult to navigate. It's important to do some internal education to be sure that people and teams understand that social models and technologies can be used in business for more than just branding and marketing products. Clearly defining and communicating the ways that social concepts and technologies can be used to enhance product development and innovation processes can help open people's minds.

*Business Processes:* Ownership of a new initiative is always a key sticking point. Many companies have jumped in with sweeping open innovation processes that create vast quantities of input, ideas, and comments that then must be analyzed. These initiatives often fail because the resources and time required to sift through the inputs for viable ideas can significantly lengthen the product development process. But implementing social product innovation processes and supporting software does not have to create more processes and work for innovation and development teams. Properly planned and managed, the processes people are using will largely stay the same: Social product innovation can augment processes already in place and actually make them faster and easier.

*Technology:* Many companies make the mistake of jumping immediately to software selection without defining the strategy, addressing the culture, and defining a business process to start with. Social product innovation technologies should be used to support the processes you've defined as the most important to your company. With an almost dizzying array of technology options available for open innovation, voice-of-customer, social product development, and sentiment analysis for in-market products, technology must be viewed as an enabler of strategies and processes. Getting bogged down too early in software selection is likely to delay the initiative.

*Sustainability:* Sustainability challenges often center on keeping the organization and collaboration partners engaged and supportive throughout the journey. In a tactical sense, as some of the supporting technologies mature, they are offering more options for incentivizing participation. On a more strategic level, the company should maintain the support of the executive team by connecting social product innovation results to business results.

It's easy for companies to get stuck worrying about tactical challenges like security concerns and software features. It's important to refocus early efforts on addressing the more strategic issues discussed above and identify how social product innovation can impact the way companies innovate and bring products and services to market. Market leaders are already beginning to learn, experiment, and develop organizational knowledge and experience. These are the companies that will lead the way.

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## 17.5 Three Basic Steps to Success

Despite the challenges, it's clear that social product innovation is an emerging trend in the early stages of adoption. Examples vary from grassroots efforts to formal strategies with established initiatives. However, while there are some early adopters with formal strategies and established initiatives, for most companies social product innovation is still extremely new. Even early adopters are rolling out initiatives for only a small percentage of their products or services. Despite this, the projected growth in this area is impressive. There is a feeling that there will be a fundamental shift, and few want to be left behind. Let's take a pragmatic look at the three basic steps to a successful social product innovation initiative.

### 17.5.1 Step 1: Make a Plan with a Cross-Functional Team

Executive defining an overall strategy and aligning it with existing innovation, new product development, and business plans is critical. However, strategies built in silos are rarely effective. Most successful strategies are developed and executed by cross-functional teams.

Deciding who to involve is often the biggest challenge. To build a team, find some peers from within the product development and product marketing areas who are interested in using social models and technologies for innovation, and approach the marketing teams already using social media tools to collaborate on ideas. Identify an executive sponsor or sponsors to help with the business perspective. Every company is different, but bringing more perspectives to the table creates ownership and buy-in from various team members and their departments, and will ultimately help improve the probability of success of the program.

The team then works together to create the strategy and plans for social product innovation by examining the following questions:

- How are we going to use social media to inform product innovation, product development, and product management processes?
- How does this link to business and innovation strategies?
- What external parties need to be included?
- What internal departments need to be included?
- Who will the owner(s) be?
- What are the goals (crowdsourcing ideas, team problem solving, knowledge sharing, resource identification, etc.)?
- How will we measure success?

In some cases, the company's partners, suppliers, and possibly customers have implemented similar programs. Consider reaching outside of the company to learn from the experiences of others. They may not sit on the team full-time, but they can offer valuable insights into strategy development.

### 17.5.2 Step 2: Determine a Starting Point

Successful companies use their defined strategy to select a small, focused starting point based on business needs and focus on demonstrating value. After an initial success, building incremental value across other business processes becomes easier.

Social product innovation should augment and enhance processes already in place. For example, for processes where companies have traditionally used focus groups and market research to connect with end users and consumers, they can now use Web 2.0 initiatives for crowdsourcing ideas, fine-tuning concepts, soliciting feedback on products and services, and sentiment analysis.

Internally, where companies have traditionally held in-person design reviews, sent mass internal emails to identify experts, and worked within narrow product development groups, they can now use Enterprise 2.0 to increase productivity, teaming, and collaboration. Enterprise 2.0 enables processes like collective problem solving, cocreation of products and services, knowledge sharing, and resource/expert identification.

### 17.5.3 Step 3: Develop a Sustainable Strategy

It's not enough to have a strategy. Social product innovation must be considered *evolutionary*, not *revolutionary*. To be sustainable, it's important not to overwhelm the organization. Build incrementally by demonstrating a clear return on investment for the selected starting point, and don't shy away from hyping results. Use your successes as an opportunity for internal education to help reduce lingering challenges from people and culture. Communication throughout the effort needs to be a true two-way dialogue so that managers can learn what is working sooner and adjust what is not. This feedback helps create a self-sustaining effort.

To build a sustainable, profitable strategy for years to come, it's important to remember that this is a journey. Leading companies throw stuff at the wall to see what sticks, then pick the best ideas and develop them.

*Social product innovation can add value in many aspects of innovation and product development across the various phases of the product life cycle.*

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## 17.6 Examples of Success

Social product innovation can add value in many aspects of innovation and product development across various phases of the product life cycle. So far, some of the most successful applications have come in the front end of innovation. A 2010 study by Kalypso<sup>3</sup> reports that in the front end of

<sup>3</sup> Kenly and Poston (2009).



innovation, almost one-half of companies (46 percent) surveyed indicated that they gained *more* new product ideas or requirements from the use of social media in product innovation. Perhaps more importantly, approximately the same percentage of companies (43 percent) benefited from *better* new product ideas or requirements. Additional benefits reported include faster time to market, faster product adoption, and lower product development costs. These benefits contribute to the success of new products or services and help achieve higher product margins.

Here are some additional examples of industries and processes where social product innovation has had a strong impact.

*The Virtual World of the Consumer:* For business-to-consumer (B2C) companies in the consumer packaged goods (CPG) or services industries, consumer immersion is key to understanding what products and services consumers really want to buy. Traditional market research methods are effective, including going into homes, workplaces, and play areas to assess consumer habits and needs, but they miss out on the growing virtual world. B2C companies that augment traditional market research with Web 2.0 models and technologies to monitor, participate in, and engage in this virtual world tap into a continuous stream of valuable unsolicited content and context, which can bring additional insights to market and consumer research. It can be a challenge to identify and build these social networks and to keep the participants engaged. With careful planning and well-defined incentive programs, traditionally expensive and time-consuming physical focus groups for testing product ideas can be replaced by virtual focus groups with greater, easier opportunities to provide feedback. These groups also help reinforce the brand in the eyes of the consumer.

*Internal Knowledge Networks:* Many companies struggle to achieve a cost-effective way of involving a larger set of internal experts to help solve problems. Many times, solutions used by one development team can be reapplied successfully to other projects or products. Internal knowledge networks help development teams connect directly with subject matter experts to provide feedback throughout the new product development process. Results can include global collaboration, increased knowledge sharing among multiple divisions, and significant R&D cost savings by reducing rework and redundancy. Using an Enterprise 2.0 solution this way is a great option for companies in regulated industries like life sciences and pharmaceuticals, where the guidelines and rules on social media communication are still evolving.

*Virtual Private Expert Networks:* When companies raise their innovation expectations but don't increase hiring, the resulting challenge is that of having to do more with less—the *squeeze*. Turning to a pure open innovation model to try to address this issue creates a large volume of ideas, but the hard work of evaluating, prioritizing, and deciding which of those ideas are worthy of pursuit still needs to be done. For many companies, a semiopen innovation model has the potential to address the squeeze. Companies can achieve faster time to value with a virtual private expert network (vPEN) model—a retained contingent network of 20 to 30 people with different areas of expertise that organizations can look to for help in supporting innovation and product development processes. The vPEN can operate virtually using a collaborative model that allows its members to communicate across the organization and with one another to generate concepts and build upon ideas. And the squeeze is avoided by engaging a group of experts the company has retained without having to hire more staff.

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## 17.7 What's Next? A Discussion of Upcoming Trends

The Kalypso researchers found that the overall social product innovation trend is growth despite uncertainty. Of the companies that are using or planning to use social media for innovation and product development, 90 percent are planning to increase their usage over the next 12 months. No companies planned to decrease it. Companies that have started to use social media for product innovation do not plan to back off. About one-third (32 percent) are planning to increase their use significantly. While initiatives are still in the early stages, they are gaining momentum. There is a feeling that there will be a fundamental shift, and few want to be left behind.

The use of social models and technologies to augment work at the front end of innovation will continue to grow as more and more companies choose this as their logical starting point. Other areas, like social product development and sentiment analysis, will begin to gain more momentum.

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## 17.8 Summary

As the use of social media explodes in our personal lives, innovative companies are piloting social media initiatives to move the needle on business results. Recent years have shown rapid growth and adoption of various mass collaboration platforms to create, share, discuss, and codevelop ideas and information. Despite this trend, companies still struggle to understand how to apply social media principles and technologies to innovation and product development in a practical, measurable way. With few best practices to follow and uncertainty about performance measurement systems, companies are clearly still experimenting.

Early results are promising, including improved problem solving, enhanced idea generation, increased customer intimacy, and expanded development networks. It will be interesting to follow the development of social product innovation over the next three to five years. The one thing that seems clear already is that the most successful social product innovation initiatives are those that align with the company's overall product development and innovation strategies.

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## SECTION FOUR

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# ACHIEVING

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*The value of achievement lies in the achieving.*

—ALBERT EINSTEIN (1879–1955), GERMAN-BORN PHYSICIST





## CHAPTER EIGHTEEN

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# DEVELOPING INTELLIGENT PRODUCTS

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Serge A. Rijsdijk and Erik Jan Hultink

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### 18.1 Introduction

The last two decades showed a trend toward equipping physical products with information and communication technology (ICT) in the form of microchips, software, sensors, and other advanced electronics. Due to this application of ICT, an increasing number of products have become able to collect, process, and produce information; essentially, they are able to *think* and can therefore be described as *intelligent products*. While intelligent industrial products (e.g., assembly robots, autopilots, and missiles) have existed for some time, the range of products showing intelligent features is increasing. An example of an intelligent consumer product is the Electrolux Trilobite autonomous vacuum cleaner. This machine uses a sonar system, four motors, and sophisticated electronics to navigate. It has no problem avoiding collisions with anything placed on the floor. When the batteries run low, the Trilobite automatically returns to the charging station and, if necessary, resumes cleaning once they are fully charged. In this chapter the topic of intelligent products is addressed, along with how companies may create ideas for intelligent products and which advantages and drawbacks are attached to the development of intelligent products.

The organization of the chapter is as follows: The chapter first defines product intelligence and describes the capabilities that distinguish intelligent products from nonintelligent products. Next, we discuss how the development of intelligent products can be beneficial for firms. After that, we describe issues that new product developers should take into account when generating ideas for new intelligent products, when designing intelligent products, and when commercializing intelligent products.

## 18.2 The Capabilities of Intelligent Products

As a result of the use of ICT, intelligent products show six specific capabilities that we will refer to as *product intelligence*. These six capabilities are the ability to *cooperate*, *adaptability*, *autonomy*, *humanlike interaction*, *personality*, and *reactivity*. We will also refer to these capabilities as *dimensions* because they are capabilities that intelligent products show to a lesser or greater degree (see also Rijdsdijk, Hultink, and Diamantopoulos, 2007). We will describe the six dimensions below in alphabetical order and illustrate them with examples of existing products.

*Intelligent products show the six specific capabilities of ability to cooperate, adaptability, autonomy, humanlike interaction, personality, and reactivity.*

### 18.2.1 Ability to Cooperate

The first dimension of product intelligence is the *ability to cooperate* with other devices to achieve a common goal. This directly corresponds to the fact that the age of discrete products that operate in an isolated manner is ending. Instead, products are becoming more and more like modules with built-in assumptions of their relationships with both users and other products and systems such as the Internet. As a result, an increasing number of products are thus able to communicate not only with their users, but also among themselves.

### 18.2.2 Adaptability

*Adaptability* is the second dimension and refers to the ability to learn and improve the match between a product's functioning and its environment. By using ICT, products can build up an internal model of their environment and perform complex decision-making tasks. As such, adaptable products are able to respond and adapt to their users or to changes in their surroundings (e.g., the room in which they are placed) over time, which may result in better performance. An excellent example of a physical product that is adaptable is the Chronotherm IV thermostat developed by Honeywell. From the moment of installation, the Chronotherm collects data on the time it takes to raise the temperature in a room. While doing this, the device also takes into account the outdoor temperature. When the user instructs the thermostat to reach a specific room temperature at a certain time, the device will do so on the basis of the data it previously collected and its performance will therefore improve over time.



### 18.2.3 Autonomy

The third dimension of *autonomy* refers to the extent to which a product is able to operate in an independent and goal-directed way without interference of the user. An example of an autonomous product is the Automower from the Swedish firm Husqvarna. This lawnmower is placed in the garden, after which it moves through the garden and cuts the grass all by itself. By setting the limits of the garden with a metal wire, the owner ensures that the lawnmower will remain within the limits of the garden.

### 18.2.4 Humanlike Interaction

The fourth dimension, *humanlike interaction*, concerns the degree to which the product communicates and interacts with the user in a natural, human way. Usability is an important determinant of the adoption of new products, and the marketplace is populated by many complex, nonintuitive, cumbersome devices that frustrate their users. One way of increasing product usability is the application of voice production and recognition. For example, car navigation systems produce speech and some of them also understand speech. There is no need for users to push any buttons while driving, and the driver is guided to his or her destination through a dialogue with the navigation system.

### 18.2.5 Personality

The fifth dimension, *personality*, refers to the ability to show the properties of a credible character. Providing a product with a personality is supposedly beneficial for the user's comprehension of the product. For example, the paperclip—or Einstein assistant in Microsoft Office—suggests that “someone” assists the users. For physical products, the property of personality mainly refers to the way in which users interact with the product. Typical examples of products with a personality are the Furby and Sony's AIBO. These toys express emotions and show certain emotional states.

### 18.2.6 Reactivity

*Reactivity* is the last dimension of intelligence and refers to the ability of a product to react to its environment in a stimulus/response manner. A good example of a reactive product is the Philips Hydraprotect hairdryer. This hairdryer lowers the temperature of the air when the humidity of the hair decreases, thereby preventing damage to the hair caused by hot air. Reactive products distinguish themselves from adaptable products in that

their reactions to the environment are merely direct responses. In contrast to adaptable products, they have no internal models of their environment and are not able to learn and adapt the nature of their reactions over time.

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## 18.3 The Opportunities of Product Intelligence for Firms

Making products more intelligent offers several opportunities for firms that are involved in new product development. First, intelligent products may gain an advantage over competing products. A more intelligent product may perform its central function better than a nonintelligent competing product. A product may also contain intelligent features that make it superior in terms of the benefits that it offers. An example of an intelligent version of a long-existing product category is the Siemens WIQ 1430 washing machine. Due to the use of ICT, the WIQ 1430 is able to do several things that conventional washing machines are not able to do. The machine weighs the laundry in its drum and advises the user about the amount of detergent to use. Also, the machine has a certain amount of autonomy in that it detects how dirty the drained water is. Depending on the amount of dirt, the machine decides to reuse this water to wash the laundry or not. As such, the intelligence of the washing machine results in the reduction of water and detergent use. This is environmentally friendly and also cost reducing for the owner of the washing machine.

Second, the development of intelligent products may open up new markets. The application of ICT can lead to products that do things that could not be done before. A typical example of such a product is the Sony AIBO, which was mentioned in Section 18.2.5. Also, personal digital assistants (PDAs) and smartphones form a product category that would not exist without ICT. One of the first PDAs was the Newton from Apple Computer. At the time it was a unique product; it contained advanced features such as handwriting recognition, and it also fulfilled multiple functions such as those of a diary and a calculator. Although the Newton was not successful in the marketplace, it caused the emergence of a new category of products and eventually set the stage for the development of smartphones such as the iPhone.

Third, intelligent products can serve as showpieces for the company. Because of their technological sophistication, intelligent products often contain cutting-edge technology. As such, intelligent products can provide the company with the image of being technologically advanced. Honda, for example, is developing the humanoid robot ASIMO. ASIMO is the result of a project that was started in 1986 with the idea of developing a new form of mobility

and creating a new kind of robot that can function in society by walking on two legs. Honda currently uses the most advanced version of the ASIMO for publicity purposes by letting it travel around the world and meet prominent people such as European politicians and Olympic medalists. With its advanced robot, Honda further strengthens its image as a technological leader.

Several leading institutes and companies have set up specialized laboratories to conduct research on the integration of ICT into new consumer products and people's living environments. For example, the Massachusetts Institute of Technology (MIT) has set up House\_*n*, a home of the future consortium (see [www.architecture.mit.edu](http://www.architecture.mit.edu)). This consortium has the ultimate goal of developing a house that adapts to people's needs and reacts to environmental influences. The "n" represents adjectives such as *next generation* and *neural*. The researchers envision a house with an electronic "nervous system" that learns the habits of those who live in it and assists in their living patterns. In business, Microsoft and Philips have set up comparable projects. Microsoft set up the EasyLiving project that aims to develop architecture and technologies for intelligent environments. Philips founded the "Homelab" and envisions a future of ambient intelligence in which they bring advanced intelligent technologies into people's homes. As such, intelligent technologies will form a key element in both today's and tomorrow's new products. Those companies that take the lead in this area may benefit by being able to create superior products and gain an advantage over their competitors. However, several barriers may have to be overcome before customers will adopt these products.

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## 18.4 Potential Barriers for Intelligent Product Acceptance

Besides the advantages that were described above, the development of intelligent products also has some disadvantages. First, intelligent products may contain hidden functionality. Second, intelligent products may be perceived as complex. Third, the unique capabilities of intelligent products may encounter resistance from customers in the form of perceived risk. We will further elaborate on these disadvantages of intelligent products below.

### 18.4.1 Hidden Functionality

Due to the fact that the functionality of intelligent products is largely based on microelectronics and software, the relation between a product's form and how it can be used is less obvious than in most traditional products.

In some intelligent products this relation is even absent. Customers may therefore have difficulty understanding an intelligent product's functionality and how it should be operated, because product form often fulfills an important role in the communication of such information to the customer (Veryzer, 1995). Product form provides cues about product attributes and helps customers to understand and categorize a product. As a result, a product that effectively communicates its function and method of operation can facilitate successful interaction between the customer and the product and positively influence customers' preferences and choices (Veryzer, 1995).

With intelligent products, however, this communication function is frequently absent because microelectronic and software components influence product form only to a limited extent. This provides developers with considerable freedom to determine the product's form. However, the functionality of most intelligent products is so complex and diverse that it is often impossible to fully express it by a product's form. An example of a product that suffers from the problem of hidden functionality is the smartphone. A challenge in marketing smartphones is to help consumers recognize and appreciate their functionality, particularly those functions that are not apparent from the product's surface attributes. In conclusion, customers may have difficulty observing the functionality and benefits of intelligent products. This disadvantage may hamper the success of intelligent products.

### 18.4.2 Complexity

Product complexity negatively influences new product success; this is also the case for intelligent products. Norman (1998) recognized that "as technology has advanced, we have understood less and less about the inner workings of the systems under our control," and he illustrates the problem by comparing a pair of scissors to a digital watch (pp.12–13):

Consider a pair of scissors: even if you have never seen or used them before, you can see that the number of possible actions is limited. The holes are clearly there to put something into, and the only logical things that will fit are fingers... . You can figure out the scissors because their operating parts are visible and the implications clear... . As a counter-example, consider the digital watch, one with two to four push buttons on the front or side. What are those push buttons for? How would you set the time? There is no way to tell—no evident relationship between

the operating controls and the functions... . With the scissors, moving a handle makes the blades move. The watch ... provides no visible relationship between the buttons and the possible actions, no discernible relationship between the actions and the end result.

The problem with the digital watch is also applicable to intelligent products. Intelligent products can be considered as some of today's most technologically advanced products, and many customers may find it difficult to understand and use them. Intelligent products have the reputation of being hard to understand, harder to use, and sometimes even inappropriate to complete the tasks they are designed for. Some intelligent products are equipped with a large number of features, but they lack appropriate user interfaces that make their functionality clear and understandable. Another factor that may complicate the use of intelligent products is the lack of feedback in the form of movements or noise. Processors and memory chips do their work invisibly and silently (Den Buurman, 1997). Several examples illustrate the complexity of intelligent products. For example, only a minority of the owners of DVD recorders can program these devices for delayed recording. Many users of cell phones do not know that certain functions exist. In other cases, customers stop using certain functions because their operation is too difficult to learn and use. Such complexity problems can be barriers to the adoption of intelligent products.

### 18.4.3 Perceived Risk

A third barrier to the adoption of intelligent products is the risk that customers perceive in these products. Although the capabilities of intelligent products may result in the benefits that were described in Section 18.2, they also have their downsides. Customers may, for example, lack confidence in the product. The idea of an autonomous vacuum cleaner may at first seem attractive. However, customers need to have sufficient confidence in the vacuum cleaner before they have it clean the floors of their house. If the vacuum cleaner cannot avoid collisions with other objects, it might cause damage. Also, customers may feel that they lose control when intelligent products start to make decisions for them. A washing machine that itself determines how much detergent should be used and at what temperature the laundry should be washed may be perceived as incapable of properly performing its task, even when it makes better decisions objectively than its owner. As such, the sometimes far-reaching functionality of intelligent products may be a reason for customers not to adopt them.

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## 18.5 Recommendations for the Development of Intelligent Products

The development of intelligent products requires specific attention in different phases of the new product development process. This section describes several research-based implications. First, we provide suggestions for how managers should generate new ideas for intelligent products. Second, we provide suggestions for how new concepts for intelligent products can be tested. Third, we describe recommendations on how to design intelligent products in a way that reduces the negative effects resulting from their increased complexity and perceived risk. Finally, we provide suggestions on how intelligent products should be commercialized.

### 18.5.1 How to Generate Ideas for Intelligent Products: Analogical Thinking

Despite the negative consequences that these intelligence dimensions may have for customer perceptions, new product developers can use these dimensions to think about their products and come up with new product ideas using analogical thinking (Dahl and Moreau, 2002). *Analogical thinking* means that existing information from one domain is transferred to another. As such, development team members or other practitioners involved in the generation of new product ideas can apply the six dimensional conceptualizations of product intelligence to their own products. For example, for a new cell phone, one could generate ideas by striving for a more autonomous, a more adaptable, or a more reactive cell phone. Generating new product ideas in such a way may result in original and successful intelligent product ideas.

Research has shown that certain product intelligence characteristics are more problematic than others (Rijsdijk and Hultink, 2009). New product ideas that are generated using one intelligence dimension as an analogy may therefore be more likely to succeed than ideas using another dimension. Idea generation in which one draws an analogy with product autonomy will result in new product ideas that are most likely to succeed. Although autonomous products may be perceived as more likely to fail than nonautonomous products, customers also generally associate higher levels of autonomy with higher levels of product advantage. Also, in some cases, higher levels of autonomy may lead to a decrease in perceived complexity when a product takes over complex cognitive tasks. A product with increased autonomy that demands less effort from users is perceived to offer more advantage and be less complex than competing products. Research, for example, showed this effect for a washing machine that decides which washing program should be

used. As such, this product took over a relatively complex task from the user, and potential customers perceived this as an advantage. We expect that other new product ideas with similar functions can be relatively successful.

Intelligent products showing properties that correspond to the dimensions of adaptability and reactivity are perceived as being more advantageous and more compatible with customer behavior. Such characteristics, however, may also lead to higher levels of perceived complexity and risk. Therefore, the generation of ideas for adaptive or reactive products can be fruitful, but it should be accompanied by measures against the increasing perceived complexity and risk. Section 18.5.3 provides several suggestions on how possible perceptions of complexity and risk can be reduced by the design of the product. Section 18.5.4.1 provides suggestions on how this can be achieved by adaptation of the commercialization phase.

Generating ideas for new products that can cooperate with other products is relatively problematic in that this process does not always deliver advantages in the eyes of the customer and the compatibility with existing customer behavior that one would wish for. When a product is able to communicate and collaborate with a larger number of products, customers may feel that the products are no longer compatible with their needs and their current way of living. Products with which a specific product can cooperate should not be too far from the core function of the specific product. Customers do not perceive advantages in functionality that is too remote from the central functionality. Developers of products that cooperate with other products should therefore extensively test their new product ideas. We will further discuss the issue of idea testing in the next section.

## 18.5.2 Testing Concepts of Intelligent Products

Once a series of new intelligent product ideas has been generated, it is necessary to evaluate their potential. As with all new product ideas, criteria such as the product's fit with a company's mission and strategy, degree of technical difficulty, and competitors' ability to follow can be used. The new product ideas that appear least viable on the basis of these criteria can be killed. Following this initial selection, however, it will be necessary to collect information from customers on their perceptions of the remaining new product ideas. Although customer concept tests for intelligent products may be generally similar to those for other types of products, our research suggests that there are several points one should pay special attention to in the concept testing of intelligent products. We will discuss these in the following section.



**18.5.2.1 Specific Issues to Pay Attention to During the Testing of Intelligent Product Concepts.** Our research showed that during intelligent product concept tests, specific issues should be addressed. Independent of the question of whether the concept tests have a qualitative or quantitative form or whether the tests are conducted using verbal product descriptions or working prototypes, specific attention should be paid to the complexity and risk that customer perceive in intelligent products. Our research showed that all product intelligence dimensions are associated with increased complexity and perceived risk. During concept tests, new product developers should inquire whether this is also the case for their product and how this product may be improved to decrease its perceived complexity and risk. Section 18.5.3 provides some suggestions on how to do this through the design of the product.

For autonomous products, new product developers should also carefully assess whether the autonomy decreases the level of input required by the user of the product. Our research showed that autonomy that requires less input from customers is evaluated more positively than autonomy that requires more input. Because the answer to this question only becomes really clear during product use, it would be most fruitful to collect information on autonomous product concepts using working prototypes.

For multifunctional products and products that are able to cooperate with other products, one should assess whether the added functionality or the products with which the new product cooperates are close enough to the new product's core functionality. Our research showed that customers may have problems dealing with products that have extended functions that are atypical for the product category. Also, the multifunctionality and the ability to cooperate with other products should not be too high, and customers should be able to deal with these dimensions. Different concept versions with various levels of these dimensions could be presented to customers in order to gain information on the intelligence level that is most appreciated.

### **18.5.3 Reducing Complexity and Risk Perceptions Through Product Design**

The complexity and risk that customers perceive in intelligent products can be reduced. Perceived complexity may be reduced by equipping intelligent products with indicators that provide feedback to the user on the task that the product is performing at a certain moment. This may be especially effective for autonomous, adaptable, and reactive products. Such products may operate without direct input from the user. From the user's perspective, some actions of these products may be unexpected or illogical; it is therefore important to inform the user why the product performs



these actions. Also, perceived risk may be reduced when the user always has the option to interrupt the action of the product at any time.

For products that cooperate with other products, customers must be able to cope with the additional functionality that follows from this cooperation. Keeping certain possibilities hidden from the user may be helpful. Only when a user specifically requests a certain connection with another system or product does it become available and visible to the user. Functionality that is relatively unimportant or too specific may remain invisible and will not confuse the user. It may also be fruitful to introduce additional connectivity to the market step by step. New generations of a specific product may be equipped with extra connections that did not exist in previous generations. Thus, customers are given the opportunity to learn and get accustomed to higher levels of connectivity.

#### 18.5.4 Implications for Intelligent Product Commercialization

Research suggests several implications for the targeting strategy and promotional activities surrounding the commercialization of intelligent products. We will first provide suggestions on how we think that target groups for intelligent products should be determined. Next, we will provide implications for promotional activities.

Research into whether customer characteristics play a role in the formation of perceptions of intelligent products did not show a general pattern that could distinguish adopters of intelligent products from non-adopters. Therefore, intelligent products do not demand specific target groups. Developers of, for example, an intelligent version of a washing machine are therefore advised to maintain a targeting strategy that is based on existing knowledge about the market segments for this product category in general.

**18.5.4.1 Reducing Perceived Complexity and Risk in the Commercialization Phase.** Customers generally perceive intelligent products as more complex and risky than nonintelligent products. In addition, customers are not always convinced of the benefits that intelligent products may offer. Several measures can be taken in the commercialization phase to deal with these problems. Naturally, promotional messages should be aimed at emphasizing the benefits of the intelligent product and reducing the complexity and risk that customers perceive. Perceived complexity can, for example, be reduced by using analogical learning theory (Gregan-Paxton and John, 1997). Analogical learning entails using customers' existing knowledge to increase their understanding of how the new product works and what its

benefits are. A good example of how analogical learning is used is the Ford Mondeo advertisement, which explains the principle of the Intelligent Protection System by illustrating the car with a guardian angel on top of it. Another way of reducing the perceived risk and complexity of an intelligent product may involve increasing the trialability of the product. Diffusion research has shown that products with a higher level of trialability are more likely to be adopted. Therefore, choosing distribution channels that are willing to demonstrate the new intelligent product or give customers the opportunity to use it is likely to increase the adoption of the product and thereby its success.

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## 18.6 Summary

As physical products are increasingly being equipped with ICT, they are becoming more intelligent. We stated that intelligent products have six capabilities that cannot be found in nonintelligent products, namely, the ability to cooperate, adaptability, autonomy, humanlike interaction, personality, and reactivity. Developing new products that include such capabilities provides firms with a competitive advantage over competing firms because of improved product functionality. Intelligent product development may also create new markets or deliver flagship products that contribute to firms' image as technological leaders. The adoption of intelligent products may, however, also be hampered because the functionality provided by intelligent products is often hidden within the product and is not communicated through its form. Also, customers may perceive intelligent products as complex and risky.

*As physical products are increasingly being equipped with ICT, they are becoming more intelligent.*

Firms that want to develop new intelligent products may generate ideas through analogical thinking. The capabilities that are most likely to deliver interesting products ideas are product autonomy and the ability to adapt or react to the environment. Such functionality is likely to easily increase the advantages provided by the product without delivering high complexity and perceived high risk as well. Complexity might also be reduced by specific adaptations of the product design or during product commercialization. By taking into account the recommendations provided in this chapter, firms are likely to develop potentially successful new products.

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## CHAPTER NINETEEN

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# STRATEGIES TO IMPROVE NPD GOVERNANCE

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Steven Haines

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### 19.1 Introduction

In any organization, the process through which leaders manage corporate policies, business processes, operations, and resources is known as *governance*. Effective governance ensures that these policies, processes, operations, and resources are strategically aligned so that investments across the organization can be easily managed. Governance policies should also provide guidance for programs that improve the effectiveness of processes and methods.

In these cost-conscious and challenging times, executives must improve efficiency and streamline operations. These are usually achieved through vigorous cost-management and process-improvement initiatives. Although these internally focused programs may improve shareholder returns, in many cases they may not contribute to the long-term growth of the organization. Why? There are too many (often inefficient) variations and inconsistencies in practices related to innovation *and* new product development (NPD).

The key to meeting this challenge is to extend effective practices and policies to the *governance of NPD* and its associated processes and methods.

Within this context, this chapter will:

1. Discuss and analyze some of the challenges that impede the consistent use of product development practices
2. Point out and characterize process areas that are governable

3. Suggest some ideas about how to get started
4. Discuss the benefits of an effective governance program for NPD

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## 19.2 Challenges

Ask senior executives “What does your company’s NPD process actually mean to you?” You will likely get many diverse responses. Similarly, ask people in marketing, product management, sales, product development, or another functional department to give their definition of NPD and the answers will also differ widely. The perception of the function(s) of NPD is in the eyes of the beholders.

One reason for this diversity of views lies in the variety of backgrounds and perspectives of those who work in other functions. As a consequence, when it comes to the oversight and governance of NPD or innovation processes and methods, the variance in perspectives can cause confusion and misalignment.

To research this chapter, many senior executives from product development, R&D, innovation management, engineering, information technology, product management, and other departments were interviewed.

All of them were passionate about their respective spheres of interest. Some focused on esoteric topics related to radical innovation; others concentrated on the contributions of their own technical domain; and still others emphasized product development process efficiency—namely, their phase gate process. When questions were posed about explicit areas of cross-functional engagement or oversight, the answers moved off in many directions.

From these observations, it was concluded that one difficulty is that there are a host of approaches used by business leaders, within the broad and complex array of work activities necessary to consistently oversee or govern product development processes and methods. Other causes of inefficiency were the following:

*When it comes to the oversight and governance of NPD or innovation processes and methods, the variance in perspectives can cause confusion and misalignment.*

- We now work in a global economy, and operations are dispersed throughout the world. Even though we are united by our electronic connections, process adherence may actually be reduced. In effect,

people may skip over important steps in vital process areas because staffs is thin and because the roles of cross-functional stakeholders are not completely understood or are misaligned.

- Product development governance policies are often administered by people in technical communities. Some executives in technical areas do not approach product development activities from a business perspective. In some cases, this could be because there are no performance metrics for tracking the effectiveness of product development initiatives; in other cases, some technical leaders may be less interested in the business side of NPD.
- Process confusion can also cause problems in many organizations. Many people do not distinguish between NPD and innovation and believe they are synonymous; therefore, they employ the same process for different purposes. In other instances, people who refer to the *NPD process* usually are really referring to the *phase gate process* and are unaware of the other processes that are needed to support product development activities. These include, among others, processes to evaluate all products across all lifecycle states that contribute to the rationalization of investments and the allocation of funds across a portfolio.
- Solid market insights that could lead to better business decisions are missing. In many instances, those responsible for the derivation of these insights seem to miss certain market signals. It doesn't matter whether people are in the same location or scattered geographically; market signals are not being uniformly picked up and assimilated into the business. For example, a U.S.-based market research analyst assigned to an Asian market may not pick up cultural clues. In another case, a product manager may not understand the operational norms of his or her own company or of a technical domain. These types of missteps may result in poor product quality or uncompetitive products.
- Many product development process areas seem to be focused only on the internal activities and the handoff of work across phases of product planning, actual product development, and launch. Informal discussions carried out in writing this chapter sought to uncover the rationale for various decisions. This was accomplished by questioning product managers, product developers, and supervisory managers about their areas. Many of them talked about the need to meet urgent customer commitments. Others felt overly constrained because only certain resources were available during a given time period. They didn't perceive that such situations were only part of a bigger picture; in other words, they reacted to situations, and their focus was internal. In terms

of more comprehensive (external) views of strategy or goals, no one alluded to broader aspects such as strategic alignment or the desire to fulfill an explicit market need as part of the decision process. When a firm operates in reactive mode, it's hard to get *ahead of the curve*.

- The phase gate process as used by many firms is inconsistently applied. This process is similar to that used by venture capital firms where the distribution of funding is dependent on milestones to get to a subsequent funding gate. It is built around actions and decisions in a linear, sequential manner. *The unfortunate side of this very popular method lies in its misuse and misinterpretation.* In some firms, the process is treated as checklists of things to do to expedite work. In other firms, the process is broken into uncoordinated work flows of various departments. Still other organizations operate as if all opportunities are equal, without a consistently applied set of decision criteria. The phase gate process should be used as a flexible, dynamic decision-making process that channels the best investments for the firm and builds a robust, balanced product portfolio.
- Other development-led techniques that are designed to speed things up may sometimes slow things down. *Cycle-time improvements* and *time to market* continue to be very meaningful watchwords. In advanced technology environments where software may be delivered as a service or where a Web presence is the sole representation of a business, it's important to move quickly. However, in some organizations, the operational or functional gears needed to support the product don't move as quickly as the product development process does. This can be problematic, as product features constructed from a "backlog" tend to build up and remain on hold until deployed. Alternatively, some product elements are rapidly developed and deployed without the proper cross-functional support. This results in product operational issues, organizational disunity, and, worst of all, unhappy customers. Suffice it to say that any organization can hold up the mirror and uncover a number of issues that may stand in the way of sustainable, efficient NPD operations.

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### 19.3 Governable Processes

Based on the challenges described above, what can be done? If a large population of individuals believes that the *function* of product development is solely linked to the phased product development process, how can perspectives be broadened? When the phased NPD process is subject

to different interpretations, how can we extend our thoughts to consider or include other necessary functional areas? The only way to solve these problems is for key stakeholders to comprehend and appreciate the host of ancillary processes that support the interconnected *system* that product development encompasses. Only then can an organization achieve greater product development efficiency.

As research was undertaken for this chapter, a number of process areas were examined to determine which ones should be targeted for improved oversight and governance. What ultimately came to light was a list of 20 associated and, in some cases, interconnected process areas used by companies to varying degrees. However, there is so much variation in how some or all of these processes are used that leaders may feel overwhelmed when trying to produce positive outcomes from directed, purposeful improvement in all areas at the same time.

Although these process areas are often utilized separately, I suggest that *effective governance policies should be implemented incrementally as leaders learn more about the process interdependencies and as the organization matures, that is, utilizes processes consistently and effectively*. Further, once those interdependencies are more easily understood by designated leaders, they can reknit some of the organization's fabric and align roles more effectively. In other words, small, purposeful steps are easier to take to achieve such lofty goals. The most important thing to remember is that all process areas should be viewed from an interconnected, holistic perspective.

*Effective governance policies should be implemented incrementally as leaders learn more about the process interdependencies and as the organization matures in terms of utilizing processes consistently and effectively.*

As suggested, each process area alone could be the subject of much study. It would be counterproductive for a single chapter in a book of this scope to study each process. Therefore, I will review only the most important process areas and the interdependencies that exist between them. These areas were selected because of their potential to be more "available" for governance and because they can have the most significant impact on product and business performance. Another reason the explanations are limited is that governance itself can be an onerous task for leadership teams in organizations that are already stretched thin. Bear in mind, though, that it is to any firm's advantage to envision a *longer-term governance program* that can be sustained.



As input to this chapter, several dozen product development executives participated in a short survey and were then interviewed. Many others were engaged in some very matter-of-fact, productive discussions on these topics. The overall goal was to speak to executives who worked in companies encompassing a variety of different sectors, with revenue profiles that range from approximately \$0.5 billion to more than \$50 billion, and whose firms operated on an international scale. The purpose of these conversations and surveys was to learn about the importance of various product development processes that might contribute to product development organizational success. This discovery process *did not attempt to correlate process areas with product success*.

Through these investigations and from the larger list of process areas from which to choose, it was determined which areas were most important to product development executives. The top three most important areas are referred to as *first-tier processes* and the second top three as *second-tier processes*. This designation is not meant to minimize any one set. Clearly, they should not be minimized. However, this distinction serves to indicate which areas executives designated as of primary importance and which ones they ranked less highly. Based on this research, all process areas have some degree of interrelatedness and none should be considered to be separate and distinct (but in dealing with such complexity, you have to start somewhere if you want to move ahead).

### 19.3.1 First-Tier Processes

The three most important processes that firms use to carry out product development work include:

1. NPD decisions
2. Business case reviews
3. Project selection

There are no surprises here. These process areas are the ones that are most familiar to people across organizations. They are most familiar because they are related to the tactical, day-to-day activities performed by most people who work in product development. I believe they are prime candidates for more effective governance and guidance because (within the investigative research) many breakdowns were uncovered. If some of these inefficiencies were addressed through better oversight, future outcomes would result in greater organizational efficiency, improved collaboration, and better decisions.

Within most organizations, NPD decisions are made by different groups. Some decisions are made inside R&D or engineering groups and some are made by senior executive teams. No matter where decisions take place, *greater executive involvement and cross-functional executive collaboration usually result in better decisions and buy-in across the organization.* The importance of this deceptively simple concept cannot be overstated.

*Greater executive involvement and cross-functional executive collaboration usually result in better decisions and buy-in across the organization.*

In approximately half of the companies included in this investigation, it was found that product investment decisions were *not* made within the context of a broad portfolio strategy. When project decisions are made on the basis of faulty data or incomplete analyses due to this disconnect, leaders have found that problems occur downstream in the organization. Further, in such cases, where projects are defunded and people are reassigned as a result of those problems, it can be very disruptive and even erode employee engagement. This is especially true when those involved learn that the reprioritization could have been avoided if portfolio alignment had been addressed early on. Overall, *firms that build a solid connection between product portfolio allocation strategies and the pool of possible product projects seem to have an easier time making decisions.*

*Firms that build a solid connection between product portfolio allocation strategies and the pool of possible product projects seem to have an easier time making decisions.*

The business case process is another crucial area on which to focus. Although managers acknowledge its importance, the business case process is carried out in vastly different ways from company to company. In some firms, it involves choosing a high-level idea and the finance department “runs the numbers.” In other firms, the business case process seems like a fill-in-the-blanks exercise. In these situations, the company does not include a robust set of scenarios and assumption sets that indicate the depth of forethought, projection, and analysis to be expected from a properly prepared business case.

The business case, when properly utilized, should be a dynamic, living document that is updated as approved product projects move across the actual product construction phases. However, few companies use it well and those that don’t fail to take advantage of a tool with great potential

for providing enhanced performance and results. What exacerbates the problem is that too many organizations do not have the oversight required to retest the business case assumptions prior to or within a reasonable time after the product launch.

The business case should also serve as an investment justification process instead of merely a document or a checklist item in the NPD protocol. If the investment decision is the tip of the iceberg, then the business case is what sits out of sight under the radar. Given this context, executives can seize a tremendous opportunity to improve their overall governance. The business case process can serve as a unifying force to bring executives together. It paves the way to better governance of product management because the business case harnesses a host of related business processes, including:

- Market insight development
- Competitive assessments and market share analysis
- Strategy formulation
- Product portfolio alignment
- Product plans and roadmaps
- Pricing strategies
- Promotional programming
- Product launch management
- Channel strategies
- Forecasting
- Finance
- Post Launch Product Management

When executive leaders collaborate to create and nurture the business case process and fine-tune all related process areas, it is easy to see how other parts of the business will more easily align. Notice that almost all of these related processes have *business* implications. Notice further that I refer to the business case process *and* the resulting business case document. This promotes the point that *effective governance of product development processes requires dedicated oversight from cross-functional business leaders*.

*Effective governance of product development processes requires dedicated oversight from cross-functional business leaders.*

These executives should operate collectively to ensure that people in their company's functional areas work from a cross-functional perspective on behalf of the product's business to produce better outcomes.

The third primary process utilized most frequently seeks to determine the best projects in which to invest. While its importance cannot be understated, the manner in which prioritization is carried out differs greatly across businesses and even within the same business. For example, several executives indicated that priorities were established without a complete picture of the organization's objectives in mind. Others lamented that there was no coordination of all product projects and that too many pet projects were decided upon without the consent of other executives whose resources were required for proper execution. More efficient firms utilized a fairly structured set of decision criteria that enabled efficient decision making. Not surprisingly, complete, realistic business cases tended to result in project decisions that were easier to make.

### 19.3.2 Second-Tier Processes

As mentioned, there is no intent to downplay the following three process areas. They contribute greatly to the overall performance of the organization. However, these processes were listed by executives as slightly less important than those in the first tier. They continue from the previous list and include:

4. Product portfolio optimization
5. Phase gate product development process oversight and improvement
6. Oversight of innovation initiatives

Wise investors rebalance their portfolios as often as needed to ensure that the outcomes produce the desired returns. When it comes to corporating product portfolio management, there is a surprising lack of governance in this critical area. Or perhaps it is not so surprising. For many companies, the data required, the complexity of the analysis, the time required, and the decisions that need to be made are just too much for current executive leadership teams. Many well-run companies rebalance their portfolios as a matter of course. However, of the companies studied, about half don't have the capacity to do this. Interestingly, the consequence for some of these firms appears negligible, with side effects that include idle stock-keeping units (SKUs) and some increased carrying costs. For others, the drainage of resources reduces the firm's ability to further innovate.

In well-run companies, a portfolio management group ensures that the portfolio is in balance. The main role of this subcommittee or council is to ensure that product investments are routinely balanced and

rationalized so that product development efforts are strategically aligned and not duplicated elsewhere in the firm.

When these firms establish this alignment, they are more efficient in the allocation of funds to the right product areas and they improve their ability to make decisions. Governance of this key area can be established by the senior executive leadership team by assigning a group of cross-functional executives to review business cases, audit business case outcomes, evaluate products across the organization to remove duplication, prioritize funding requests, and determine which products need to be pruned from the portfolio.

In the area of phase gate product development process oversight, it was learned that many firms actually do have a process owner. However, process ownership does not equate to process efficiency and ongoing process improvement. The reason is this: Many process owners may understand and create the documents and diagrams that depict the work flows and the cadence of work; unfortunately, they don't understand the actual work involved. For example, several major corporate diagnostic projects revealed that NPD owners have never done the job of a product manager, an engineer, a marketer, an operations manager, or other functions related to *Product Management*. Trained loosely in process management techniques, these individuals can easily use the jargon and cite the methods and academic resources. Some of them work on their own as part of a program management office; others work in small administrative groups isolated from the main work streams of the organization. Without any practical work experience and the techniques to finesse cross-organizational relationships, many managers are seen as somewhat heavy-handed and rigid in their insistence on having product managers and others fill out forms and documents for every project they're involved in, as if each project has the same weight and priority. This is another reason that process oversight is so important.

Companies that effectively govern the phase gate NPD process understand that product projects must be judged on their merits of business, technical, and operational viability. However, well-governed firms tend to look at each project as a new precedent and continually evaluate and reevaluate these precedents overall to fine-tune and streamline operations.

Earlier I mentioned that *many executives and others use the same definition to characterize the innovation process and the NPD process*. It is important to reemphasize the fact that the phase gate NPD process should channel ideas and opportunities from a variety of sources and vet them accordingly. It's easy to understand why people combine innovation projects and current product projects for enhancements and newer products in the same pipeline. However, as I learned from speaking with executives in

writing this chapter, in many firms the innovation work stream is purposely considered as a separate process. Interestingly, firms with well-run portfolio councils seem to have this figured out. They *separate* the ongoing product planning and vetting process from projects that are from derivative discovery processes. One firm indicated that, from time to time, they remove product managers, product developers, and marketers from their normal routines. These individuals, as small *away teams*, take field visits, attend classes, speak to university researchers, and use other methods to gain perspectives outside of their day-to-day work paradigms. Most innovation consultants and academics would agree that this is vital to the stimulation of orthogonal thinking that may lead to the discovery of an implicit market problem. The goal is to prompt the team to spot potential innovations that might relate to the products themselves, to the processes that support products, or to the other organizational gears that must act synchronously in order to effectively support the product's business. It is fine to use the decision-making methodology of the phase gate process when innovative ideas are generated—although the cadence of work might be different. For instance, an innovative idea may be given time to germinate by devoting more effort and resources to prototypes and concept discussions with customers and others. In other words, well-run firms treat the innovation work stream differently to allow some ideas ample time for gestation. *Governance of the regular phase gate NPD process work streams and innovation process work streams requires that leaders consider the two as separate and distinct processes.* The work involves two pipelines instead of just one.

*Governance of the regular phase gate NPD process work streams and innovation process work streams requires that leaders consider the two as separate and distinct processes.*

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## 19.4 Starting the Governance Process

For a firm to organize in a way that will allow them to effectively govern the processes and methods associated with product development (as opposed to the function of product development), an oversight group should be appointed by the executive leadership team. It would be beneficial for the group to be cross-functional and led by a key executive such as a general manager or a product management leader. This group should be able to begin its work with a comprehensive organizational review to

understand which strategic objectives meld with specific product development processes and activities. The watchwords here are *strategic objectives*. Too often, people who become accountable for process improvements often begin with the process as opposed to explicit strategic objectives.

Once the strategic objectives are on the table, it becomes possible for the oversight group, in conjunction with the corporate leadership team, to examine the critical success factors that are necessary to achieve those objectives. In the same vein, both the corporate leadership team and the product development oversight group should examine the key performance indicators that are used to quantify the thresholds that demonstrate success or failure in any one area. For example, if a certain market share is a key performance indicator for achieving a strategic objective (e.g., business growth or market expansion), the critical success factors related to the firm's ability to achieve that market share can be examined. A root cause analysis may force the examination of a number of organizational factors, which could include functional resource capability, product availability, product quality, or even organizational readiness. In some cases, the root cause analysis may appear complex and time-consuming. This is why many firms fail to effectively govern these key process areas. However, it is important to get started—and work begins with the analysis of strategic objectives, critical success factors, and key performance indicators—in order to expose the most important affected process areas that might require attention.

In getting started, the most important thing to do is to keep the momentum. It is easy to look at one area and feel overwhelmed by the work required to address the issues that are uncovered. If the organization does not have resources dedicated to these areas, then *point solutions*. In some industries, a “point solution” is a product attribute that solves part of a problem, not the entire problem. It's usually because there is a shortage of resources, an urgent need to address a customer complaint, or some other response. A point solution tries to solve a narrow problem without regard for other interdependencies. will be patched into the organizational fabric. The unfortunate outcome of this approach is that the patch will ultimately tear apart if people across business functions are not effectively guided and led—which is the reason for the governance body.

As all executives know, change is difficult to bring about and more difficult to sustain when there is a time lag between taking actions and producing expected outcomes. Therefore, the governance body should establish realistic objectives and associated measurement systems that can track progress toward stated process improvement goals. One place to start is the more consistent use of a business case (format, structure, and



evaluation) across the enterprise. Metrics could be established for usage, completeness, number of cases considered, funding required, and so on. These cases could then be audited in areas such as forecast accuracy, market share improvements, or operating efficiencies achieved.

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## 19.5 Benefits of an Effective Governance Program

The journey to better governance can be a challenge, especially when people who lead various business functions don't foresee the benefits. Many functional leaders may not be motivated to change if they don't believe a change is needed—when, in fact, their assertions mainly concern their inability to grasp the changes needed to improve NPD efficiency. Fortunately, there are several important benefits that can be realized by any firm from improved NPD governance practices. These include:

1. *Common understanding.* When all interested people in the functional areas that support product development have a common understanding of all aspects of NPD governance, they are more likely to reduce their divergent and discrete interests.
2. *Focused work.* Collective perspectives lead to focused work. This means an increased probability that better decisions will be made, which, in turn, will lead to more successful products, improved profitability, and higher business valuations.
3. *Transparency and cross-functional collaboration.* When concerned people who lead the main business functions have a common view of the NPD operations and their inner workings, they tend to want to produce better business outcomes.
4. *Multiprocess knowledge.* When all NPD-related processes are understood by all and are governed in a balanced manner, all stakeholders work together more efficiently. Just as developing and balancing a product portfolio helps produce better results, business actions will be more focused and produce more optimal results.
5. *Quality decisions.* The preceding benefits collectively contribute to an organization's ability to improve the speed and quality of decisions. Enhanced communication and agreed-to priorities will help bring this about.
6. *Accelerated organizational maturity.* When the collective efforts of all NPD processes are understood and more consistently carried out, and when these efforts result in more predictable outcomes, the resulting maturity level will enable the firm to focus improvement efforts in other important areas.



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## 19.6 Summary

Publicly held firms are rewarded when shareholders vote with their wallets by bidding up the price of the stock. Many companies are seen as successful because their brand reputation stimulates demand and cash flow. Leaders in some of these firms feel that they are operating efficiently because the money is flowing in. Unfortunately, this can lead to a false sense of security, often because key product management and product development processes are overlooked. On the opposite side of the spectrum, other firms aren't so lucky. In these firms, the product process pendulum swings from side to side as various constituencies seek to tame the multitude of processes, either through too much or too little governance. When a firm is inattentive to or overly focused on its processes and methods, a more predictable path is needed.

At the beginning of the chapter, it was indicated that effective governance ensures that processes and resources are aligned. That's the key. However, effective governance assumes that leaders are willing to evaluate the current situation with respect to all related processes and to uncover viable options for process improvement. These steps become the first ones on the road to more cohesive product management and NPD governance policies. Then the real work begins. This is because effective governance requires concerted, long-term dedication to continuous improvement of the structure that provides guidance to the multitude of interconnected processes and cross-functional efforts that bring good products to life.

To achieve this requires a committed, dedicated cross-functional governance team and purposeful evaluations of every process that touches the planning, development, commercialization, and management of products and services. When effective governance policies are in place, goals are easier to envision, roles are easier to clarify, projects are easier to complete (on time and within budget), and, most of all, the company's culture can more easily flourish.

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## CHAPTER TWENTY

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# MANAGING THE SUPPLY CHAIN IMPLICATIONS OF LAUNCH

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Roger J. Calantone and C. Anthony Di Benedetto

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### 20.1 Introduction

The launch activity for new consumer products is a risky endeavor and typically is the most expensive stage in the new product development process. Typically, launch involves the efforts of brand management and the supply chain (logistics and operations). Accordingly, launch represents a major stumbling block in coordinating brand management, logistics, and operations, and the financial amounts at stake are often a critical factor in determining the success of new consumer products.

A particular launch consideration is the clean handoff from the development team to the team that will manage the product during and following launch. This handoff provides considerable opportunity to turn a successful product development into a commercial failure. By *handoff*, we mean that tactical decisions made at launch must align with the strategy that justified the product's development. For example, distribution logistics must be in place; a reliable demand forecast for the new product must be made to guide manufacturing ramp-up; and promotional activities aimed at both the consumer and the trade must be appropriately timed. While many of these launch aspects have been well studied and understood by product development professionals, the importance of supply chain and distribution logistics to product launch success has been largely overlooked.

*Supply chain capabilities support successful launches and minimize losses from unsuccessful ones.*

There is much to be gained by a more thorough consideration of supply chain capabilities to support successful launches and minimize losses from unsuccessful ones. As we will see later, integrating supply chain capability issues explicitly into the product launch strategy is central to *lean launch* methods. Lean launch methods involve the use of a flexible supply chain system to enable the firm to react quickly to emerging customer needs and market demands. Companies have been adopting lean launch methods for some time, and given the success seen so far, especially during the recession, lean launch has become a requirement in a variety of consumer product launch scenarios.

Overall, the goals of this chapter are as follows:

- To describe the potential pitfalls at the launch stage
- To outline the development of a launch strategy to manage these pitfalls
- To present the advantages of lean launch and flexible supply chain processes in launch strategy development
- To illustrate the successful application of lean launch methods
- To draw managerial insights and conclusions regarding the benefits of a lean launch

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## 20.2 Pitfalls at the Launch Stage

Traditionally, product launch is managed using anticipatory methods; that is, manufacturing, marketing, and supply chain/distribution decisions are made in advance of the launch based on early forecasts of demand, assumptions of competitors' actions, and assumptions of resellers' costs that must be absorbed to gain efficacious market access. Yet, it is possible for the firm to time the product launch poorly using these methods. If the marketing programs are carried out well but the launch is slow, the product may never achieve its marketplace potential or the market window could be totally missed. Similarly, if the launch is timed too early, key marketplace information may be missing or unavailable (such as information about changing product technology or customer requirements) (Calantone and Di Benedetto, 2012).

Three negative, and avoidable, outcomes of a traditional anticipatory launch are possible. When a product is both technically and financially successful across a broad range of market segments, unplanned out-of-stock problems are likely to materialize. Even when a product has widespread success, its popularity and its adoption rate are likely to vary among market segments. Replenishment inventory needed for markets experiencing

rapid penetration may not be available due to preintroduction inventory commitment to other segments. When products are highly successful, the manufacturing and logistics capacity may not be able to keep up with the demand because of scheduling lead-time and material procurement inflexibility. If inventory is available in the aggregate, the product may still be out of stock on retail shelves in some markets while being overstocked in other markets. For at least the time it takes to reposition inventory to where it is needed and to ramp up manufacturing support, the launch success may be in jeopardy. For products that are neither technical nor financial successes, preallocation of inventory results in overstock. In this case, inventory is positioned forward in the channel, resulting in excess reclamation expense.

Launch of the Advantix camera provides an illustration of the problems associated with the coordination of consumer promotions and trade support with manufacturing and distribution ramp-up. A consortium of camera makers including Kodak and Fuji developed the Advantix system. Its upcoming launch in early 1996 was kept secret, causing some retailers to be skeptical of the new product. Additionally, early reviews of the system were modestly positive at best. Consortium members, including Fuji, kept sales projections and production plans relatively modest. When retailers did get to see the camera in February 1996, however, they were very impressed, and demand for cameras and accessories was much higher than anticipated. Manufacturers went into back order, and the anticipated April shipping date was missed. Since products were unavailable, retailers were reluctant to do the planned in-store promotions, and consortium members pulled back on consumer advertising until production could be sufficiently ramped up. Unfortunately, none of the consortium members increased production quantities enough, resulting in poor consumer availability as late as August 1996, though by late summer the ramp-up problems had been remedied. In short, the camera makers missed the whole peak summer season of 1996 (Crawford and Di Benedetto, 2011, p. 475).

Realize that new product introductions are seldom clear-cut successes or failures. Products may initially appeal to only a narrow segment of the target market, such as a specific geographic region or usage group, as contrasted to the broader market to which they are presented. Financial success depends on sufficient penetration to cover manufacturing, inventory, and promotional startup costs.

Therefore, products that experience limited technical success but have a potential for achieving broader appeal over time may fail at launch due to the inability to focus resources (including logistical support), generate sufficient segmental revenue, and cover market rollout costs.

A launch of a new cracker product provides an example of the pitfalls of anticipatory launch strategies. Two variants of a new thin cracker were introduced prior to the year-end holiday season. One variant was flavored similarly to the established cracker brand, while the other was onion-flavored. The manufacturing process for the products involved production of the regular-flavored cracker with an additional flavoring process for the onion-flavored variant. Significant inventory of each variant was sold to retailers and forward deployed for the expected holiday sales. The market enthusiastically received the regular-flavored cracker. The onion-flavored version, however, was not well received and sales lagged behind those of the regular variant by a considerable margin. Unfortunately, the supply chain was unable to fully replenish the regular-flavored version, resulting in out-of-stock situations, while high levels of onion-flavored stock remained on retail shelves until after the holiday season. The combination of reclamation costs for unused onion-flavored inventory and out-of-stock costs for the regular-flavored cracker resulted in limited financial success of the overall launch.

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## 20.3 Launch Strategy

At a (more) macro level, the launch strategy is simply the decision to launch or not launch the product. More specifically, launch strategy decisions are concerned with both product and market issues: the innovativeness of the new product, the targeted market, the competitive positioning, and so forth (Di Benedetto, 1999). As noted above, careful timing of the launch is also an important part of the launch strategy. On the engineering side, the launch strategy is supported by market tests that confirm the adequacy of the product prototypes, as evidenced in internal alpha testing or beta testing with select customers. On the marketing side, the launch strategy requires knowledge of the product's ability to satisfy the customer's value proposition, in requisite quantities, at a price with sufficient margin over the cost to provide an adequate financial return to justify the production and marketing investments the commercialization stage requires. This stage of the new product development process requires actual financial returns rather than just the promise of returns. The launch strategy needs another component in order to calibrate the cost basis of the decision: The scale of the launch with regard to the size of the potential addressable market is required. As shown in Figure 20.1, the challenge is to get close to the right size of the market, to properly scale both the size of the marketing investment and the size of the production and distribution facility.

**FIGURE 20.1 MATCHING CONSEQUENCES  
BETWEEN LAUNCH SIZE AND MARKET SIZE.**

		Actual Market Size	
		LOW	HIGH
Launch Size	LOW	Commercial Failure	Opportunity Cost
	HIGH	Cost Overrun, Commercial Failure	Commercial Success

Often, demand and profit assessment, and the decision to develop and launch the product, are supported by teardown analysis. For example, in a traditional teardown analysis of a new sport-utility vehicle (SUV) aimed at consumers, a carmaker will buy several competitive models, move them to a central location, and “tear them down” to examine their individual components. Each part is cost estimated, leading to a very good projection of material costs per unit or even the bill of materials. The type of labor involved is also assessed (i.e., whether human labor or robotics is used), and a labor cost per unit is estimated. A usual accompanying step is to take the public plant tour to confirm exactly what kinds of robots and other equipment are being used, the number of workstations and inspection points, and so on. Yet, in a complete teardown analysis, the carmaker would project the total size of the SUV market and then assess the total unit costs at various levels of production (keeping in mind that average total costs will decrease as production increases). The carmaker can then make an intelligent decision as to whether the SUV should be launched. For example, if the firm believes it can get 10 percent of the SUV market with this new product, how many units does that translate to? What would be the average total cost incurred? And, given the going selling price, could the company make a large enough profit to generate target net present values or to pay back the development costs in the desired period?

The forecasting and management challenge is to properly size the launch for the market demand. When this is impossible, that is, when the firm cannot know the market reality in advance of the launch sizing decision, they must try to increase the flexibility of the production

response tactics for marketing and distribution resource allocation. This would permit the firm to rapidly respond to early sales success without overcommitting to inventory during the introductory rollout phase. Closely monitoring sales trends, through the use of point-of-sale (POS) information, can assist the firm in responding in a timely manner to sales fluctuations. These efforts can be further facilitated by regional rollouts that build a response to demand slowly, and slowly ramp up productive and distributive capacity, again while avoiding overcommitment. Furthermore, political elements come into play when sizing the production facility. For many years, General Motors decreed that no car could be built in a volume less than that of the Corvette, despite having a highly flexible facility (craft center) in Michigan that could build cars economically at lower volumes. The wonderful but low-volume Buick Reatta fell victim to the overforecasting demand to save the project. The opportunity cost scenario as well as the overcommitment scenario are both addressed by a variety of supply chain strategies, discussed later. For now, suffice it to say that flexibility and staged market commitment are necessary to a right-sized launch strategy. The next section describes how lean launch methods can help firms achieve the required level of supply chain flexibility described here.

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## 20.4 The Flexible Supply Chain and Lean Launch

Advanced supply chain capabilities offer an alternative way to support a successful new product launch as well as contain losses when products fail to meet expectations. The lean launch method involves development of a flexible supply chain system capable of rapidly responding to early sales success in order to limit commitment of inventory during introductory rollout. Flexible supply chain logistics systems are characterized by coordinated source, make, and deliver operations that drastically cut raw material to consumer cycle times and enable the firm to respond to actual market needs rather than anticipate demand with inventory.

Postponement is the basic principle driving the development of lean launch strategies. Leading-edge firms increasingly use postponement as the logic for flexible operations that enable quick reaction to customer needs and actual market demand. Postponement delays finalization of

*The lean launch method involves a flexible supply chain capable of rapidly responding to early sales success and limiting the commitment of inventory during introductory rollout.*



product form and identity to the latest possible point in the marketing flow and postpones commitment of inventory to specific locations to the latest possible point in time. Cutting lead times can reduce uncertainty and increase operational flexibility so that products can be produced to order or at least manufactured at a time closer to when demand materializes. The volatility of demand for new products can be managed by reducing lead times, which shortens the forecasting horizon and lowers the risk of error (Bowersox, Stank, and Daugherty, 1999).

*Postponement is a key principle driving lean launch.*

Postponement of time and form can be employed. In time postponement, the key differential is the timing of inventory deployment to the next location in the distribution process. In contrast to anticipatory shipment to distribution warehouses based on forecasts, the goal of time postponement is to ship exact product quantities from a central location to satisfy specific customer requirements. The practice of shipping exact quantities to specific destinations greatly reduces the risk of improper inventory deployment and eliminates duplicate inventory safety stocks throughout the channel. Time postponement provides inventory-positioning flexibility by alleviating the need for forward deployment of inventory to cover total forecasted sales. Positioning flexibility allows firms to strategically position only limited inventory in the market and selectively replenish stock based on closely monitored sales information. Benefits from time postponement may be realized regardless of whether one or multiple new product variants are launched (Bowersox, Stank, and Daugherty, 1999).

Form postponement provides product variation flexibility by alleviating the need to lock in feature design prior to gaining some understanding of a product's market appeal. Assembly, packaging, and labeling postponement are options in which firms initially manufacture products to an intermediate or neutral form with the intent to delay customization until specific customer orders are received. Benefits from form postponement become significant when introducing multiple product variants. Postponement of product differentiation reduces the need to stock inventory of all product variations. For example, computers are often assembled, packaged, and labeled to meet specific configurations during customer order processing. Demand variations from forecasted volumes for each product variant following launch can be accommodated without the out-of-stock or overstock risk associated with traditional anticipatory launch strategies.

Form postponement may also involve forward deployment of materials or components to support final customized manufacturing to specific customer requirements. The shipment of house paint to retailers as a neutral base with subsequent mixing to customer-specified colors provides the classic example of postponing form until end-consumer purchase. International shipments that necessitate language-specific labels and support materials, such as instruction manuals, also frequently utilize form postponement. Such products are shipped in bulk quantities to a regional distribution center where labeling and packaging are completed as customer orders are processed.

The application of lean launch strategies is driven by key competence in five areas of supply chain management (Bowersox, Closs, and Stank, 1999). These include collaborative relationships, information systems, measurement systems, internal operations, and external operations—all representing critical elements of a firm's supply chain strategies, structures, and processes. Competence in collaborative relationships requires a willingness on the part of supply chain partners to create structures, frameworks, and metrics that encourage cross-organizational behavior. This consists of sharing strategic planning and operational information as well as creating financial linkages that make firms dependent upon mutual performance. Suppliers, manufacturers, third-party providers, and customers are encouraged to identify and partner with firms that share a common vision and are pursuing parallel objectives pertaining to partnership interdependence and the principles of collaboration. Efforts must focus on providing the best end-customer value, regardless of where along the supply chain the necessary competencies exist. This collaborative relationship perspective is key to developing effective supply chain structures that align the functional operations of multiple firms into an integrated system.

Supply chains capable of supporting lean launch also depend upon the availability of sophisticated and economical information technology that allows businesses to quantify sales, define requirements, and trigger production and inventory replenishment 24 hours a day, 7 days a week. Such systems provide the input needed for short-, mid-, and long-term plans, which translate strategic goals and objectives into action and work to guide each operating area. Effective information systems provide thorough, accurate, and timely information from customers, material and service suppliers, and internal functional areas regarding current and expected conditions. Managers with access to data throughout the supply chain, and with the hardware and software needed to process them, are better positioned to gain rapid insight into demand patterns and trends.

Accessibility allows integrated operational decisions to be made in complex global supply chains. Rather than relying upon forecast sales, inventory replenishments are driven by precise sales information regarding specific stock items in the market. The success of such technology and planning integration rests upon a firm's ability to manage information on supply chain resource allocation through seamless transactions across the total order-to-delivery cycle. It requires adaptation of technological systems to exchange information across functional boundaries in a timely, responsive, and usable format and to extend such internal communications capabilities to external supply chain partners.

Measurement system integration is also required to manage coordinated supply chain lean launches. These systems must track performance across the borders of internal functional areas and external supply chain partners, measuring both the operations of the overall supply chain and the financial performance of individual firms. Measurement systems must also reflect the operational performance of the overall supply chain and the financial performance of individual firms. Integrated performance measurement provides the basis for calibrating the many parts of the supply chain. Good metrics and strong measurement systems serve to provide timely feedback so that management can take corrective action and drive integrated operations.

Greater coordination of internal source, production, and delivery operations also enables lean launch applications. Integration of internal operations provides a firm with the ability to seamlessly link activities across internal functional areas in order to achieve synergies that lead to better performance in meeting customer requirements. Internal integration is achieved by linking operations into a seamless, synchronized operational flow, encouraging front-line managers and employees to use their own discretion, within policy guidelines, to make timely decisions. Empowered employees have the authority and information necessary to do a job and they are trusted to perform work without intense over-the-shoulder supervision, enabling them to focus resources on providing unique and customer-valued product/service offerings that competitors cannot effectively match. Coordination of procurement and production techniques such as concurrent engineering and design, supplier partnerships, agile manufacturing, and improved transportation performance has the potential to create flexible processes that enable firms to accommodate actual market needs rather than rely on anticipatory forecasts.

*Greater coordination of internal source, production, and delivery operations enables lean launch applications.*

The need to reduce redundancies and achieve greater economies of scale in launch operations is not limited to internal activities alone. External integration synchronizes the core competencies of selected supply chain participants to jointly achieve improved service capabilities at lower total supply chain cost. The goal is to outsource specialized activities that previously were developed and performed internally. After outsourcing activities are identified and appropriate suppliers are chosen, systems and operational interfaces between firms must be synchronized to reduce duplication, redundancy, and dwell time (the ratio of days inventory sits idle in the supply chain relative to the days it is being used productively). Synchronization requires extensive information sharing between firms to standardize processes and procedures. Additionally, synchronization ensures that all activities are conducted by the supply chain entity that best creates the service and cost configuration to meet customer requirements. That is, the timing of the launch is in line with supply chain partner concerns and customer needs, and allows the firm to capitalize optimally on the marketplace opportunity (Calantone and Di Benedetto, 2012). Innovative firms have utilized the principles of response-based logistics to customize product and service offerings without increasing manufacturing capacity or stock levels. The following examples illustrate how these principles have been applied in two diverse industries (from Bowersox, Stank, and Daugherty, 1999).

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## 20.5 A Computer Industry Illustration

Dell Computer's approach to manufacturing and distribution has become the personal computer (PC) industry source model. Dell assembles computer systems as end consumers order, thus reducing or eliminating anticipatory inventory commitment. As a direct marketer, Dell uses no resellers. In contrast, most PC vendors build, test, package, and ship systems to resellers. The reseller holds products in inventory in anticipation of customer purchase. Historically, that stocking period averages six to eight weeks. At the time of sale, the system is opened and modified to meet the purchaser's specification.

Dell takes a very different approach to marketing its product, which necessitates using a lean launch method. Dell's strategy has been to focus almost exclusively on corporate customers. In contrast, most of their competitors have committed substantial resources to reaching consumers through conventional retail distribution. Dell developed flexible manufacturing techniques that allow the company to build computers

to order. To support this assemble-to-order strategy, they run a lean manufacturing operation. By working closely with suppliers, component and material inventories are minimized. The close relationships and support of suppliers have allowed Dell to operate with nearly no work-in-process inventory. In fact, Dell averages less than one day's inventory and component parts stock supply. They "pull" parts from suppliers just as they are needed for production. Replenishment requirements are instantaneously forwarded to suppliers based on actual orders.

Assembling systems to order means there is no finished inventory in the channel to manage. Transitioning from a finished-goods inventory model to assemble-to-order with channel-assisted computer system configuration has become the industry model. Other competitors in the PC industry are moving to emulate Dell's direct sales model. For example, prior to its merger with Hewlett-Packard (HP), Compaq had moved toward a build-to-order manufacturing strategy to reduce the time it takes the company to deliver product to corporate clients. By postponing build to stock and moving final assembly forward in the channel, Compaq hoped to avoid problems associated with forecasting demand and holding extensive inventories. Since the merger, HP has worked extensively with resellers to set up a channel assembly program. The intent is to leave assembly in the hands of resellers so that HP has no finished goods inventory. Gateway has developed a program that allows components to be merged while in transit. Transportation carriers complete the merging prior to final delivery. All of these examples are forms of lean launch formats for new products based on supply chain management principles.

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## 20.6 A Lean Launch Illustration: Benetton

Apparel manufacturer Benetton has enhanced its competitiveness in a highly competitive market through lean launch application. Benetton's agents in various countries utilize electronic data interchange (EDI) to transmit orders to Italy on a daily basis. Based on this market information, Benetton is able to precisely track sales and react to demand by manufacturing only those garment styles, colors, and sizes being sold. Computer-aided design (CAD) and computer-aided manufacturing (CAM) make their manufacturing operation fast and flexible. From the time a garment is designed to when it is actually manufactured can take as little as a few hours. State-of-the-art software allows designs to be created in-house and be quickly fed to computer-controlled garment cutters and knitting machines.

Benetton utilizes form postponement to apply dyes. Traditionally, manufacturing of clothing starts with dyeing of the yarn, followed by knitting into garments. Because of the short cycle associated with seasonal clothing sales, it is difficult to restock retailers with the right color and size assortment. The traditional anticipatory process potentially yields excess inventories of unpopular colors while at the same time increasing the risk of out-of-stocks on popular colors, historically resulting in lost sales opportunities or overstocks that require extensive markdown. Benetton, however, manufactures garments from bleached yarn and delays dyeing until market information on color preferences is available through their EDI linkages with market-based agents.

Benetton's sophisticated manufacturing system is supplemented with a highly responsive logistics system. Their distribution center is highly mechanized. To the largest extent possible, all work processes are standardized. For example, garments are packed in one of two standard-sized boxes; barcoding and preaddressed customer labels are utilized to speed processing. To facilitate logistics, Benetton entered into a joint venture with a service company to manage international forwarding and customs clearance. EDI technology is used to transmit documentation before actual shipments arrive at entry ports, thus facilitating speedy clearance through customs and routing on to retail outlets. The system provides a significant reduction in physical distribution costs and reduces lead times to U.S. markets by greater than 50 percent (Pepper, 1991).

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## 20.7 Summary

The pressure is increasingly on firms to meet customer needs and market-place demands more quickly and completely than the competition. Many firms see the development and launch of successful new products as their lifeblood, and their ability to identify and meet emerging customer needs and demands quickly as a key component of their competitive strategy. Until relatively recently, however, new product launch had been "business as usual" in many firms: Marketing, manufacturing, and distribution channel decisions pertaining to launch had been made in anticipatory fashion based on early forecasts.

By including distribution and logistics employees more fully on the launch team, firms can become more adept at increasing supply chain flexibility and improve the effectiveness and efficiency of the new product

launch. Those firms employing lean launch methods have been able to accelerate the time to market and cut lead times drastically, thereby enabling them to match emerging customer needs more rapidly. By postponing major decisions as long as possible, even large firms can seem to turn on a dime; match product features and production to customer demand much more effectively than before; and reduce costs through cheaper distribution and reduced manufacturing change orders gained by postponement. External integration synchronization ensures that the timing of the launch meets the requirements of supply chain members and end customers. The Dell and Benetton examples illustrate how some of the best lean launch firms do it and provide a starting point for analysis of one's own company in search of ways to "get lean" during the launch phase.

In sum, launch is a key stage in the new product development process and deserves a much more strategic view.

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## CHAPTER TWENTY-ONE

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# POST-LAUNCH PRODUCT MANAGEMENT

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Steven Haines

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### 21.1 Introduction

After a product or major enhancement is launched, it must be merged into the corporate product portfolio. While this statement is simple, the overall management of in-market products and services is not always well defined. Unlike the structured, linear product development process, the myriad processes related to Post-Launch Product Management (PLPM) are not always well understood, documented, or delineated.

Based on my firm's research, we have learned that there is a significant amount of variation in most companies about how existing products are managed. Where there are such inconsistencies, important signals may be missed, which can result in suboptimal business outcomes. As a consequence, product managers (and others) seem to be forever racing to put out one fire after another instead of doing more productive work.

Senior executives place tremendous expectations on product managers. They are supposed to serve as stewards of the product's business, but in companies where there is no explicit formula for managing existing products, opportunities for optimizing the performance of products and portfolios may be missed. The objective of this chapter is to provide solid suggestions that can align the organization so that products and portfolios can be more easily optimized. To achieve this objective, five important topics will be discussed:

1. Utilizing a cross-functional team
2. Auditing launch results

3. Managing the product in the market
4. Optimizing the portfolio
5. Discontinuing products

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## 21.2 Post-Launch Product Management

Before I delve into the main topics of this chapter, I'd like to establish a clear definition for product management so that PLPM can be more clearly understood.

Although product management is on the organizational chart in many companies, the roles and expectations of the people who actually manage products (usually the product managers) tend to vary widely. From my experience in the field, I've found that companies often confuse the functions of product development, project management, and product management. It should be noted that product management does not refer to a job title. To clarify and define the function, product management refers to the business management of products and services in a systemic and holistic manner.<sup>1</sup>

A good way to look at PLPM is to understand its overall context by characterizing product management in a visual model, the product management life cycle model,<sup>2</sup> shown in Figure 21.1.

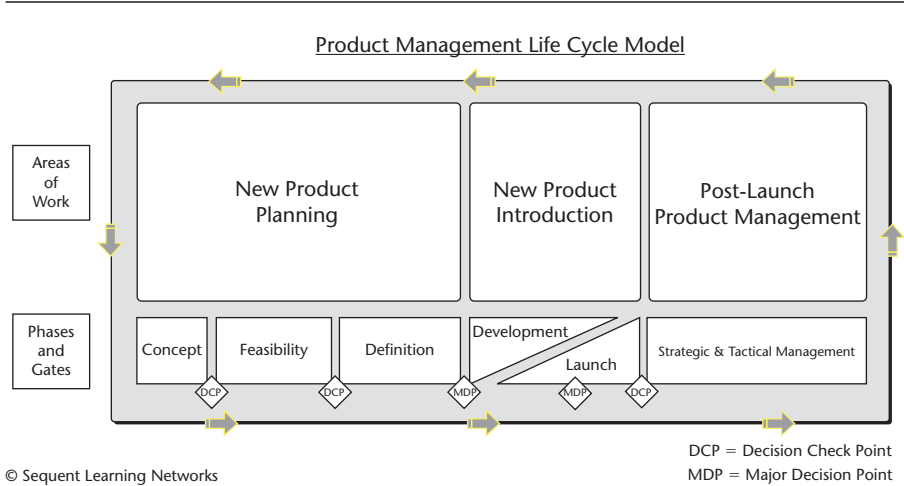
The model is (of necessity) a linear, progressive, static depiction of something that is actually three-dimensional, recursive, and dynamic, but for most purposes, it's a useful approximation of how the product's business gets done. Three areas of work are undertaken as a product proceeds from beginning to end:

1. New product planning (NPP) is a creative process used to guide planning activities and decisions.
2. New product introduction (NPI) provides the context for execution of plans and covers the actual development of the product and its launch into the market.
3. Postlaunch product management (PLPM) refers to the work undertaken to manage various aspects of the product's business as it moves through the market and fulfills its strategic objectives.

<sup>1</sup>Steven Haines, *Managing Product Management: Empowering Your Organization to Produce Competitive Products and Brands* (New York: McGraw-Hill, 2011), p. 90.

<sup>2</sup>Steven Haines, *The Product Manager's Desk Reference* (New York: McGraw-Hill, 2009), p. 60.

FIGURE 21.1 THE PRODUCT MANAGEMENT LIFE CYCLE MODEL.



Used with permission from *The Product Manager's Desk Reference* (2008).

As you can see, NPP and NPI are supported in part by a standard phased product development process. Companies that seek to improve cycle time and time to market, and to improve decision accuracy, have utilized these phased processes for decades. However, PLPM is of even greater importance. The activities and tasks that are carried out while the product is in market should produce positive returns to the business. These outcomes directly impact the opportunities that flow into the NPP processes. Further, it should be clearly understood that in NPP and NPI, the firm is expending resources that result in *negative cash flow*. For PLPM, products are intended to contribute positively to the firm's bottom line and produce *positive cash flow*.

W. Edwards Deming contributed greatly to the art and science of innovation and quality. Some of the principles he discovered can and should be considered valuable reference points. Consistent with the precepts of the product management life cycle model, Deming used a simple technique: Plan, Do, Check, and Act (PDCA). Simply stated, to effectively manage the performance of existing products, all outcomes need to be measured against established plans.

With this context, we are now ready to explore the four main areas of PLPM.

*To effectively manage the performance of existing products, all outcomes need to be measured against established plans.*

## 21.3 Utilizing a Cross-Functional Product Team

Almost all organizations make some use of cross-functional teams. During the phases of new product development, it is common business practice to have people from other functions work together as products are planned, developed, and launched. These are cross-functional *project teams*. In cross-functional project teams, resources are dedicated to the team for only the duration of the project. When the project is completed, *the team is usually disbanded*, and the participants are assigned to other projects.

*Product teams are distinctly different from project teams.*

Many firms refer to these teams as *product teams*. However, in actuality, they are not. *Product teams are distinctly different from project teams*. Product teams are (or should be) considered microcosms of a cross-functional executive leadership team. Their members are responsible for the performance of a product or product line. Product teams *should not disband because any one project is over*. They should be in place for the life of the product or product line.

This can be a big challenge for senior leaders. In many organizations, after a product is launched, a product manager or product line manager becomes responsible for its management. In effect, the new product development (NPD) team “tosses the product over the wall.” The person or persons who must “catch the product” (i.e., manage it) may feel overwhelmed by the continuous stream of urgent tasks that cannot always be effectively structured into a neat linear process. When a product is sold in the market and roles across the organization are unclear, the product managers may feel overwhelmed by the demands placed on them from people in other functions.

There are many reasons for this. One is that executives do not have a sense of how much work is involved in managing an existing product. Another is that cross-functional team members are reassigned to other project after the product is launched. A third reason is that performance metrics are often unavailable to the product manager to effectively steer the product through the market.

It is certainly easier to assign resources for NPD projects because most of the people who work on those cross-functional teams have enough experience to allocate resources and complete their work. Unfortunately, there is much less insight into the level of effort required of a single product manager or product line manager.

Companies that maintain cross-functional teams to manage products after their launch and throughout their lifecycles tend to have a more balanced and successful product management discipline. This also better enables them to manage their broader portfolios of new and existing products and services.

Although this is not the norm, some companies utilize the original NPD cross-functional team to perform PLPM. This could be an excellent work transition, since that NPD team will already have intimate knowledge and experience with the product and its market drivers and positioning. The team will have the greatest ability to immediately make quick decisions and trade-offs, especially during the critical growth phase of PLPM, where “crossing the chasm”<sup>3</sup> from early adopters to mass markets is imperative.

If suitably chartered, the cross-functional product team can be a highly effective work structure. It could function as a “mini-business” or “business within the business.” Properly empowered and credibly led, it would serve to synchronize the work activities of people across all business functions, and it would ensure that all financial and business objectives are fulfilled.

As the chapter unfolds, it will become more evident how suitable and apposite a cross-functional product team would be to handle the myriad activities required to run the product’s business.

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## 21.4 Auditing Results After the Launch

Some of the most important business lessons can be learned after a product is launched. Unfortunately, many firms don’t make postlaunch audits a part of the vital suite of product management processes. Some people tend to have an uneasy reaction when the word *audit* is mentioned, either because they don’t understand what is involved or because the idea of an investigatory procedure makes them uncomfortable. However, when it comes to good product management, early postlaunch surveillance has much to offer due to the information it yields. These clues and insights can identify and help overcome present and potential problems and improve future product launch success. Failure to seriously audit launches and take corrective action will usually result in good news for your competitors.

The timing of any audit depends on the type of product. Fast-moving consumer goods may require rapid evaluations when conducting market tests and very soon after a broad market introduction. Larger-scale

<sup>3</sup>Geoffrey Moore, *Crossing the Chasm* (New York: HarperCollins, 2002).

TABLE 21.1 A GAP ANALYSIS MATRIX.

Launch Element	Plan of Record	Actual Outcome	Gap Analysis
Market window			
Executive support			
Business case			
Sales preparation			
Cross-functional support			

business-to-business products may require more market maturation or a lead-user/early adopter study in order to gather and evaluate auditable data.

It is also important to make sure that someone is assigned a key oversight role to evaluate launches and launch performance; an auditor would be the preferable choice. In many organizations, people who are too close to any one process may not have the right perspective, experience, or knowledge of corporate systems, processes, or methods.

A postlaunch audit is intended to examine every aspect and element of a product launch plan. A helpful technique to use is a gap analysis matrix, as shown in Table 21.1.

There are some very important areas that should be the focus of serious investigation. These include:

- *The accuracy of the market window.* Every product needs to be in market at a given time. Many firms use trade shows or some type of seasonal time slot to get to market. Beyond these simpler market-timing aspects, there are others that can be more important. For example, when product managers and their teams know that a product’s life is ebbing, there may be an important signal to make a strategically competitive statement.
- *The degree to which executives support or drive the launch effort.* In many organizations, a project manager is usually appointed to supervise and coordinate the launch. However, his or her knowledge and experience in planning and overseeing a launch may be limited. Firms that tend to launch successfully usually have a solid executive champion who is engaged early in the launch planning process and who follows the launch project to completion.
- *The validity of all aspects of the business case.* The business case serves as the primary document to justify product investments. Well-constructed business cases contain vital assumptions for the market context, strategic importance, market share estimates, forecasts, and financials. Product leaders often learn valuable lessons when they find that important details were overlooked in the business case.

- *The effectiveness of sales preparation.* Products cannot be effectively sold if salespeople are not brought on board and trained to effectively position the product. Sales executives must also buy in through their agreements to fulfill sales forecasts, provide adequate sales staff, and provide a compensation plan that motivates people to sell and close deals. Salespeople must be given the right material and information, either through formal or informal means. When sales fail to materialize, it is often because there are gaps between what should have been done and what actually happened for the variables mentioned here.
- *Cross-functional alignment.* Product launches are not single-person activities. Rather, they are intensive cross-functional initiatives. The people involved in these functions not only have to work together to bring the product to market, they also have to work collectively to “absorb” the product into the product portfolio. Any missteps in these efforts can have a ripple effect across the organization. As an example, if a new product is launched and the customer service department isn’t adequately staffed or trained to either take orders or resolve issues, customer satisfaction will wane. Audits should be used to isolate any breakdowns in communication, handoff, and other aspects that allow the organization’s gears to spin at the right speed to support the product’s entry into the market and absorption into the portfolio.

These five elements are not only important to the “soon-after” period of the product launch; they serve to set the stage for ongoing analysis of the product’s market and business performance.

Leaders should recognize that the postlaunch audit serves as a vital root-cause analysis that should result in action-based recommendations. Some of these recommendations should be acted on immediately, especially when reputations are at stake. Important lessons from these audits can and should be used to improve future launches.

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## 21.5 Managing the Product in the Market

As mentioned earlier, there is no linear process to follow while a product moves through the market. Even if a company has established routines for budgeting, planning, and monthly reviews, the management of existing products can be highly disruptive and situational. Despite the fact that product managers and others feel that they are constantly reactive, there are some routines that can be followed to make sense of what’s going on. To do this, a cross-functional product team must be able to evaluate a variety of key

performance indicators to determine the product's life cycle state and market position. The team must also make changes to the product's supporting business infrastructure and the marketing mix based on those performance indicators. These help product managers and the cross-functional product team to strategize and restrategize across the product's in-market life.

### 21.5.1 Evaluating Performance and Restrategizing

Most people are familiar with the product life cycle curve with its basic phases: growth, maturity, and decline. The product life cycle curve is an S curve that depicts the diffusion of a product as it saturates a given market. It is a graphical representation of various measures, which may include revenue, profit, costs, cash flow, or unit volumes. It is interesting to note that this very simple tool is often misunderstood and misused. When I ask a product manager or a marketing manager, "Where is your product in its life?" they usually respond with a generalized answer such as "My product is in growth." Then, when I ask, "What data did you use to come to this conclusion?" they usually tell me, "Sales are going up" to indicate that the product is in the growth phase. Then I may ask, "Compared to what?" This last question is a real challenge.

One of the best ways to portray the envisioned in-market life cycle phases is to refer to the assumptions and forecasts from the product's business case. Of course, if the product is more than 5 or 10 years old, chances are that the business case will be difficult to locate. The main idea here is to have indicated in the business case that *acceptable growth* might consist of specific percentage increases in revenue and profit from quarter to quarter over a given period of time. This way, if you're two years into the product's market life and you see lower or higher rates of revenue movement, you'll know that something's happening—or not happening.

As mentioned, product managers and their teams may look at a variety of key performance indicators (KPIs) in order to ascertain the product's current position. When they combine financial, market, and operational KPIs, the team is in a better position to understand what's happening with the product's business and to recommend strategic and tactical adjustments. These adjustments could include making enhancements to the product or expanding the product's market footprint. This simplified approach was explained by H. Igor Ansoff, a noted academic and consultant who wrote extensively about this topic.

Changes in operational systems, infrastructure, or service and support mechanisms may also be warranted. Unfortunately, many people who work in product organizations tend to focus more on the evolution of



functionality, features, and product attributes. This myopic perspective may leave the company vulnerable if other aspects of the business are not included in routine examinations of the product's business.

### 21.5.2 The Marketing Mix

As I mentioned earlier, many people engaged in product development tend to utilize linear processes to plan and carry out their work. When products are in the market, it's important to understand the dynamic nature of various events and activities that must be taken into consideration so that the best decisions can be made about the product's future. Because the product's business is impacted by many internal and external influences, a structured set of outbound activities must be planned and carried out. These are embodied in the marketing mix model.

Many marketing mix models are made up of four major areas that are often referred to as the four P's: product, price, promotion, and place. These four elements act as control levers to execute the product's business strategy and to monitor the product's performance. These levers cannot work independently because an action taken in one mix element will affect one or more of the others. For example, a business cannot launch a product without a channel (place) strategy. A price reduction strategy cannot be undertaken without a complementary promotional action that communicates this pricing action to the intended market audience. Further, a major product enhancement might require pricing changes, promotional support (such as a trade show or an advertising campaign), or an augmentation to the distribution channels.

The challenge faced by many firms is that no one "owns" the collective plans and performance management of the marketing mix, because some of these P's are owned by different executives. For example, a marketing executive might own advertising and promotion programs, and the sales executive might be accountable for direct and indirect sales (place or channel). In many organizations, the product may be owned by a product management executive, a product development executive, or even a general manager. When there are so many people involved in aspects of the product's business, it's difficult to manage that business.

One of the ways to secure a more integrated, holistic view of the product's business is to utilize a cross-functional product team. As mentioned earlier, the cross-functional product team can collectively plan and monitor the marketing mix for a product or product line across its life, consistent with the strategies of the organization.

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## 21.6 Dimensions of Product Performance

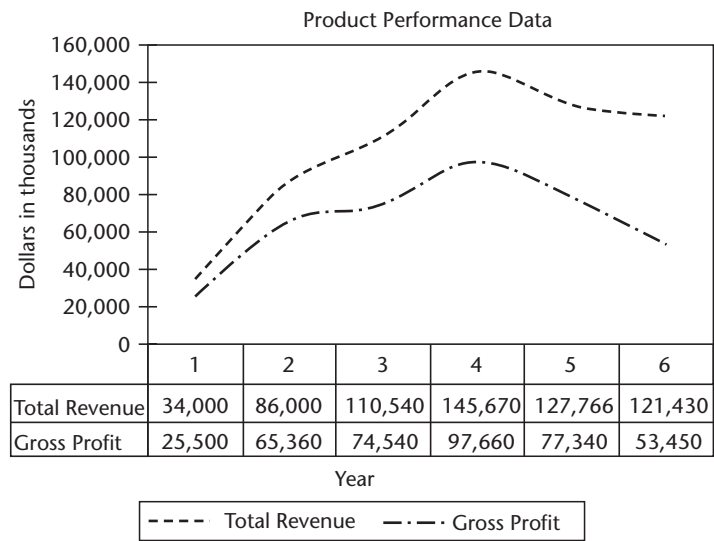
Even if an organization effectively and collectively plans and monitors the marketing mix elements, there are other dimensions of the product's business that require attention. These include indicators of financial and operational performance. The product manager and the cross-functional team should work together to understand each of these dimensions of the product's business. They should keep their eyes on these dimensions, along with the (aforementioned) marketing mix elements, in order to periodically recast the strategy for the product or product line.

- *Financial performance.* Businesses “keep score” by carefully monitoring a product's financial performance against budgets and plans. Therefore, it is imperative that product managers and their teams pay close attention to the product's financials, especially the profit and loss (P&L) statement. While this may sound simple, in some organizations the P&L statement may be unavailable to the product manager, or the product manager may not be inclined to pay attention to the numbers. Also, in many organizations, the P&L statement for a product may contain a number of expenses that are allocated at the corporate level and are beyond the control of the product manager and the team. However, it is vital that *basic numbers be made available*, including unit volumes, prices charged, cost of goods (for tangible products), and the gross margin.

When these figures are available to the product manager and the team, they can analyze the product's current sales, cost, and gross margin against its established plans. The team can also chart the product's course on the life cycle curve, as shown in Figure 21.2. This depiction provides useful visual indicators that can then be meshed with other performance indicators based on the marketing mix, operational metrics, and service and support metrics. When the financial data are available and are analyzed, along with the other performance indicators, a clear picture of the product's health can be portrayed. Furthermore, when these data are tracked over time, others can see the path that the product traveled and why its performance changed. **Figure 21.2 Tracking the Product's Financial Performance.**

- *Operations.* There is a vast infrastructure that exists to sustain the product's business inside the organization. Product managers and their

**FIGURE 21.2 TRACKING THE PRODUCT’S FINANCIAL PERFORMANCE.**



Used with permission from *The Product Manager's Desk Reference* (2008), p. 491.

teams should understand how each of these functions contributes to the product’s success. These functions may include the supply chain, human resource management, facilities, legal, regulatory, compliance, and others. While the people in these functional areas don’t necessarily work with the product team on a day-to-day basis, the outcomes and impact of their departments must be understood by the product team. For example, the supply chain group manages those processes that ensure that resources can be secured and deployed across the organization and that products can be distributed. The supply chain group also helps with inventory management and often works closely with demand planning workers to ensure that enough of the right materials is available at the right time. Aside from the supply chain function, product managers may need to work with supporting functional departments. For example, the human resource department may provide new employees for important product initiatives. The legal department may provide help with beta customer contracts or in guiding the team through the intricacies of product discontinuation.

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## 21.7 Optimizing the Product Portfolio

All investors are vitally concerned about the performance of their investment portfolio. They continually review their holdings and try to anticipate where markets are headed so that they can make as much money as possible within their own tolerance for risk. Periodically, they adjust or rebalance their portfolios to eliminate investments that don't contribute to their goals and make other investments that are seen as more favorable.

Managing a product portfolio involves a similar mindset plus constant vigilance. Products represent the investments made by the company so that the company's strategies can be realized. Unfortunately, many firms fall short in this area. Often, it's because they don't have the time, data, or inclination to take on this difficult, complex, and time-consuming work. This work also requires the right staff with the skills and experience to understand how product portfolios are constructed and reconstructed over time.

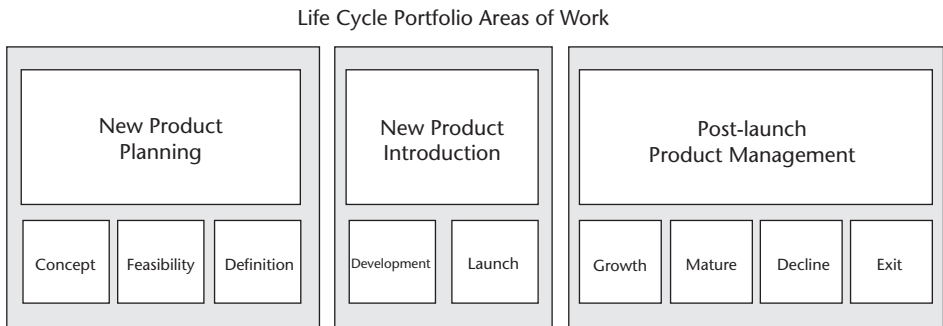
There are several different approaches taken by academics and consultants in the area of product portfolio management. Some of the traditional methods, which include the Boston Consulting Group's BCG Growth Share Matrix and the GE/McKinsey model, only look at existing products in the portfolio. Others advocate for, and write extensively about, portfolio management as the maximization of the pipeline of new products and major enhancements.

These models, while easily understood, may not offer the right depth and breadth of analysis required to evaluate product lines and product portfolios across the entire life cycle, not just for products that are in market or products being planned, developed, or launched.

Executives should be particularly concerned about tools and methods that focus solely on NPD project portfolio management. When a company is on this *treadmill*, they get lured into using an unsustainable operating model where a steady stream of new products and innovations is indicated as the cure for poor corporate performance. Although this steady stream is not completely unwarranted, it can certainly be the cause of some major corporate indigestion. I have seen people in product organizations struggle because they didn't understand the level of effort required to integrate a new product into the operational model of the firm. Important steps are missed, which then causes excessive rework that come back to haunt the organization after the product is launched. Often the root cause can be traced to a lack of cross-functional collaboration in planning, development, and launch.

Furthermore, in some firms, the person designated to be responsible for product portfolio management (whether the product manager or another individual) is so overwhelmed with day-to-day tasks that he or she cannot do the work needed to support an additional product. Overall, it's

**FIGURE 21.3 PRODUCT PORTFOLIO WORK AREA BUCKETS.**



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Used with permission from *The Product Manager's Desk Reference* (2008), p. 529.

fine to want new and innovative products in the portfolio. However, plans need to be put in place to ensure that all products in the portfolio can be managed effectively while in market.

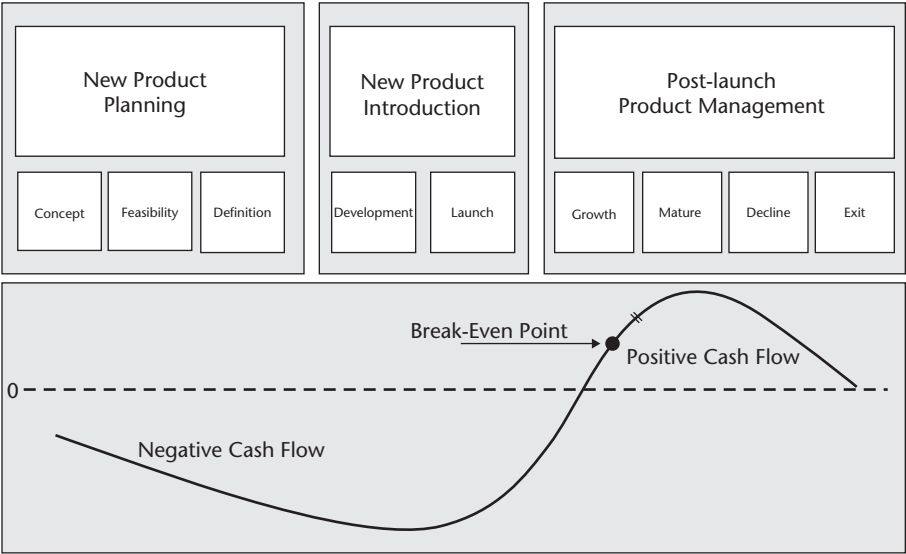
In order to overcome this dilemma of imbalance, there are some steps that leaders can take to improve product portfolio performance:

1. Make sure that efforts are undertaken to balance the portfolio as often as necessary (at the speed of your market).
2. View all product investments during all life cycle phases to determine the level of effort required for each phase. To visualize this point, refer to Figure 21.3 as a good reference for a holistic perspective. Notice that this model is a derivation of the product management life cycle model shown in Figure 21.2. The notable difference is that the smaller boxes below the main work areas are now represented as portfolio “buckets.”

As can be seen, this model helps product portfolio leaders to divide the portfolio into its basic elements so that each element can be assessed. It also allows for a more holistic view of all the products in the portfolio. The main points include:

- a. Product projects that exist in various phases of evolution in the areas of new product planning and new product introduction absorb resources and do not contribute any money to the company.
- b. Products in various phases of the product life in the area of post-launch product management generally contribute positively to the corporate portfolio. Figure 21.4 depicts the cash flow across the life cycles of all products in the portfolio.

**FIGURE 21.4 PRODUCT PORTFOLIO WORK AREA BUCKETS WITH CASH FLOW OVERLAY.**



Used with permission from *The Product Manager's Desk Reference* (2008), p. 531.

3. Make real decisions. Product portfolio management is not only about reviewing and analyzing investments and outcomes. It's also about making decisions and triggering action. Moreover, portfolio decisions require a strong connection to the corporate or business unit strategy. A few of the types of questions that executives want to answer include:
- a. If products being planned should be continued or canceled
  - b. If products being developed can meet the targets indicated in the business case
  - c. If a product being readied for launch will have the desired market impact
  - d. If an existing growth phase product's operational support structure should be streamlined
  - e. If a product line should be pruned or discontinued

In order to effectively deploy this type of structure, a product portfolio board should serve as the primary governing body. In a recent survey I carried out where 97 product executives were polled, about 40 percent

indicated that their firms utilized a product portfolio review board. These boards meet frequently, analyze vast amounts of data, and use a robust suite of decision criteria to continually screen and evaluate portfolio contributions. Typical screening criteria include strategic fit, market share, market potential, organizational capacity, competitive position, and other vital indicators. Where such a corporate entity exists and where it uses structured processes to make decisions about what to do and not do, there is a better chance for the optimized product portfolio to produce the desired results and achieve the firm's strategic objectives.

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## 21.8 Downstream Product Strategies

An understanding of the product life cycle, from beginning to end, offers tremendous opportunities for leaders to anticipate strategic and tactical options for product investments as product lives evolve. Theodore Levitt wrote in the *Harvard Business Review* in 1965 that “One of the greatest values of the life cycle concept ... is to try to foresee the profile of the proposed product's cycle<sup>4</sup>.” This insight could serve to guide leaders so that they may avoid many of the problems that firms experience in downstream product management. In the same article, he wrote that “there may be considerable value for people involved in new product work to begin planning for the extension of the lives of their products even before the products are formally launched.<sup>5</sup>” His ideas can be usefully applied as firms consider where to invest or divest as products move toward later life cycle states.

When products are less than viable, either because they don't meet a market need, their competitive advantage has waned, or they don't contribute as much as they should to the firm, action is required. As indicated in this chapter, *all products need to be managed at all phases of their lives, and the late maturity or decline phase is no exception*. Unfortunately, many firms neglect this aspect of portfolio management, and executives wonder why products languish and don't move as they once did.

From a psychological perspective, many employees indicate that there is

*All products need to be managed at all phases of their lives, and the late maturity or decline phase is no exception.*

<sup>4</sup>Levitt, Theodore (1965). Exploit the product life cycle. *Harvard Business Review* 43(6): 81-94.

<sup>5</sup>Levitt, Theodore (1965). Exploit the product life cycle. *Harvard Business Review* 43(6): 91.

no glory or fun in the management of an older or undesirable product. Some leaders reassign product managers to other products and pay little attention to those products. Some product managers feel that if they make a recommendation to act on or discontinue a decline phase product, it will adversely impact their career. While these behaviors or feelings may be accurate, they are unwarranted. Leaders should discourage this mindset and encourage frank discussion of such issues so that the portfolio does not suffer unnecessarily.

Downstream decisions can be made within the context of the marketing mix model: product, price, promotion, and place or channel.

- *Product investments* should be heavily scrutinized for downstream products. It is difficult to differentiate a commoditized product during a late life cycle phase. However, if it is possible to sustain the product and maintain an acceptable positive cash flow, then select changes might be called for. Some firms, especially in the consumer products space, may make changes to packaging, designs, formulations, or even line extensions. Others, in the business-to-business space, may decide to cost-reduce components or even improve quality levels. Some firms may choose to reduce the number of product options by pruning the product line. Lastly, many companies may just want to stop supporting the product and “migrate” their customers to a new product, platform, or technology.
- *Pricing* adjustments are often used to inspire behavioral changes in product purchases or usage or to encourage migration. Some firms raise prices in order to eliminate customers. Others reduce prices to maintain or grow market share in an environment of lower demand. Price reductions are often a short-lived solution because competitors tend to follow quickly, which leaves all competitors with lower profits.
- *Promotional* actions may be used to stimulate the demand for slower-moving products. This can include attending a trade show or revamping the company’s website. Often, promotions for downstream products are paired with pricing adjustments to produce the desired result. Like pricing changes, promotional changes for these products are usually a short-lived solution.
- *Place or channel changes* may be used to improve the flow of goods from the point of creation to the point of use. Many business-to-business firms utilize direct salespeople to create demand and to process orders. However, some firms may promote the use of the company’s website to stimulate reorders or to interact with the customer in order to cut down on distribution costs. Other firms may also move from a direct



sales model to the use of resellers or distributors in order to cover broad market areas at lower costs.

Business stakeholders should always monitor the product's performance. Ultimately, market pressures will cause volumes to sag and share to erode. In these cases, marketing mix investments may serve to sustain these products for extended periods of time.

On the other hand, nonviable or marginally viable products may use vital resources that could be otherwise deployed elsewhere. In this case, the product's contribution to the portfolio should be carefully evaluated to determine whether it should be discontinued. In such cases, a structured discontinuation process would be followed. This process actually resembles a business case, since the precepts upon which product investments are made are similar to those for the disinvestment in products or product lines.

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## 21.9 Summary

Because funding for new products comes primarily, if not exclusively, from products that are currently in the market, it is vital that companies do their best to optimize products that are in the market. *Post-Launch Product Management* is the term used to define the methods and techniques used to evaluate and strategize so that the current product portfolio can be kept up-to-date and in optimal condition. When companies pay close attention to their existing products, they can make sure that they will improve the cash flow that is so vital to new product innovation initiatives that will ultimately improve corporate performance.

**Steven Haines** is the founder and President of Sequent Learning Networks and The Product Management Executive Board. Steven's primary emphasis is on helping companies, across industries and around the world, to effectively organize for and manage the product management function. Steven has held leadership positions in companies such as Oracle, AT&T, and WR Grace. His career also includes 12 years as Adjunct Professor of Marketing and Management at Rutgers University. Steven is the author of the category-defining books *The Product Manager's Desk Reference*, *Managing Product Management*, and *The Product Manager's Survival Guide*, all published by McGraw-Hill. The New York City native received a bachelor's degree in Management Science from Binghamton University and an MBA in Corporate Financial Management from the Lubin School of Business at Pace University.



## CHAPTER TWENTY-TWO

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# MANAGING INNOVATION PARADOXES FOR ORGANIZATIONAL AMBIDEXTERITY

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Marianne W. Lewis and Constantine Andriopoulos

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### 22.1 Introduction

Innovation is a vital but challenging management responsibility. To prosper and even survive, firms must excel at both exploitative and exploratory innovation. Yet, tensions emanate from the differences in these forms of innovation. As Atuahene-Gima (2005) explains, exploitation hones and extends current knowledge, seeking greater efficiency and improvements to enable incremental innovation. Exploration, on the other hand, entails the development of new knowledge, experimenting to foster the variation and novelty needed for more radical innovation.

*Organizational ambidexterity* signifies a firm's ability to manage these tensions. Ambidextrous firms are capable of simultaneous yet contradictory forms of innovation, exploiting current competencies and exploring new domains with equal dexterity. Yet, related research suggests different paths to ambidexterity. Advocates of a differentiation approach call for dual structures and strategies, separate efforts to focus units on either exploitative or exploratory innovation. In contrast, advocates of

*Ambidextrous firms are capable of simultaneous yet contradictory forms of innovation, exploiting current competencies and exploring new domains with equal dexterity.*

an integration approach emphasize behavioral and social means of achieving exploitation and exploration simultaneously. Socialization, human resource, and team-building practices, for instance, aid sharing of values and coordination, helping actors think and act ambidextrously on a daily basis.

While literature often warns about the difficulties of managing innovation paradoxes, related studies are scarce. In response, we conducted a comparative case study of five firms that excel at product development. Our results offer insights into how ambidextrous firms manage exploitation and exploration. In particular, we focus on three innovation paradoxes, focusing on issues of top management (profitability-breakthroughs), projects (experimentation-constraints), and individuals (discipline-passion). The cases clarify how both integration and differentiation tactics enable ambidexterity.

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## 22.2 Innovation and Organizational Ambidexterity

In his foundational work, March (1991) proposes that innovation sparks tensions surrounding exploitation and exploration. Both forms of innovation entail combining knowledge, one employing existing knowledge in well-understood ways, the other leveraging varied knowledge in new ways. Exploitation demands efficiency and convergent thinking to harness current capabilities and continuously improve product offerings. Exploration, in contrast, entails experimentation and divergent thinking to generate novel recombinations of knowledge. Studies find that excelling at these competing forms of innovation is vital to successful product development (e.g., Sheremata, 2000) and to long-term performance (e.g., Tushman and O'Reilly, 1996).

The complexity of innovation paradoxes intensifies management challenges. Exploitation and exploration represent overarching demands, spurring nested tensions throughout the firm. An example is firms grappling with multiple innovation tensions, such as conflicts between outside and inside, new and old, determined and emergent, and freedom and responsibility. Innovation paradoxes also may trigger vicious cycles that stem from an increasingly one-sided focus on either exploitation or exploration. Firms tend toward homogeneity, finding comfort as they develop mindsets and routines supporting one form of innovation, escalating their efforts in their

preferred mode to the neglect of the other. The efforts are counterproductive, however. Exploitation drives out exploration and vice versa. An exploitation bent may spur *competency traps*. Leveraging current capabilities may enable immediate profits but foster eventual stagnation, leaving firms vulnerable to market and technological changes. Likewise, *failure traps* can be triggered by stressing exploration (see Gupta, Smith, and Shalley, 2006). Firms take escalating risks, attempting to overcome past innovation failures, while ignoring core competencies.

Organizational ambidexterity is prized as a means of managing innovation paradoxes. Top management teams, therefore, need to create supportive structures and strategies to achieve balance. Balance in this context does not mean a mediocre split or bland compromise, but truly excelling at both exploitation *and* exploration. The approaches to ambidexterity can differ based on whether a firm uses differentiation or integration tactics. Proponents of differentiation call for separate efforts targeted at either exploitation or exploration. For example, work may be separated into distinct units focused on either mode, or the same unit may focus at different times on either exploitation or exploration. Such differentiation helps ensure focus but may foster isolation, encourage a preferred innovation mode, and limit coordination between varied efforts. In contrast, integration approaches leverage by more cultural and social means to achieve exploitation and exploration simultaneously. Here top management teams seek synergies between contrasting innovation efforts and supportive social processes (e.g., socialization and human resource practices) to support a culture and interpersonal relations that help employees throughout the firm think and act ambidextrously. The challenge is that such integration may strain actors, given the complexity and potential confusion posed by contradictory forms of innovation.

Although researchers call for more comprehensive insights into managing innovation paradoxes, such studies are rare. In response, we offer a comparative case study of five ambidextrous firms, examining their exploitation-exploration tensions and corresponding management approaches. Our goal is to garner lessons from ambidextrous leaders.

*Organizational ambidexterity is prized as a means of managing innovation paradoxes.*

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## 22.3 Innovation Paradoxes and Their Management

In investigating innovation paradoxes across five cases of new product design consultancies, we identified two overarching patterns. First, company personnel who were interviewed were acutely aware of exploration-exploitation tensions, which were evident in their rich descriptions of the tensions not as problematic dilemmas or trade-offs, but rather as valued and interwoven paradoxes. These paradoxes appeared at three levels: top management (profit-breakthroughs), projects (experimentation-constraints), and individual (discipline-passion). Second, integration *and* differentiation tactics were praised as keys to managing each paradox. *Integration* efforts stress interdependence between seeming opposites and enable coordination. In contrast, *differentiation* focuses efforts on either exploitative or exploratory efforts. We now present each paradox and its corresponding management approaches (see Table 22.1 for a summary).

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### 22.4 Top Management: Managing Profit and Breakthroughs

Top management grapples with the paradoxical need to strategically position the firm so that it can excel at both profitability and breakthroughs. Exploitation and exploration have opposing goals: stable revenues that enable higher mean performance and frame-breaking opportunities that foster greater peak performance, respectively. Similarly, product extensions fuel positive and consistent returns, while radically new products are characterized by high risk and uncertainty, resulting in mixes of high-visibility successes and dismal failures. Across the cases, a profit emphasis seemed infused with conservatism. Interviewees stressed the value of incremental projects and efficiency, noting the need to carefully allocate resources and select projects to leverage and hone their firm's expertise. In contrast to such conservatism, a breakthrough emphasis entails risk taking in search of opportunities that may enhance the firm's reputation and adaptability. Informants often stated that being on the cutting edge is the reason they work in product development in the first place, seeking reputation building for themselves and the firm. Further, such risk taking enhances long-run adaptability. Continuously exploring new domains fosters the flexibility that is vital in an intense and dynamic field.

TABLE 22.1 INNOVATION PARADOXES AND THEIR MANAGEMENT.

	Integration Positions Innovation Tensions as Valued Synergies	Differentiation Targets Actions Toward Opposing Sides of a Tension
Top Management	<p><b>Paradox:</b> Need to excel at both profitability and breakthroughs; seek opportunities that spark radical innovation and leverage existing capabilities</p> <p><b>Management:</b> <i>Consistently communicate dual (“both/and”) vision</i></p> <p>Provide forums for sharing ideas and learning across units; highlight synergies between award-winning products and profitable product extensions</p>	<p><b>Management:</b> <i>Apply a “project portfolio” approach</i></p> <p>Diversify projects to ensure a mix that hones existing specializations (incremental projects) and funds riskier ventures (radical inventions)</p>
Projects	<p><b>Paradox:</b> Need to experiment with emerging possibilities (new markets and technologies) while managing within project constraints (which ensure fit with current market needs)</p> <p><b>Management:</b> <i>Stress improvisation</i></p> <p>Recombine existing elements in new ways (seek unconventional connections between existing ideas); use and push project boundaries to guide and focus creativity</p>	<p><b>Management:</b> <i>Iterate between constraints and experimentation</i></p> <p>Start by gaining insight into market needs and project boundaries; pull away from constraints to explore new domains; return to evaluate results against project boundaries</p>
Individuals	<p><b>Paradox:</b> Need to embrace competing inner drives for discipline (control and structure that power execution) and passion (challenge and risk taking that fuel creative expression)</p> <p><b>Management:</b> <i>Cultivate a shared identity as practical and creative</i></p> <p>Socialize employees via hiring, mentoring, and ongoing reviews</p>	<p><b>Management:</b> <i>Vary the nature of work at different times</i></p> <p>Separate creative efforts (that stretch capabilities) from routine work (that hones skills) by rotating individuals across projects and project phases</p>

### 22.4.1 Management Approaches

Seeking profit and breakthroughs and achieving both, however, are different matters, the latter demanding deft ambidexterity. In these case firms, managing this paradox involved both integration and differentiation. Integration required consistently communicating a paradoxical vision that emphasizes the dual goals. These product development firms embraced a “both/and vision.” Informants described how distinctive products attract clients, while incremental innovations fund riskier work. Such an explicit, paradoxical vision helped employees at all levels value the paradox. Through this lens, profit, for instance, can provide the slack and opportunity to tackle potentially breakthrough projects. Successful incremental innovation also builds trust in the firm’s capabilities, attracting new opportunities. Such synergies were often reiterated in firm-wide meetings, written communications, and group interactions. Supportive communications help avoid the interpretation of paradoxical visions as oversimplified or unrealistic. Reiteration also helps avoid a perception of mixed messages, such as employees perceiving cost controls and efficiency as assuming priority over more radical innovation.

In contrast to integration, differentiation targets distinctive efforts at each strategic goal. Specifically, the firms diversify their product development portfolios with more routine, profitable projects and high-risk, breakthrough projects. In their view, portfolios ideally include incremental projects that pay the bills and radical projects that build new capabilities and morale. This tactic enables focus within distinct projects, yet builds a diverse project portfolio. To aid exploitation, firms seek projects that leverage their existing specializations. Exploratory projects, in comparison, are more rare and often require creative efforts such as collaborating through joint ventures.

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## 22.5 Projects: Managing Experimentation and Constraints

During projects, paradox focused on the need to experiment and to adhere to project constraints. Project managers set boundaries by stressing competitive and market constraints, while product development engineers and designers seek to explore emerging technologies and trends. Yet, innovation projects rarely leverage both current needs and future possibilities. Project constraints thus can become both a blessing and a curse, aiding insight into the current market but potentially inhibiting greater creativity. In these cases, product development teams value project constraints for offering

insights into the market and helping ensure customer satisfaction. Experimentation, on the other hand, helps teams break free of constraints and probe novel opportunities. Pushing the boundaries allows project teams to investigate unrelated areas, hoping to identify new possibilities and to expose previously unrecognized potential.

### 22.5.1 Management Approaches

Integration and differentiation helped case firms manage this paradox. Integration was evident in calls for improvisation. Project managers stressed the need to exploit existing routines and knowledge while exploring within and pushing project boundaries. Such descriptions fit the definition of improvisation as recombining existing elements in new ways, much as musicians reassemble previously performed bundles of notes into unique melodies (Miner, Bassoff, and Moorman, 2001). Without making efforts to push constraints, project managers may inhibit creativity. A likely result is the regurgitation of mundane, overcommercialized products. At the opposite extreme, projects driven solely by a future orientation can lack clear goals and become wasteful. As problems arise, product development teams can become overly focused on their own views and neglect the market. With these concerns in mind, project managers stressed improvisation, encouraging teams to both work within and stretch project boundaries.

Differentiation appeared to occur within projects as product development teams purposefully change between project constraints and freed experimentation. Most often, teams described starting a project by defining goals and constraints, seeking to fully grasp project boundaries. Designers and engineers then begin to pull away from initial constraints, most often using brainstorming to explore new domains. As projects progress, experimentation-constraint iterations may increase in frequency. The effect of such iterations as a guided interplay between creator and customer enables creative expression and commercial success.

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## 22.6 Individuals: Managing Discipline and Passion

Informants across cases described discipline and passion as interdependent, energizing their own innovative efforts. Such depictions suggested a paradoxical inner drive. While discipline, control, and structure power execution, passion, challenge, and risk taking mobilize creative expression. Indeed, product development challenges—seeking exciting new



products in short time frames with limited budgets—demand both sets of qualities. Successful projects require designers and engineers who “live and breathe” creativity but also take advantage of streamlined processes to speed development. Discipline was described in terms of control and structure. Informants stressed how well-defined processes empower individual contribution, targets help ensure project execution, and explicit roles enable focus. Such repetition of activities embedded in standardized best practices increases the speed and efficiency of innovation. Likewise, passion seemed to signify a powerful blending of personal expression and risk taking. Informants described their zeal as emanating from an intense desire for work that is engaging and challenging. They often noted how product development permeates their lives, stressing that internalizing their work can open opportunities for unexpected inspiration. Such depictions exemplify how intrinsic motivation is vital to creativity.

### 22.6.1 Management Approaches

To manage this individual-level paradox, integration fostered both/and thinking, while differentiation compartmentalized routine and nonroutine work. Integration was evident in team members’ descriptions of discipline and passion as synergistic. Indeed, this and other studies suggest the dangers of overemphasizing discipline or passion. On the one hand, excessive standardization may spur alienation and rigidity. Such results were described as a worst case scenario—a workplace devoid of inspiration. On the other hand, passion without discipline can fuel chaos. The result can be escalating obsession for individuals and inefficiency for firms. To enable integration, case firms cultivate paradoxical work identities. Socialization—from hiring to mentoring to ongoing reviews—helps designers and engineers identify themselves as both practical and creative, highlighting the simultaneity of discipline and passion.

Differentiation helped manage these competing personal drivers by varying the nature of work at different times—during different projects and different project phases. Routine and nonroutine work could be distinguished. As projects evolve, a team member’s focus systematically shifts from exploitation to exploration and back. Likewise, individuals rotate across projects, working on an incremental product extension, then shifting to a potentially frame-breaking invention. Similarly, individuals rotate through distinct roles as different individuals or units focus on the discipline of execution, budgeting, and administrative elements, while others tap into the passion fostered by experimentation and ideation.

## 22.7 Sustaining Ambidexterity

Through these case studies, we sought to contribute deeper insights into sustaining ambidexterity. Our findings highlight three nested paradoxes of innovation. Furthermore, managing these paradoxes involved a mix of integration and differentiation tactics. These findings suggest that a multilevel approach is vital to managing innovation paradoxes. As these paradoxes appeared at the levels of top management, projects, and individuals, our findings support the claim that exploitation-exploration conflicts spawn a host of tensions throughout organizations. And efforts to manage only one tension may be contradicted by efforts aimed at other interconnected tensions. In the product development firms studied, claims of seeking a both/and strategy aimed at profit and breakthroughs could be easily discounted by one-sided efforts in projects or individual efforts (e.g., emphasis on project constraints and on disciplined work practices might signal that exploitation reigns supreme). By managing innovation paradoxes across levels, management also becomes the responsibility of persons throughout the firm. Executives set the context, providing strategic leadership and allocating resources that determine their firm's portfolio of product development projects. Project managers, in turn, guide specific projects, ensuring adherence to clear development processes and encouraging improvisation as well as iterations between work modes. Finally, individual employees choose when and how to best apply their discipline and passion to enhance product development. Together these efforts reinforce each other as ambidexterity becomes pervasive.

This work suggests that integration and differentiation offer powerful complementary tactics for fostering ambidexterity. Integration tactics accentuate the importance of both poles of innovation paradoxes. Social and cultural approaches (e.g., organizational vision, socialization,

communication) enable a paradoxical mindset. Yet, differentiation is also vital. Clearly focusing actions (e.g., on projects targeted at different strategies, at constraints or freedom during project phases and with segregated work modes) helps maximize the distinct benefits of the opposing poles. In conjunction, the tactics work in harmony. For instance, a paradoxical vision of the firm as seeking both profit and breakthroughs may foster improvisation as project teams value project boundaries while pushing those boundaries to probe new possibilities. In turn, the need to exploit

*Managing innovation paradoxes involves a mix of integration and differentiation tactics.*

and the opportunity to explore may foster the discipline and passion that energize individual employees. As the cycle continues, interactions reinforce ambidextrous practices, positioning the firm to meet financial goals and leverage frame-breaking opportunities. Resulting benefits sustain ambidexterity. Yet, given the ongoing need to manage such complexity, it is not surprising that ambidexterity remains a much lauded but rarely achieved organizational capability. For this reason, we hope that these case firms may serve as exemplars of product development management.

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## 22.8 Summary

Innovation offers an increasingly critical yet still elusive source of competitive advantage. Long-term success requires firms to excel at both exploration (the ability to identify and seize new opportunities that foster radical innovation) and exploitation (the ability to enhance current capabilities that enable incremental innovation). Organizational ambidexterity offers a key, enabling these conflicting modes of innovation. Related research offers conflicting insights, recommending either differentiation or integration approaches. In response, we asked, how do product development leaders foster ambidexterity throughout their firm?

As discussed, four years of studying firms that excel at both exploiting existing products and exploring new opportunities revealed two valuable lessons. First, these ambidextrous innovators embrace tensions at different levels: profit-breakthroughs at the strategic level, experimentation-constraints at the project level, and discipline-passion at the individual level. Second, managing these tensions entails a combination of integration and differentiation tactics. The best innovators systematically nurture a paradoxical mindset that enables both/and thinking aimed at fostering synergies (integration), and distinctive practices that separate the competing demands to focus resources and action on one or the other at any point in time (differentiation). Blending both tactics stimulates and sustains ambidexterity.

*Ambidextrous innovators embrace tensions at different levels.*

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## CHAPTER TWENTY-THREE

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# UNDERSTANDING THE MOST COMMON TYPES OF INTELLECTUAL PROPERTY RIGHTS AND APPLYING THEM TO THE PRODUCT DEVELOPMENT PROCESS

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Rel S. Ambrozy

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### 23.1 Introduction

When developing any type of technology, the developer will certainly touch on at least one, if not more, types of intellectual property rights. The reason for intellectual property's wide reach is not hard to understand. Without legal protection that prevents Company B from misappropriating Company A's intellectual property, there would be no motivation for Company A to invest its resources in the research and development necessary to bring about innovation. The recognition of the need to foster and reward innovation via legal protections, among other means, is so deeply rooted in U.S. law that the Founding Fathers included a provision in the Constitution that still serves as the basis for most intellectual property rights that exist today.

This chapter first provides an overview of the four types of intellectual property rights that are most pertinent

*The four types of intellectual property rights that are most pertinent in the world of research and development are patents, trade secrets, copy-rights, and trademarks.*

in the world of research and development: (1) patents, (2) trade secrets, (3) copyrights, and (4) trademarks. It then discusses how intellectual property rights both impact and influence the analysis performed when preparing to launch a product. Next, the chapter explains how the analysis itself can, in turn, impact intellectual property rights. The chapter concludes with a review of the process for obtaining a patent and the problems that may arise when entering into a joint development arrangement.

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## **23.2 Most Common Types of Intellectual Property and Their Protections**

The chapter is limited to the most commonly known types of intellectual property (IP) rights, as it is simply intended to act as both a primer and a tool for providing direction to those involved in product development. After obtaining the necessary understanding and direction from this chapter, readers should seek legal advice that specifically pertains to their individual issue. The developer should also understand that there is a cost associated with obtaining, maintaining, and enforcing intellectual property rights. The benefits that flow from obtaining intellectual property should therefore be balanced against other means of establishing non-intellectual-property-based barriers to limit your competitor's entry into your market. For example, one type of non-intellectual-property-based barrier could entail entering into an agreement with a vertically aligned partner in your market so as to provide you and your partner with a business advantage that your competitor cannot offer.

### **23.2.1 Patents**

The best-known intellectual property right is likely the patent. Quite simply, a patent protects an invention conceived by an inventor or inventors. By comparison, a copyright protects the expression of an idea.

In the United States, a patent may be awarded to the inventor(s) so long as the invention has utility, novelty, and is nonobvious. Other countries have similar requirements for patentability; in fact, many are known to have more stringent tests for novelty and nonobviousness than the United States. Moreover, other countries have differing standards of utility, and thus do not offer patent protection for certain types

of technology that are protectable in the United States. For example, many countries do not provide patent protection for software-based inventions.

Importantly, a patent provides its owner with the right to exclude others from *practicing* the invention covered by the patent. Practicing the invention is another way of stating the types of activity that a patent right can exclude. In the United States, the types of activity that can be excluded are the making, using, selling, offering to sell, and/or importing the patented idea or patented invention, as well as *contributing* to or *inducing* direct infringement by a third party. Importantly, and as explained in greater detail below, a patent does not afford the patent owner the right to practice his or her own invention. This distinction must be appreciated because laymen typically believe that by obtaining a patent, they are free to make or sell their own invention. But that belief is incorrect, because most inventions are simply improvements on prior or underlying inventions or may incorporate other patentable technology. If those underlying inventions are patented, then the owners of those underlying patents may have the right to exclude you or your company from practicing their underlying invention. Thus, if the underlying patented technology is used without permission, the inventor may be infringing those underlying patents simply by practicing his or her own invention.

The period of exclusivity provided by a patent will differ, depending on the country of interest. In the United States, the right to exclude others from practicing the patented invention presently lasts for 20 years from the date the inventor filed a nonprovisional patent application. This 20-year right applies to all nonprovisional applications filed after June 8, 1995. The previous term for utility patents (i.e., those applications filed on or before June 8, 1995) was 17 years from the date of the issue of the patent. Technically, a patent is available in the United States for a process, a machine or device, an article of manufacture, a composition of matter, or any new and useful improvement thereof. More generically, the U.S. Supreme Court held that an inventor can obtain a patent for virtually “anything under the sun made by man,” which includes, by way of example only, electrical or mechanical devices, genetically modified organisms including human cells, chemical processes, software (if properly applied for), and plants, as well as methods of making or using such technologies, to name just a few. But it is worth repeating that this view is not universally shared, and many countries do not issue or recognize patents for software-based inventions, genetically modified matter, business methods, and certain subject areas. Just about every country, however, including



the United States, agrees that laws of nature, physical phenomena, and abstract ideas are not patentable.

### 23.2.2 Trade Secrets

Trade secrets are also important to an employee or company involved in research and development because this type of intellectual property allows an inventor or a company to legally prohibit others from misappropriating their ideas. Virtually any type of formula, pattern, or device, and occasionally a compilation of information, can attain trade secret status. Similarly, specific technical ideas, such as molding processes and chemical formulas, are routinely recognized as trade secrets. However, nontechnical information, such as customer lists, is less likely to attain trade secret status.

Unlike patents, however, trade secrets are protectable only if the idea is not generally known to others, it is not readily ascertainable by proper means, and the owner took certain precautions to protect the secrecy of the trade secret at issue. Specifically, U.S. trade secret law protects information so long as it remains a secret, is used in one's business, and affords the company an opportunity to obtain an advantage over competitors who do not know or use that trade secret. If that information becomes public, however, through no fault of the owner, then any rights to protect that trade secret vanish. For example, if a competitor independently develops the same idea or reverse engineers a product available to the public that is manufactured using the trade secret at issue, then there is no right to exclude others from using or publishing that same trade secret.

U.S. trade secret law thus protects an inventor or a company from the unauthorized publication or use of the trade secret by a party only to the extent that the party obtained that trade secret either improperly (e.g., via industrial espionage) or under an obligation of secrecy (e.g., a nondisclosure agreement). Not surprisingly, foreign countries have a wide variety of trade secret laws, and each should be studied as necessary. Trade secret law in the United States also varies from state to state, even though at least 45 states and the District of Columbia have adopted a version of the Uniform Trade Secrets Act, which helps ensure some measure of uniformity nationwide. It should be noted that many states recognize and enforce contractual covenants against reverse engineering when a relationship exists between the trade secret holder and the customer. Accordingly, a supplier may consider using such a covenant with her customer so as to limit the permissible means for independent development of the trade secret at issue.

A real dichotomy of interests exists between patent rights and trade secret rights. For example, regardless of the country, obtaining a patent is often a years-long process and typically costs thousands of dollars. By comparison, the trade secret right comes into effect once the idea is conceived, presents a business advantage, and is the subject of at least reasonable efforts to maintain its secrecy. And there is no cost to the inventor to obtain the trade secret right, except perhaps for the cost associated with keeping it secret. Also, the protections afforded trade secrets last only so long as their secrecy is maintained, whereas one of the requirements for obtaining a patent is that it be published and thus be publicly available for all the world to see. Similarly, the patent right to exclude others from practicing the invention stays in effect for many years after the patent is issued, but the inventor of the trade secret cannot stop anyone else from practicing the trade secret if that person thought up the idea on his own or reverse engineers it. Thus, as discussed in Section 23.6, there comes a point in the product development process where the company needs to decide either to seek patent protection for the new invention or rely simply on trade secret protection.

### 23.2.3 Copyrights

A copyright protects the expression of an idea (as opposed to a patent, which protects the invention) and allows the copyright owner to, among other things, control the reproduction of the subject work as well as to restrict derivations of the subject work. In the United States, a copyright is available for an original work of authorship, whether published or unpublished, that exists in a tangible medium of expression (e.g., a written form, a recording). In regard to product development, copyrights are most commonly used to protect software, although copyright protection can also be obtained for owners' manuals or operators' manuals (just as copyrights originally arose to protect books, songs, and plays).

In the United States, a copyright is self-effecting in that the rights attach as soon as the author creates the work, and there is no need to register the work with the U.S. Copyright Office. Such registration is only necessary if the copyright owner wishes to sue for copyright infringement. Other benefits of a preinfringement registration include a presumption of ownership, as well as the right to seek recovery of statutory damages and attorneys' fees. Generally speaking, the rights associated with a copyright will last for the length of the author's life plus 70 years. For an anonymous work, a pseudonymous work, or a work made for hire, however, the

right will last for 95 years from the year of first publication or 120 years from the year of its creation, whichever expires first. Copyrights are also available in foreign countries, but because of the wide range of matter protected or not protected and the varying length of those protections, each country's laws should be carefully considered.

#### 23.2.4 Trademarks

A trademark is any word, symbol, or device, including, for example, a sound or scent, or combinations thereof, that is used by the trademark's owner to identify the source of its product or service. By this means, consumers of the trademarked item can associate a product with a particular source and differentiate between similar products offered by different manufacturers. Trademarks are employed by many countries throughout the world, with reportedly the first trademark being used by the blacksmiths who crafted swords for the Roman Army (Richardson 2008).

In the United States, common law trademark ownership rights are obtained by use of the mark in commerce and begin on the date of first actual use. A company may also register its trademark with the United States Patent and Trademark Office to secure its trademark rights. Although federal trademark registration is not required, it is recommended because it provides nationwide rights and other key benefits. Trademark registration is also available at the state level.

In order to maintain a trademark registration in good standing, certain requirements must be followed, including (1) continuous use of the mark in commerce; (2) compliance with all maintenance obligations, including the filing of the mandatory Section 8 Affidavit of Continued Use and renewal filings; and (3) policing the mark for unauthorized uses and to prevent the mark from becoming generic. If the trademark owner fails to fulfill any of these requirements, the owner is at risk of losing its trademark rights. For example, Aspirin is an example of a registered trademark that lost its protected status because the owner of that mark failed to *police* the indiscriminate and unauthorized use of that mark in advertisements by other companies, such as competitors, and therefore a federal court found it to be generic. In contrast, other companies, such as Clorox and Coca-Cola, actively police and stop others' improper use of their marks, thereby ensuring that their trade names do not become generic terms for bleach or cola, respectively (which would result in the forfeiture of those trade names).

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## 23.3 How IP Rights Impact Product Development

Among the myriad issues a company beginning the product development cycle must address is how its intellectual property rights may help and/or hinder that development cycle. This section discusses, on a very high level, how intellectual property rights impact the product development process. More specifically, this section uses the Stage-Gate® Model as a backdrop for that discussion and explains how to deal with IP's impact on the product development cycle.® Although the discussion in this section focuses primarily on patent rights, it is applicable to other intellectual property rights, such as copyrights and trademarks, because the development and marketing of a single product could easily infringe more than just patent rights.

The Stage-Gate® Model of new product development is a very helpful backdrop for this discussion because it highlights the real-life considerations that come into play when researching, developing, and marketing a new product. For example, valuable company resources are expended researching and developing the “New Product” for “Your Company.” But the manufacture and sale of Your Company's New Product might result not only in the infringement of another company's patent rights, copyrights, or trademark rights, but also in the loss of Your Company's ability to obtain its own intellectual property rights. Such a scenario could occur when Your Company failed to recognize that a patent belonging to “Your Competitor, Inc.” existed and that Your Competitor Inc.'s patent covered the New Product about to be launched by Your Company. Moreover, the trademark that Your Company planned to use on its about-to-be-launched product was already owned by “Your Other Competitor, Inc.”

At this point Your Company's management has many options, but none of them is palatable. First, Your Company could choose to go forward with its product release and risk being sued for both patent and trademark infringement. If Your Company loses that litigation, the court could issue an injunction that forbids any future sales in the United States of the newly developed product. Second, Your Company could seek a license to both the patent and the trademark rights. But if the owners of those IP rights are truly competitors, there is little to no motivation for them to authorize their competitor (Your Company) to enter their market. Even if a license could be executed, it would probably exact a much larger royalty than if Your Company had sought a license earlier in the development process because the owner of the relevant rights would be well aware of the costly investment already made by Your Company. Third, Your Company could

seek to redesign the product and the trademark so that they no longer infringe, but such a process would likely be very expensive, as the product development process would need to jump from Stage 4 of the Stage-Gate® Model back to Stage 2, and then repeat Stages 2–4 again.

Obviously, the best choice would be for Your Company to conduct a legal review early enough in the product development process that it not only allows for the identification of preexisting intellectual property, but also allows Your Company to deal with the problems that intellectual property presents in a rational and cost-effective manner.

### **23.3.1 Identifying and Screening the Invention for Potential Value**

Stage 1 and Gate 1 can be characterized as comprising the Invention Screening Committee. The function of an Invention Screening Committee is exactly as its title suggests. At Gate 1, the Committee reviews all the inventions collected at Stage 1 in order to screen out the inventions that offer little promise of value while simultaneously passing the promising ideas through the screening process to Stage 2. At Stage 2, Your Company preliminarily assesses the technical potential of each invention as well as its market appeal. At Gate 2, Your Company performs a business case assessment of each invention allowed to pass through Gate 1. This assessment essentially evaluates whether the invention can offer true value to Your Company's business. If the answer is no, then the idea can be dropped. But if the answer is yes, then Your Company performs a legal analysis of whether the idea is worth protecting. This analysis is best performed by seasoned intellectual property attorneys. Depending on the size of the company and its available resources, the Stage 2 and Gate 2 assessment could be performed by the Invention Screening Committee, or it could be performed by a business division of Your Company that better understands the marketplace.

### **23.3.2 Evaluating Whether the Idea Can Be Protected and Protecting It**

The first step in conducting the legal analysis of whether Your Company's Product can be legally protected is to forward an invention disclosure (e.g., a form containing a description of the invention being considered for development) to a patent attorney. This patent attorney may be either an in-house intellectual property counsel at Your Company or an outside intellectual property counsel. A Stage 2 and Gate 2 assessment could also be performed by an informal IP Committee within Your Company that has previously met with intellectual property attorneys and learned how to spot potentially patentable inventions, although this method is not

preferred for obvious reasons. Regardless of what entity performs this assessment, the sole purpose of that assessment is to decide whether the invention might potentially qualify for intellectual property protection. For example, the patent attorney could perform a “prior art” search to determine if there is a prior publication that discloses the same invention as the one Your Company is interested in. If so, the newly identified invention will likely not qualify for patent protection because (1) it is not novel (i.e., another person already invented the exact same invention) or (2) it is obvious in light of the prior art. An early determination that Your Company’s New Product lacks novelty or is obvious, while disappointing, allows Your Company to avoid expending the resources it otherwise would have spent on drafting and seeking allowance of the corresponding patent.

But if the patent attorney determines that Your Company’s New Product might qualify for intellectual property protection, the intellectual property counsel will direct Your Company to put in place safeguards to help avert a loss of intellectual property rights. For example, beginning on March 16, 2013, the United States will award patents on a first to file basis rather than the previous first to invent standard. Thus, the patent application process must begin sooner in time than previously contemplated. Moreover, if Your Company were to put the newly identified invention on public display at a trade show, without having already filed a patent application, Your Company not only may have voided any hope of obtaining patent rights in most foreign countries, but it has also now started the *one-year grace period* for filing a patent application in the United States. More specifically, foreign countries require absolute novelty when filing a patent application. Therefore, if the invention was shown to the public without an obligation of secrecy, a foreign patent will likely never be granted for that invention. By comparison, the United States allows a one-year grace period from the date of the *public use* or *offer for sale* or *publication* of the invention until the inventor files the corresponding patent application. This situation can arise in Stage 2, Stage 3 or even Stage 4 of the Stage-Gate® Model. Public disclosure of the invention could likely void any trade secrets as well.

The situations presented above are only examples, as it is impossible to describe in this chapter all the potential traps that may cause the loss of intellectual property rights or all the necessary safeguards that need to be put in place at this point in the product development cycle in order to protect Your Company from voiding its patent rights. Thus, a company should not rely on this chapter as providing legal advice, but should seek competent legal advice from a qualified intellectual property attorney.

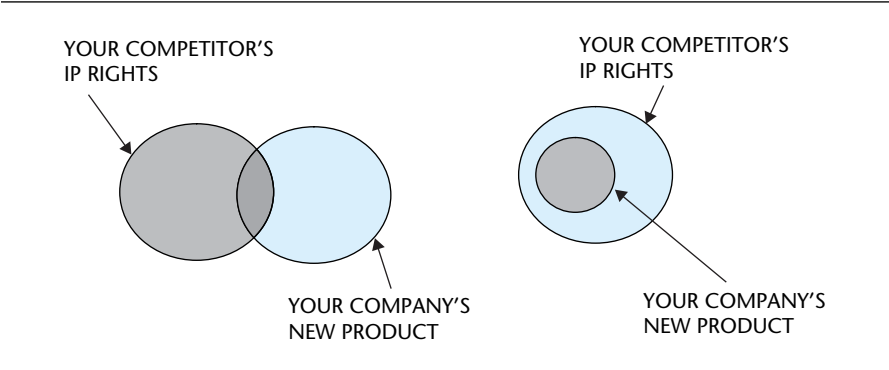
### 23.3.3 Determining Whether You Can Avoid the Intellectual Property of Others

After the invention has been found to be potentially patentable, and sufficient protections have been enacted to protect against voiding those patent rights, the next step in the legal clearance process is the *clearance review*. Although any type of intellectual property could conceivably be used for this discussion, the most relevant type of intellectual property to focus on is a patent. In particular, a patent attorney performing a clearance review will conduct a patent search to determine whether other parties have already invented and patented aspects of your invention. Patents, as discussed above, provide the owner with the right to exclude others from using the invention and are typically awarded for improvements to preexisting technology. Thus, the clearance review is an important step because it determines whether the intellectual property rights of another are blocking the future release of Your Company's currently undeveloped product and whether those blocking rights can be ameliorated.

In particular, the patent attorney performing the clearance review will focus on the claims of the patent. More specifically, the claims of a patent set out the *metes and bounds* (i.e., the boundaries) of the inventor's intellectual property rights. The claims of a patent are analogous to the deed employed in real estate (or real property) to determine the boundaries of that real property. And as shown in Figure 23.1 on the right, if Your Competitor owns an underlying patent that covers Your Company's New Product, Your Competitor can possibly exclude Your Company from making, using, selling, offering to sell, or importing its New Product. Conversely, if Your Competitor's patent rights only slightly overlap Your Company's New Product (as shown in Figure 23.1 on the left), then Your Company's New Product might be free of any conflicting patent rights and thus is legally cleared for release.

Such an analysis should be performed only by a patent attorney for many reasons. One of the primary reasons for retaining a qualified patent attorney is that this attorney is specifically trained to offer such an opinion. By comparison, an engineer employed by Your Company lacks the years of experience necessary to provide an accurate assessment of infringement or validity. Instead, the only value of an analysis performed by Your Company's engineer will be to the patent holder, because that engineer will likely create a damaging trail of evidence that could come back to haunt Your Company at a future patent infringement trial. This is especially true when the employee's opinion may have been incorrect (due to their lack of legal training). Moreover, if Your

**FIGURE 23.1 THE BOUNDARIES OF INTELLECTUAL PROPERTY RIGHTS.**



Company retains a patent attorney to provide his or her opinion, all communications regarding that opinion are privileged, and thus are at least initially protected from disclosure to Your Competitor.

If the patent attorney determines that blocking patent rights exist, then the clearance review can help determine whether the new Product can and should be redesigned to avoid the claims of the patent at issue. This may entail a very simple tweak of the invention, or it could involve a highly complex restructuring (known as a *design around*). If a design around of the patent is possible, then the entire product development process needs to return to Stage 2 of the Stage-Gate® Model. Doing so will allow the development team and legal counsel to repeat the preliminary marketing and technical assessments so as to determine whether the redesigned invention still possesses the same marketing appeal and technical capability as the original version.

If the invention cannot be redesigned so as to avoid the patent at issue, the clearance review process should investigate whether the patent at issue can be licensed. Licensing the patent removes the possibility that Your Company will be sued for patent infringement in the future, thereby eliminating the legal obstacle to launch. Moreover, seeking a license earlier in the process will help ensure that a better business decision can be made as to whether the ultimate product can bear the added cost of paying a royalty and remain profitable. Thus, if the patent owner agrees to license the patent at issue for a reasonable royalty, the legal analysis ends, and the intellectual property review process can continue the normal Stage- Gate® Model, picking up at Stage 3 and flowing to Gate 4.

If a license cannot be obtained, the next step is for Your Company and its legal counsel to evaluate whether the patent at issue can be invalidated.



An invalidity study involves a very complex comparison of the claims of the patent at issue with known prior art, and a careful determination of whether that prior art discloses the invention claimed in the patent at issue, or renders it obvious. Because of its complexity, an invalidity analysis should be prepared only by a patent attorney.

There are several ways to proceed once the validity determination has been made. For example, if the patent's validity can reasonably be called into question, the company could petition the U.S. Patent Office to *reexamine* that patent. The decision about whether to proceed with the reexamination process must be considered very carefully. While reexamination may result in the Patent Office's invalidating the patent at issue, it could also result in the patent claims emerging from the reexamination process without amendment, and thus more difficult to attack on invalidity grounds in future proceedings (e.g., at trial). Alternatively, Your Company could choose to obtain an opinion of counsel as to the patent's validity. Either process is expensive, and each has its benefits and disadvantages. If there are grounds for a patent attorney to opine that the patent at issue is invalid, then the clearance review process can end, and the product development process resumes at Stage 3 of the Stage-Gate® Model. But if the competent legal counsel is of the opinion that the patent cannot be invalidated, then the management of Your Company should meet with its legal counsel to decide how best to proceed next.

#### 23.3.4 Moving Toward and Enacting Product Launch

After the clearance review process ends, the product launch process will continue with development and testing of the potential product that was initially identified in Stage 1. Such product development and testing will determine whether the product possesses the qualities needed to be successful in the marketplace. Again, this stage is fraught with peril if the protections discussed above have not been enacted so as to protect against an inadvertent waiver of patent or trade secret rights. If Your Company decides at Gate 3 that the product should be launched, it will do so according to the normal course of following Stage 4 and possibly Gate 4.

It is worth reiterating, however, that unless all of the legal reviews discussed above have been conducted fully and competently, there is the real possibility that all the effort expended from Gate 2 through Gate 4 will be wasted because (1) conflicting intellectual property rights may block the new invention's release in the form of a new product or (2) a judge may order Your Company to stop selling the New Product because she finds

that Your Company's New Product infringes Your Competitor's patent rights, trade secret rights, copyrights, or trademark rights.

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## 23.4 The Patent Application Process

An invention may be identified in Stage 1 as potentially bringing real value to the company. Such value might arise in the future because the invention may (1) present an opportunity for the company to establish a beachhead in a competitive marketplace or (2) lead to revenue generation for the company. In such an instance, the employees who perform the business case evaluation at Gate 2 will likely recommend that the invention be protected by a patent.

The Patent Reform Act of 2011 made many changes to U.S. law that companies and inventors need to be aware of and understand. The most significant of these changes is that, beginning on March 16, 2013, the United States will no longer award patents based on the prior *first to invent* law, but will instead apply the new *first to file* law. Thus, absent any prior public disclosure of the claimed invention, the applicant who first files a patent application will be the one eligible to be awarded a patent for that invention, even if the first person to actually invent the invention files a subsequent patent application. The Patent Reform Act makes many other changes to the U.S. patent law; thus, any entity seeking advice regarding intellectual property should work with competent patent counsel to guide them through the new law, especially when seeking a patent.

The patent process typically involves the inventor speaking with patent counsel or a patent agent and describing his or her invention in sufficient detail that a patent application may be drawn up. To facilitate the patent-drafting exercise, the applicant might consider conducting a prior art search so as to determine whether any prior art exists that might affect the patentability and/or scope of his or her invention. A typical U.S. patent application will consist of (1) a written description of the invention (called the *specification*), (2) drawings that aid in understanding the invention, and (3) one or more claims. Importantly, the claims should be drafted to be not only as broad as possible, so as to ensure that the inventor obtains the full scope of the invention as described by the specification and illustrated by the drawings, but should also be drafted narrowly so as to cover any and all aspects the applicant deems central to the invention. The specification, drawings, and claims should also cover alternative embodiments if applicable, as discussed in greater detail below.

In a typical application filing, the applicant will initially file his or her application in the patent office of the applicant's home country. If the applicant wishes to obtain foreign protection, then within one year of the initial application, the applicant will need to file the application either directly in the patent office of that corresponding foreign country or countries or in the form of an international application via a Patent Cooperation Treaty (PCT) filing.

When the patent application is filed, the claims will typically include several types of claims that recite differing embodiments. For example, an initial set of claims might specify (1) a device, (2) the chemical formula for the solution used in that device, and (3) a method for making the device containing that solution. Each of these sets of claims pertains to a separate *species*. In the United States, the Patent Office will typically issue a *restriction requirement* that directs the inventor to select or *elect* the set of claims pertaining to a single species for further prosecution. The remaining claims are *restricted out*, and their examination by the Patent Office is delayed until either prosecution of the claims for the elected species is complete or at the appropriate time.

Focusing only on the U.S. filing, the U.S. Patent and Trademark Office (PTO; <http://www.uspto.gov/>) will also assign each submitted patent application to a patent Examiner. The Examiner is a person who is very skilled in the *art* or technology relevant to the invention. Upon receiving the newly filed patent application, the Examiner will review the specification and drawings for potential flaws or deficiencies, and study the claims to understand the metes and bounds of what the inventor(s) believes to be their invention.

The Examiner then compares the scope or boundaries of the claims to other patents and publications in that same art that could potentially have already captured the invention for which a patent is being sought. Such prior existing patents and publications are commonly referred to as *prior art*. If the Examiner determines that the prior art discloses the invention as recited in the pending claims, the Examiner will reject those pending claims as not being patentable. The Examiner records his or her rejections, along with the any other objections to the claims, specification or drawings in the pending application, in to an *Office Action*. The Patent Office then mails that Office Action to the applicant or to his or her patent counsel. The inventor(s) then will work with their patent counsel to first review the content of the Office Action and then draft a response to that Office Action. The response will (1) state that the grounds for the objections and/or rejection were incorrect and explain why; or (2) correct the aspects

of the application that the Examiner objected to and narrow the scope of the claims so as to remove the basis for the Examiner's rejection; or (3) do some combination of both. This back-and-forth process typically occurs more than a few times and will end with any number of outcomes, including (1) a patent issuing that contains any number of allowed claims; (2) no patent issuing because the Examiner refused to drop the rejections of all the pending claims; or (3) some combination of allowed and rejected claims. Should the patent applicant choose, he or she can always appeal the rejections or continue prosecution by filing related applications, such as a *continuation* application or a *continuation-in-part* application.

If the Examiner does find that certain claims are patentable, the Examiner will issue a Notice of Allowance, which may include the Examiner's explanation as to why certain claims were allowed to issue. Shortly after the Notice of Allowance is issued, the inventor typically pays the issue fee, and the patent will ultimately issue. If the inventor previously received a restriction requirement, however, the inventor must file a divisional application in order to prosecute the claims that were previously restricted out.

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## 23.5 Ownership of Intellectual Property and Joint Ventures

Ownership of intellectual property is strongly fact dependent and should never be dealt with in a cursory manner. For example, even though Your Company paid a contractor to develop software for Your Company's use, and that contractor used Your Company's resources and computers, unless the proper precautions were put in place, that contractor could very well own all intellectual property associated with that software.

In order to ensure that ownership of their employees' and consultants' work product is assigned to the hiring entity, corporations typically have assignment clauses in their employment and consultant contracts that (1) specify that all inventions or copyrightable works made by the employee or consultant (typically restricted to those made on company time) are the property of the corporation and (2) require that the employee assign all intellectual property rights flowing from those inventions or works to the employer and cooperate with the employer during any prosecution of the intellectual property rights in question.

This situation is especially important to address when two or more entities enter into a joint development situation. Assume, for example, that Entity A and Entity B begin working on a joint project without any

intellectual property agreement in place. Entity A contributes its know-how (which is covered by several already issued patents) to the joint development effort, while Entity B contributes resources in the form of funding and equipment. As a result of their joint research efforts, they develop and patent a new invention. But the ultimately issued patent only names employees of Entity A as the inventors. In the absence of any agreement to share their jointly developed technology, Entity B could be barred from practicing the very inventions (i.e., making, using, selling, offering to sell, or importing products containing the inventions) that it paid to develop during the joint venture.

Accordingly, it is always best if the parties, prior to beginning work on any joint development effort, enter into an agreement that covers all possible contingencies that may arise during or after the end of that joint development effort. For example, the joint development agreement could identify (1) the intellectual property each entity is contributing to the joint development effort; (2) the rights each entity will have to practice that underlying intellectual property after the completion of the effort; (3) the rights each entity will have to any intellectual property arising during the course of the joint development effort; (4) which entity will be responsible for seeking protection for that intellectual property; and (5) whether either entity can license the resulting intellectual property to a third party without the permission of the other entity.

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## 23.6 The Trade-off between Trade Secrets and Patent Rights

Even though a company determines at Gate 2 that an idea possesses business value, this does not necessarily mean that the company should apply for a patent for that invention. Instead, the company should consider whether a patent or trade secret offers the best form of intellectual property protection under the circumstances. One consideration is whether the technology is in such a fast-changing marketplace that it will become obsolete within two or three years. If so, then it may not be worth the cost of pursuing a patent, and maintaining the invention as a trade secret might suffice. On the other hand, if the new technology can be easily reverse engineered, then a patent is the best source of protection, especially if the technology is likely to be valuable in the marketplace. Given that the value of these options will be determined by the specific facts of the case, these options should be carefully weighed in consultation with a qualified intellectual property attorney.

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## 23.7 Summary

This chapter briefly introduced many complex ideas, none of which was treated in an exhaustive manner. In fact, entire legal textbooks, treatises, and law review articles have been written on every topic and issue presented here. The practical application of these ideas, as well as the merits of different approaches, depends entirely on the unique circumstances of each particular case. Accordingly, the reader should not rely on any statement made herein as authoritative or as providing legal advice. Instead, the reader should take from this chapter only general guidance on how and when to seek proper legal advice.

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## Reference

Richardson, Gary (2008). *Brand Names Before The Industrial Revolution*, National Bureau of Economic Research, Working Paper No. 13930, April 2008.

**Rel S. Ambrozy** is a partner with McKenna Long & Aldridge. Mr. Ambrozy holds a Bachelor of Science in Biology-Mathematics from Wake Forest University, a Master of Science in Biomedical Engineering from the University of Miami, and a Juris Doctor from Catholic University's Columbus School of Law. Prior to attending law school, Mr. Ambrozy researched and developed hardware and software components for heart pacemakers systems, and he wrote software for the Strategic Defense Initiative Organization (SDIO), also known as the Star Wars Program. Mr. Ambrozy has counseled clients in all aspects of obtaining, enforcing, and licensing their intellectual property. Mr. Ambrozy has also employed the lessons learned during his years of private practice in founding several technology-based start-up companies. Mr. Ambrozy is a named inventor on several U.S. Patents.



## SECTION FIVE

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# PDMA RESEARCH

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*All truths are easy to understand once they are discovered; the point is to discover them.*

GALILEO GALILEI (1564–1642), ITALIAN PHYSICIST,  
MATHEMATICIAN, ASTRONOMER, AND PHILOSOPHER







## CHAPTER TWENTY-FOUR

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# LESSONS LEARNED FROM OUTSTANDING CORPORATE INNOVATORS

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Sally Evans Kay, Douglas Boike, Wayne Fisher, Thomas Hustad, Stan Jankowski, Deborah A. Mills, Barry J. Novotny, Albert Page, and William M. Riggs

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### 24.1 Introduction

Lessons learned from proven successful practitioner companies often provide very effective techniques for companies facing challenges in improving their new product/service development performance. For the past 24 years, PD-MA's Outstanding Corporate Innovator (OCI) Award has recognized companies that have demonstrated sustained quantifiable innovation success and the winners have provided a valuable set of "lessons learned." The objective of this chapter is to take "a look under the hood" of the 44 OCI winners to identify the practices and processes that have contributed to their success.

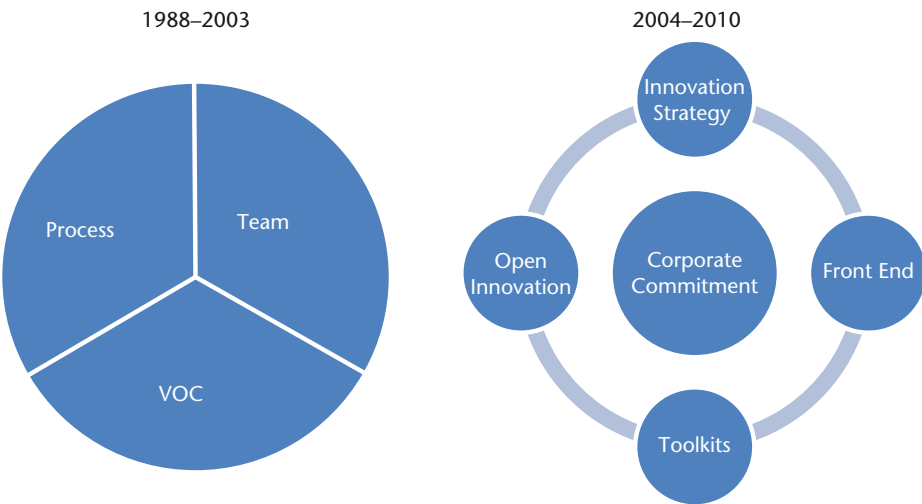
The chapter will summarize key lessons learned and provide real-life case studies of these leading innovators.

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### 24.2 Overview

Two retrospective reviews of OCI winners conducted in 2003 and 2010 captured significant lessons learned about the practices and processes that contributed to their success. These reviews also showed the important changes in innovation best practices over time. Comparing the lessons

FIGURE 24.1 OCI BEST PRACTICES



learned from OCI winners in the 1988–2003 period to those in the 2004–2010 period, it is clear that innovation best practices are not stagnant and that to be successful, companies must adapt their practices to changing global trends and market conditions. Figure 24.1 provides an overview of the changes observed in innovation best practices.

One of the most significant changes observed was that for the most recent OCI winners, innovation has become *the* corporate strategy and is critical to corporate business performance and success. Innovation has also increased in complexity, as evidenced by the proliferation of toolkits, the need for extensive knowledge at the front end, and the increasing role of external collaboration throughout the innovation process.

*For the most recent OCI winners, innovation has become the corporate strategy and is critical to corporate business performance and success.*

24.3 Introduction to the OCI Award

PDMA initiated its OCI Award in 1988. Each year the OCI Committee uses a rigorous process to screen and evaluate the nominees for the award using the following criteria:

- A sustained record of success in launching new products over a five-year period
- Significant and quantifiable business results delivered by new products
- Consistent use of a set of teachable new product development practices
- Distinctive innovative organizational characteristics and intangibles

Through 2011, 44 companies have been selected as award winners. They are shown in Table 24.1.

Each year the OCI winners are presented their awards at a special session at PDMA's Annual Global Conference. At the conference the winners also give a keynote presentation that highlights their practices and processes and the impact their product development efforts have had on their business.

**TABLE 24.1 OCI WINNERS**

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**Past Outstanding Corporate Innovator Award Winners**

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1988–Merck & Company	1999–Maytag
1989–Hewlett Packard	2000–EXFO Electro Optical –Rockwell Collins Inc.
1990–Advanced Cardiovascular Systems, Ltd. –Harris Corporation, Broadcast Division –New Pig Corporation	2001–Windows Fashions Division Hunter Douglas
1991–Safety Kleen Corporation	2002–BMW Group –Tecknion Inc.
1992–Keithley Corporation –Marriott Lodging Group	2003–Harley Davidson –Dow Chemical Co. Polymers & Elastomers Division
1993–Apple Computer –Nabisco Biscuit Company –Nordic Track	2004–Affymetrix –AFRL
1994–Bausch & Lomb, Eyewear Division –Chrysler Corporation –Welch Allyn	2005–djOrthopedics –Sprint Nextel
1995–Fluke Corporation –Pepsi-Cola Company –Senco Products, Inc.	2006–Xerox Corporation –Bank of America Global Consumer and Small Business Banking
1996–Eastman Kodak	2007–FedEx Corporation –Mine Safety Appliance (MSA) Inc.
1997–Herman Miller –3Com (US Robotics)	2008–Corning –DuPont
1998–Cincinnati Machine Tool	2009–DSM –PGi
	2010–Kennametal Inc.
	2011–Illumina, Inc. –UnitedHealth Group

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## 24.4 Common Practices of Award Winners: 1988–2003

In 2003 the OCI Committee took a look at past OCI winners. What they discovered was that despite significant diversity in industry and size, the companies displayed a number of important similarities in their approach to new product development. All of the winners had in place processes, systems, and resources that reflected the following notable best practices:

- A well-defined product development process unique to their market and technology environment
- A strong commitment to cross-functional teams as the fundamental organizational construct for executing new product development
- Strong voice of the customer input
- A robust process at the front end to drive innovation in their product portfolio
- A strong linkage of new product development to the company's corporate strategy, thus ensuring top management commitment

The OCI Committee also concluded that while a clear set of common practices could be defined across the population of past award winners, the implementation detail of the common practices varied across the group, driven by their market, technology, and organizational environment. A more detailed discussion of this retrospective look can be found in Chapter 35 of the second edition of *The PDMA Handbook of New Product Development*.

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## 24.5 Common Practices of Award Winners: 2004–2010

In 2010 the OCI Committee decided to take another retrospective look at the practices that appeared to differentiate the more recent OCI winners. In a period characterized by economic turbulence, resource reduction, globalization, and the digital explosion, the common practices of the winners in the 2004–2010 time frame emerged as quite different from those identified in the earlier analysis. The best practices observed in the more recent winners were:

- Corporate strategic commitment to innovation
- Innovation strategy as a critical driver of business performance
- Innovation driving corporate transformation/survival

- Open innovation/collaborative development
- Intense focus on the front end

While not all of these were new practices, they did appear to be more prevalent and better defined than in the previous period and now appear to differentiate the winners from the rest.

### 24.5.1 Corporate Strategic Commitment to Innovation

For the winners in the 2004–2010 time frame, innovation has become a corporate strategic core value. The commitment to innovation is reflected in the following practices:

- Senior management involvement
- Dedicated cross-functional resources
- Career paths in innovation
- Innovation process owners to ensure best practices
- Continuous improvement in innovation practices
- Venturing

These companies have also put in place well-defined metrics to measure their innovation success. They have developed cultures that are comfortable with managing risk and are not afraid to fail. Figure 24.2 depicts the commitment of DSM, a 2009 OCI winner, to innovation

In 2005 DSM made a strategic decision to transform their portfolio and to exit some of their current businesses and build a new corporate strategy founded on innovation in broad global opportunity (magnet) areas identified via analysis of global megatrends. The company also made the decision to commit to open innovation as a fundamental corporate strategy and a source of competitive advantage. To support this commitment, DSM put together a market-driven innovation organization, processes, and culture. The statement “Innovation is in our genes” reflects the total corporate commitment to innovation.

The 2010 OCI winner Kennametal Inc. is another recent winner that has demonstrated an impressive corporate commitment to innovation. During turbulent economic times, Kennametal used its commitment to innovation to provide unique customer solutions and to gain a competitive advantage. Key to the company’s success was the establishment of an innovation strategy to introduce new products at a market-leading pace and to be a breakaway company in their industry. How Kennametal became a breakaway company is depicted in Figures 24.3 and 24.4.

FIGURE 24.2 DSM INNOVATION STRATEGY



Within its corporate strategy, DSM committed itself in 2005 to a number of ambitious innovation objectives, of which an additional €1 billions sales derived from innovation by 2010 was one of the most tengible ones.

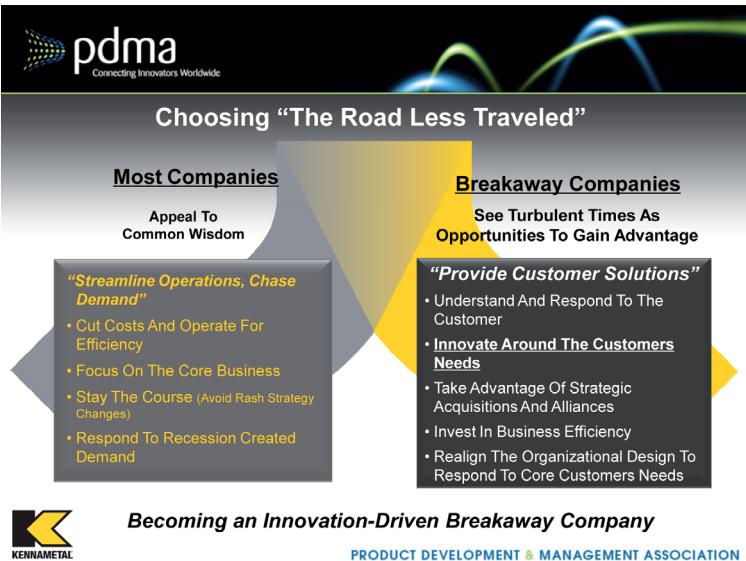
FIGURE 24.3 CREATING A BREAKAWAY COMPANY



Opportunity to Reinvent Ourselves with Innovation Focus

Used with permission from R. Gulati/HBS.

**FIGURE 24.4 BECOMING AN INNOVATION-DRIVEN COMPANY**



Used with permission from R. Gulati/HBS.

### 24.5.2 Innovation Strategy Is the Critical Driver

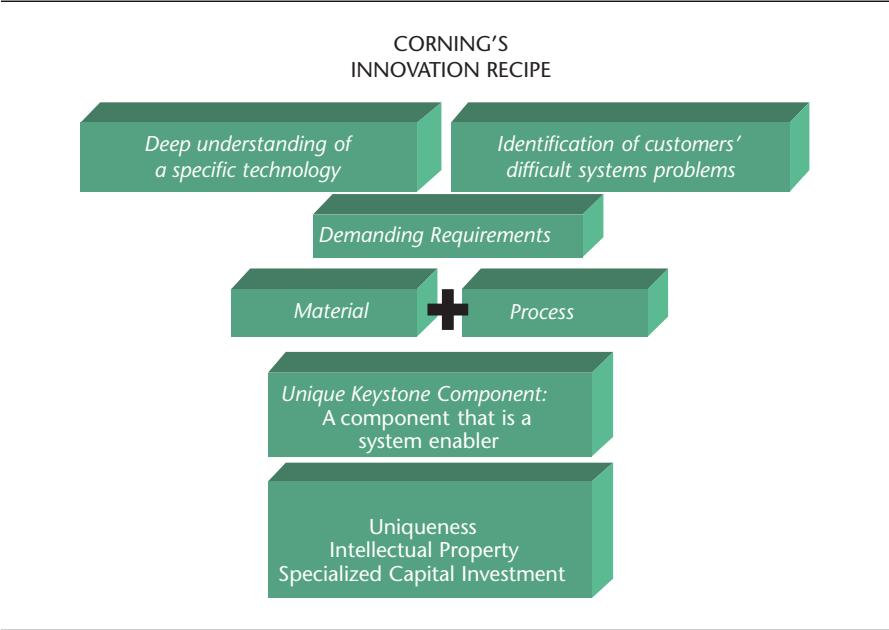
In the analysis of the 1988–2003 winners, the OCI Committee noted that linking specific goals and objectives for innovation to the corporate strategy was critical to success. In the more recent analysis, it was observed that all of the winners had a well-articulated innovation strategy that drove all innovation efforts and was understood by all those involved in innovation in the corporation. The innovation strategy provides focus and platforms for product development and drives resource allocation.

A 2008 winner, Corning, has one of the best examples of an innovation strategy (Figure 24.5).

As a major supplier of optical fiber to the telecom industry, Corning saw their business decline significantly during the collapse of the telecom market in 2002. They then assessed their current portfolio and decided that they needed to diversify and have a well-defined plan for growth in the future. The Innovation Recipe that was created at that time has provided strong direction for new product and new business development efforts and has contributed to the company’s success.

The innovation strategies of recent OCI winners are quite diverse, but each reflects the company’s core competencies, market environment, and

FIGURE 24.5 INNOVATION STRATEGY



competitive situation. The strategies define where the companies will play and how they will win.

24.5.3 Innovation Driving Corporate Transformation/Survival

One of the significant findings from the most recent retrospective look at OCI winners was that innovation was not just a component of the corporate strategy but instead was an essential component of corporate success and even sometimes of corporate survival. Our winners realized that cost cutting, resource reduction, and process improvement alone would not guarantee a successful future and that they needed a more intense focus on innovation for survival. These companies invested resources in developing a well-defined innovation strategy (see Section 24.5.2) and disciplined innovation processes and practices in order to establish a long-term leadership role in their industries. They discovered that incremental innovation was not sufficient to ensure future growth and success, and they turned their focus to disruptive/breakthrough innovations.

Part of the transformation that was observed in many companies was that innovation involved having both a market and a technology focus



TABLE 24.2 INNOVATION CULTURE

To Be:	But Also:
Close to the business	Close to the leading edge of science
Using the world’s creativity	Generating critical knowledge internally
Disciplined and focused	Creative & freewheeling
Staffed by the best people	Free of prima donnas
Insuring the present	Inventing the future

from the beginning of the process. No longer was it sufficient to have just a great idea or great technology.

One of the companies that best depicts innovation driving transformation and survival is Xerox. In October 2000 the company announced that its business model was unsustainable. Double-digit revenue declines, slipping margins, too-high expenses, competition in core markets, and delayed product launches had all contributed to the deterioration. One of the key factors in the turnaround that was initiated that year was the decision to “identify opportunities for growth and *innovate*.” By 2005, 95 percent of Xerox’s products were new and the company had the strongest portfolio in the industry.

A critical contributor to Xerox’s transformation was the creation of a culture conducive to innovation (see Table 24.2).

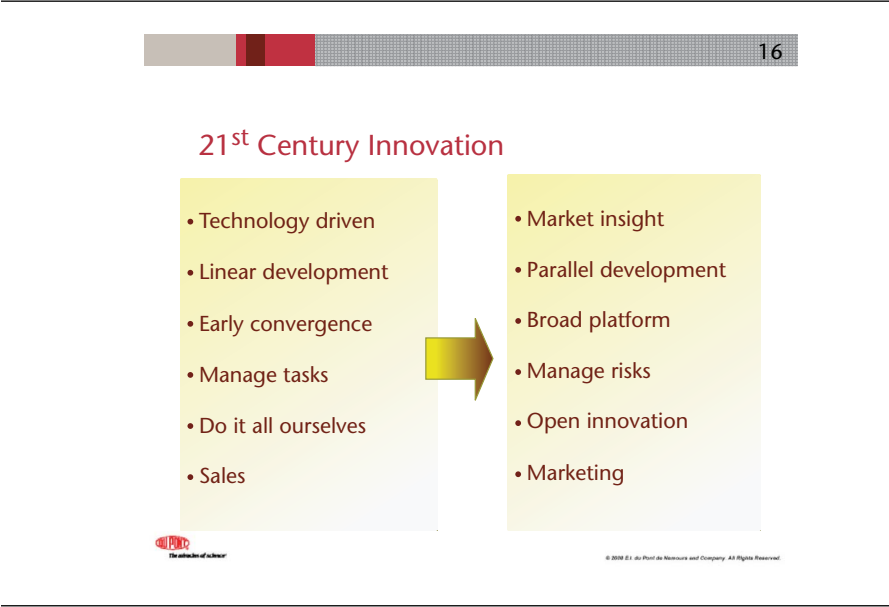
E.I. DuPont, a 2008 OCI winner, a 200-year-old company deeply rooted in science- and technology-led innovation, transformed itself into a new enterprise strongly focused on growth via market-led innovation. In the late 1990s, DuPont found that its innovation had stalled and that the company was focusing on business maintenance and cost control of current business. Management realized that its science and technology development resources had to be deployed against significant market needs in order to achieve product and business innovation renewal.

Figure 24.6 depicts the significant changes that were made in the company’s approach to innovation.

24.5.4 Open Innovation/Collaborative Development

While several OCI winners before 2004 did engage in external partnering as part of their product development efforts, for many of the 2004–2010 winners open innovation was a key corporate strategy. In this time frame we saw open innovation play a role throughout the innovation process from discovery to launch. Companies that adopted open innovation saw the value

FIGURE 24.6 TRANSFORMATION



of having access to extensive and diverse resources to enhance their product development efforts and to reduce their time to market. Companies also benefited from shared risk and reduced need for internal resources.

To be successful in external partnering, companies had to make cultural changes—perhaps the most challenging being going from a “not invented here” mindset to “proudly found elsewhere” (a phrase used by DSM, a 2009 winner) mindset. New practices and processes had to be put in place to adapt to the complexities of working with different external partners. The norm has changed from colocated teams in the 1988–2003 period to virtual teams in 2004–2010.

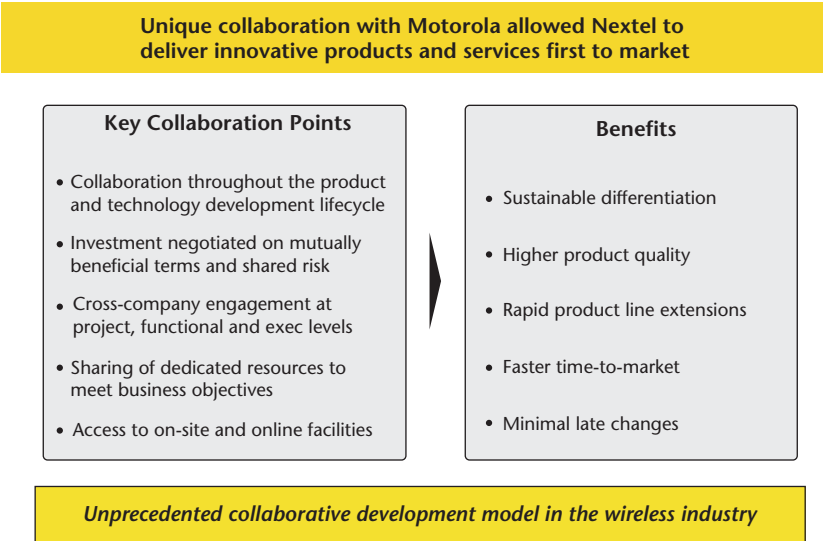
Nextel, a 2005 OCI winner, provides an excellent example of external collaboration (see Figure 24.7).

In Figure 24.8 DSM, which has an innovation model totally built around open innovation, shows how it steers its innovation pipeline using various forms of open innovation.

24.5.5 Intense Focus on the Front End

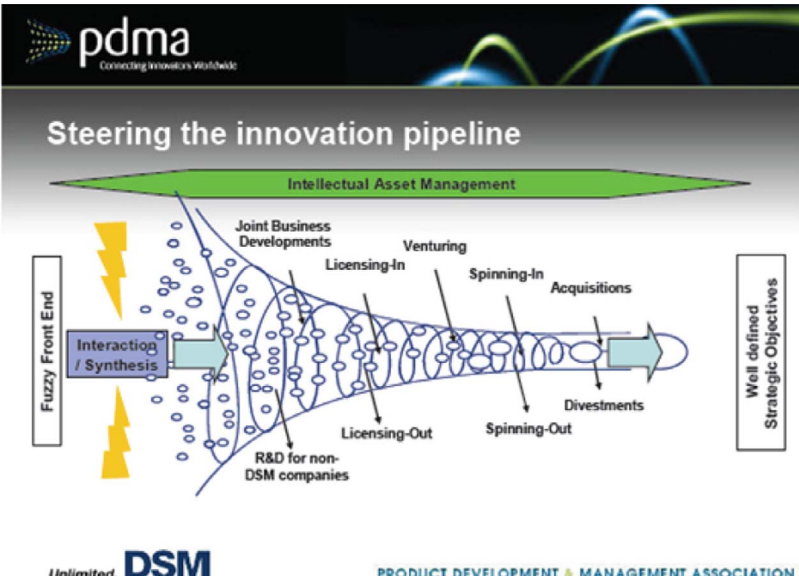
Numerous research studies have shown that the primary reason new products/opportunities fail is insufficient time and resources spent at the front end of the innovation process. The 2004–2010 OCI winners are clearly aware

FIGURE 24.7 EXTERNAL COLLABORATION



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FIGURE 24.8 OPEN INNOVATION COMMITMENT



of that reality and have made a commitment to focus on the front end to build an extensive knowledge base before moving on in the new product development process and making significant investments in development. One of the most important benefits of investing in the front end is in fact *failing fast*—not investing significant resources in products/services that either do not fit the corporate strategy or are not viable long-term opportunities.

Spending time at the front end no longer just means obtaining voice of the customer input. It involves understanding the global trends that will impact the opportunity, gaining the diverse perspectives of thought leaders, and conducting detailed competitive analyses.

One of the best examples of an exploratory process at the front end is Corning’s Magellan Process, which you can read about in Chapter 10.

Another concept of the front end that emerged in this time period was *incubators*—a safe haven for higher-risk and longer-term projects. In the incubator, additional information about the opportunity can be obtained and difficult challenges can be addressed without exposing them to intense management scrutiny.

The front end of innovation for the OCI winners is no longer owned by just marketing or technical departments but is jointly owned from the discovery phase. An example of this can be seen in Figure 24.9, which is Xerox’s depiction of their intense customer focus.

FIGURE 24.9 FRONT-END FOCUS

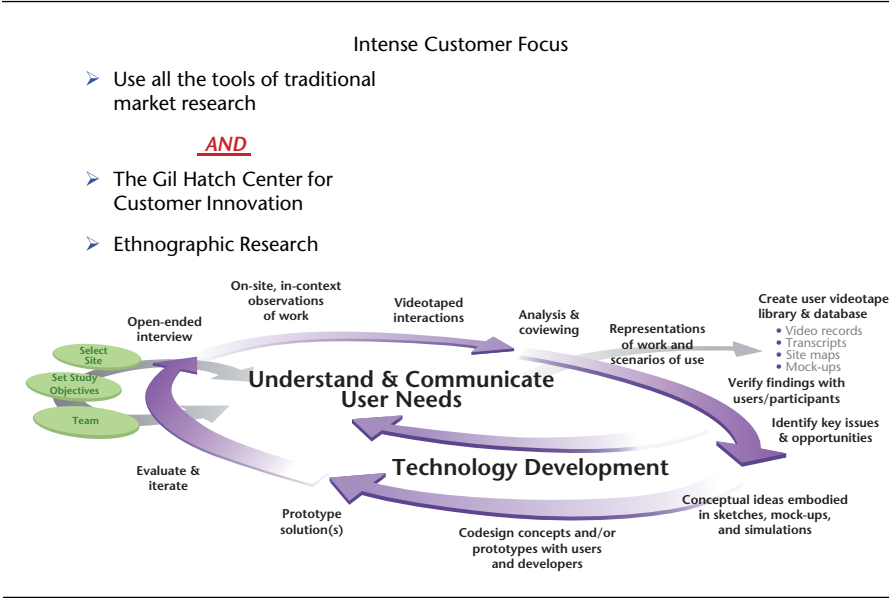
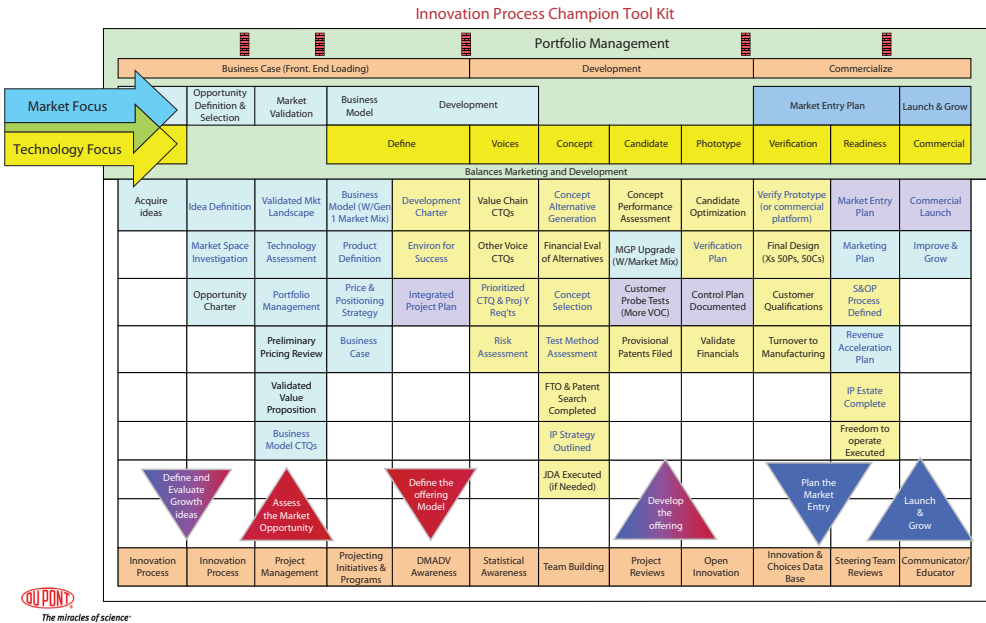


FIGURE 24.10 COMPLEX TOOLKIT



### 24.5.6 Comprehensive Toolkits

To improve their innovation effectiveness and efficiency, many of the 2004–2010 OCI winners employed comprehensive toolkits throughout the new product development process. Toolkits bring discipline, consistency, and a common language to the innovation process. The OCI winners believe that the use of the toolkits reduces risk and uncertainty. Typically, these toolkits and the innovation process are owned by a corporate innovation process function that facilitates the use of the tools and provides full-time expertise on the innovation process. The process owners also are responsible for ensuring that the tools being used are best practice/state of the art. Toolkits are available on the corporate intranet site.

Figure 24.10 is an example from DuPont of an innovation process toolkit.

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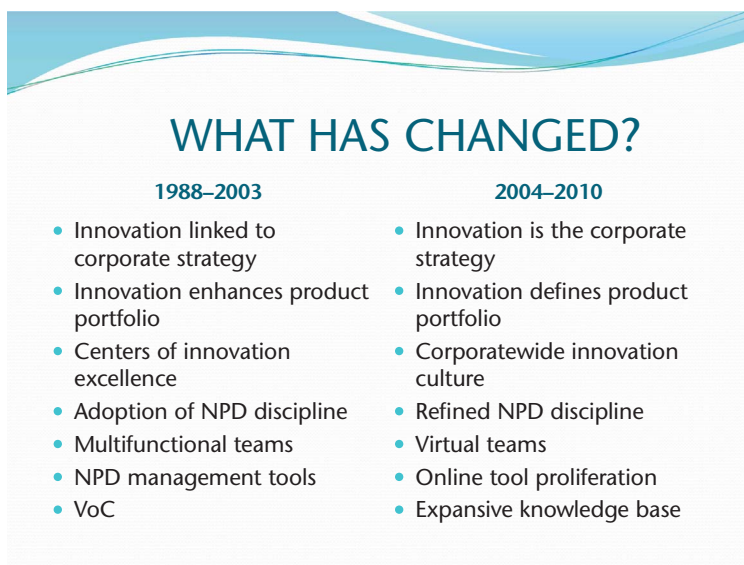
## 24.6 Summary

In summary, applying lessons learned from leading practitioner companies is often a very effective method for companies facing challenges in improving their new product/service development performance. PDMA's Outstanding Corporate Innovator Award Winners are companies which have met the award's rigorous criteria of sustained quantifiable innovation success and thus provide a valuable set of such learning experiences.

Comparing lessons learned from OCI Winners in the 1988-2003<sup>1</sup> period to lessons learned in the 2004-2010 period it is clear that innovation best practices are not stagnant and to be successful companies must adapt their practices to changing global trends and market conditions. Our review of the more recent winners has shown that they have had to adapt their practices to the economic turbulence, globalization trends and the digital explosion which have characterized this period. The key observations made by the Committee about the Winners in the 2004–2010 period include corporate commitment to innovation, innovation strategy as a critical driver, collaborative development, intense focus on the front end and for many innovation driving corporate transformation/survival. Figure 24.11 captures some of the most significant changes observed between the two periods.

<sup>1</sup>Presentations detailing the practices and processes contributing to the success of the individual OCI winners are available on the PDMA website: [www.pdma.org](http://www.pdma.org).

**FIGURE 24.11 CHANGES IN INNOVATION  
BEST PRACTICES**



**Sally Evans Kay** spent 36 years with the Dow Chemical Company and GlaxoSmithKline Consumer Healthcare. After assignments in R&D, finance, sales, and marketing, her career focused on various areas of innovation and new product development. In 2004 she started her own consulting business, Strategic Product Development, which focuses on the front end of the innovation process. Sally has been active in PDMA since 1988 both nationally and at the chapter level. She currently chairs the Outstanding Corporate Innovator Award Committee, is on the Board of Directors of the Cincinnati chapter, and is an Associate Editor of the third edition of the *PDMA Handbook of New Product Development*. Sally has a BS in Biology/Chemistry from the University of Pittsburgh.

**Douglas Boike** has been involved in the PDMA since 1990, serving as Vice President of Research for the PDMA and Treasurer of the PDMA Foundation. Recently, he served as Project Director for the Foundation's Comparative Practices Assessment Study (CPAS). Most notably, he is a past Chair of the Outstanding Corporate Innovator (OCI) Committee and has served on that committee since 1993. Dr. Boike has had a broad career in both industry and consulting. He has held senior positions at Xerox and B/E Aerospace and has held partner-level appointments at Booz & Company and Mercer Management Consulting (now Oliver Wyman). He now manages his own consulting firm, Triad Consulting, Inc. He is also the founder and Chairman of the Board of the Bank of Oak Ridge, a community bank in the Piedmont Triad region of North Carolina. He has a BA in Physics from Kalamazoo College, an MEng in Engineering Management from Rochester Institute of Technology, and a PhD in Engineering Science from Dartmouth College.

**Wayne Fisher** is a full-time creativity consultant and innovation facilitator for P&G. Wayne has created a series of popular innovation workshops focused on new product development, training thousands of managers in P&G's diverse business units and regions. These workshops and related tools provide a common language and framework for innovation, fostering collaboration across P&G's diverse business units and regions. In his current role, Wayne is a full-time creativity consultant and innovation workshop facilitator at The GYM, P&G's design studio in West Chester, Ohio. Wayne received his PhD in Chemical Engineering from the University of Massachusetts and has been granted 14 U.S. patents.

**Thomas Hustad** is Professor Emeritus of Marketing and earlier chaired the MBA program at Indiana University's Kelley School of Business. He is a Certified New Product Development Professional. He was the 1981 President of PDMA and has served on PDMA's board for most of the association's life. He is the founder and for 15 years was the Editor of the *Journal of Product Innovation Management*. He became a Crawford Fellow in 1993. He managed PDMA's headquarters from 1984 to 1996. The Nestlé-Hustad Professorship and Fellowship was created in his honor at Indiana University by Nestlé. He is listed in *Who's Who in America* and *Who's Who in the World*.



**Stan Jankowski** was formerly Corporate Director of the Global Economic Planning and Strategic Management Practices functions of the Dow Chemical Company. He founded N.O.V.A. Consulting Co. LLC in 2000, supporting new product development activities of Fortune 500 corporations. He provides new product strategy development, provides innovation skills training for product development professionals, and conducts customized new product Opportunity Assessments. Stan has been a PDMA volunteer since 1987, is a past PDMA Director, and was the OCI Committee Chairperson from 2001 to 2010. Stan holds BS and MS degrees in Chemical Engineering from the University of Pittsburgh and is a certified Planned Innovation™ Opportunity Analyst.

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## CHAPTER TWENTY-FIVE

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# THE DIFFERENCE BETWEEN GOODS AND SERVICES DEVELOPMENT: A PDMA CPAS RESEARCH STUDY

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Stephen K. Markham and Thomas Hollmann

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### 25.1 Introduction

Services development is profoundly different from goods development. Much of the product innovation literature assumes that goods and services development methods are interchangeable. The best practices research conducted by the PDMA Research Foundation reveals critical differences. These differences are striking because services projects take only half as much time to complete as goods projects and yield the same sales and profitability.

1. Services projects expend the most effort in the front and final stages of innovation, while goods projects expend the most effort in the middle.
2. Services projects are more independent of the rest of the organization than goods projects.
3. Service projects engage in more teamwork and team-development activities, while goods projects stress the use of new product development (NPD) tools.
4. Services projects emphasize skills and downplay processes, while goods projects utilize processes more often.

*The best practices research conducted by the PDMA Research Foundation reveals critical differences between goods and services development.*

25.2 The Differences between Goods and Services

There is general agreement that differences between goods and services exist and that these distinctive characteristics result in real challenges for managers (refer to Chapter 3). Table 25.1 shows these differences.

25.3 Project Details

The PDMA Best Practices study formally known as the Comparative Performance Assessment Study (CPAS) collected data from 416 companies. These comprised 231 goods development companies and 79 services development companies and 106 companies that offered both goods and services at the same level. Sixty percent of the companies were business-to-business and 40 percent developed consumer goods and services. Forty-one percent of the companies had sales below \$100M and 59 percent had sales over \$100M. Over 160 innovation practices were reported, including

TABLE 25.1 DIFFERENCES BETWEEN GOODS AND SERVICES

Goods	Services	Resulting Implications
Tangible	Intangible	Services cannot be inventoried Services cannot be easily patented Services cannot be readily displayed or communicated Pricing is difficult
Standardized	Homogeneous	Service delivery and customer satisfaction depend on employee and customer actions Service quality depends on many uncontrollable factors There is no sure knowledge that the services delivered matches what was planned or promoted
Production separate from consumption	Simultaneous production & consumption	Customers participate in and affect the transaction Customers affect each other Employees affect the service outcome Decentralization may be essential Mass production is difficult
Nonperishable	Perishable	It is difficult to synchronize supply and demand with services Services cannot be returned or resold

Source: A. Parasuraman, V.A. Zeithaml, and L.L. Berry, A conceptual model of service quality and its implications for future research, *Journal of Marketing* 49: 41–50, 1985. Used with permission.

front-end, NPD process, portfolio management, NPD organization, tools, methods, target setting, and NPD results practices.

## 25.4 Results from the Study

First, comparisons are made between goods and services for mortality, development time, and performance. Finally, specific development practices are compared.

*Mortality.* The first analysis compared the mortality curves for goods and services. Much to our surprise, goods and services projects survived between stages of development at the same rate, as shown in Figure 25.1.

*Development Time.* The development times for radical, innovative, and incremental service projects were consistently half those of goods development. Table 25.2 shows that while radical goods innovations took 122 weeks, radical services innovations took only 61 weeks to develop. More innovative goods took 71 weeks to develop, while services took only 36 weeks. Incremental goods took 33 weeks and services only 18. It is also interesting to note that companies develop almost three times as many goods as services.

**FIGURE 25.1 MORTALITY CURVE FOR GOODS AND SERVICES**

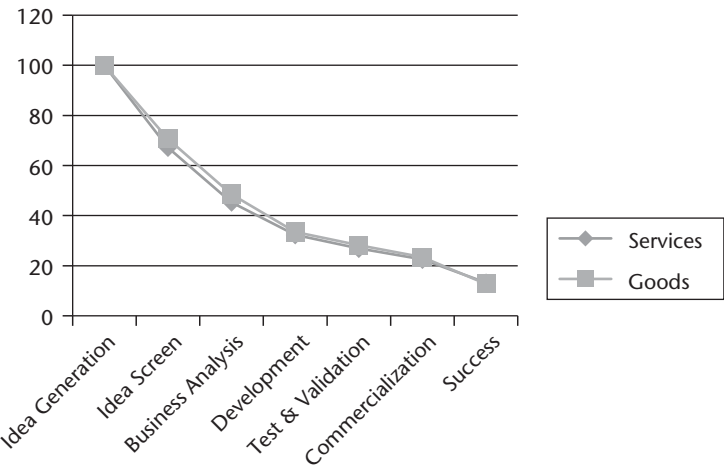


TABLE 25.2 SERVICES AND GOODS DEVELOPMENT TIMES

Outcome Measure	Goods	Services	Statistically Different?
Number of new products commercialized per year	8.79	3.00	Yes
Development time for radical innovations	122.48 weeks	54.61 weeks	Yes
Development time for more innovative offerings (new line/major revision)	71.08 weeks	36.10 weeks	Yes
Development time for incremental innovations	33.31 weeks	18.26 weeks	Yes

TABLE 25.3 SERVICES AND GOODS PERFORMANCE AND SATISFACTION

Outcome Measure	Goods	Services	Statistically Different?
Percent of sales from new products	25.74	31.63	No
Percent of profits from new products	26.45	29.05	No
Percent feeling successful	58.78	54.39	No
Percent feeling profitable	52.94	51.69	No

*Performance.* Although performance times differed, performance was similar. Both sales and performance tended to be higher for services. Subjective measures of success and profitability were lower for services (see Table 25.3). Sales from new products was 26 percent for goods companies and 32 percent for services companies. Profits from new products for goods companies were 26 percent, and those for services were 29 percent. On the other hand, respondents indicated a stronger feeling of success in developing goods (59 percent) than developing services (54 percent). Respondents also felt that goods projects were more profitable (53 percent) than services projects (52 percent), although none of these differences were statistically significant.

25.5 Goods and Services Practice Differences

We can see how goods and services development differ in development time and performance, but how does the actual practice of goods and services development differ? Of the 160 practices reported on in the survey,

**TABLE 25.4 SERVICES AND GOODS INDICES.**

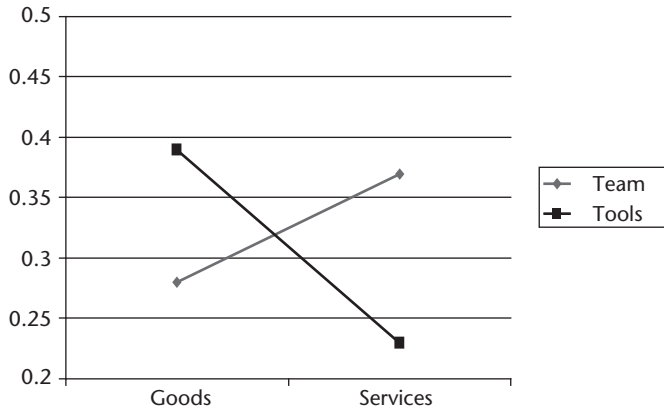
Indices (No. of Items)	Services	Goods	Comparison of Service Companies to Goods Companies	Stage of Development
Tools (15)	0.23	0.39	Less tools	Development
Teams (5)	0.37	0.28	More teams	Front end
Support (3)	0.50	0.62	Less supported	Development
Separate (4)	0.35	0.24	More separate	Front end
Process (17)	0.41	0.52	Less process	Development
Leadership oversight (4)	0.57	0.67	Less oversight	Development
Market (2)	0.35	0.29	More market oriented	Front end
Leader (5)	0.31	0.23	More full-timers	Front end
IT (2)	0.33	0.25	More web use	Front end
Goals (3)	0.59	0.66	Independent goals	Front end
Compensation (3)	0.25	0.16	More rewards, less celebration	Commercialization
Checking (3)	0.39	0.34	More checking at end	Commercialization

75 were significantly different between goods and services at the 0.05 level of probability. The items were categorized to form indices. Each index was normed to range from a minimum of 0 to a maximum of 1. The first column of Table 25.4 presents the indices with the number of items in parentheses. For example, 15 different product development tools were combined to form the tool index. The “Services” column reports the average use of NPD tools by the 79 companies that reported that they were primarily service developers. The “Goods” column assesses how much the companies that developed goods used NPD tools. The “Comparison” column compares service companies to goods companies. If the column indicates “Less tools,” this means that service companies use tools less than goods companies. Finally, each index was placed along the development process as belonging to the front end of innovation, NPD, or commercialization.

*Teams and Tools.* Most companies use both NPD teams and NPD tools to work on new product innovations. The dynamics of how services- and goods-developing companies use teams and tools, however, are very different. Service companies use NPD tools less than goods companies, but they utilize teams to a greater extent (see Figure 25.2). It is also interesting to note that along with using teams more, services companies also spend more time training teams.

*Support and Separated.* How much NPD efforts are supported or separated from the mainstream of the organization is a critical question

**FIGURE 25.2 USE OF TOOLS AND TEAMS BY SERVICES- AND GOODS- DEVELOPING COMPANIES.**



even when not considering services. Service development is generally more separated from the organization than goods development. Similarly, services developments are less supported by the organization than goods developments (see Figure 25.3).

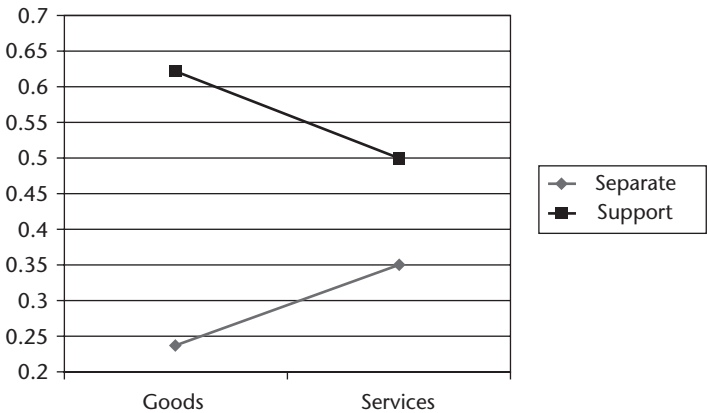
*Leader Oversight and Process.* Control over projects is exerted both by leadership oversight and by the use of formal processes. Services companies use formal processes significantly less than goods companies, but they use a higher level of leadership oversight (see Figure 25.4).

*Market Orientation and Goal Matching.* Organizations are driven to meet multiple objectives with NPD projects. The degree to which organizations seek to match projects to their own goals rather than market demands is a constant challenge. Figure 25.5 shows that most companies, both goods and services, are driven more by the attempt to match their project to their company's goals rather than to meet customer demands. Services projects, however, are more market oriented and less driven by organizational goals.

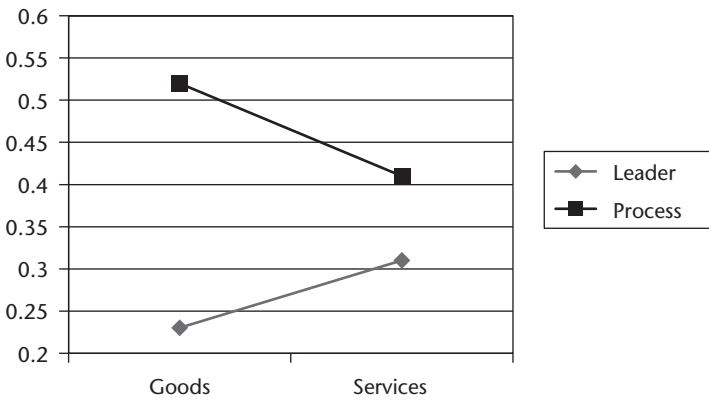
*Oversight and Performance Checks.* How goods and services companies prefer to manage performance differs systematically. Both types of companies use managerial oversight more than performance checks. Service companies, however, use significantly less managerial oversight and significantly more performance checks throughout the life of projects (see Figure 25.6).



**FIGURE 25.3 AMOUNT OF SUPPORT AND SEPARATION OF GOODS AND SERVICES DEVELOPMENT.**

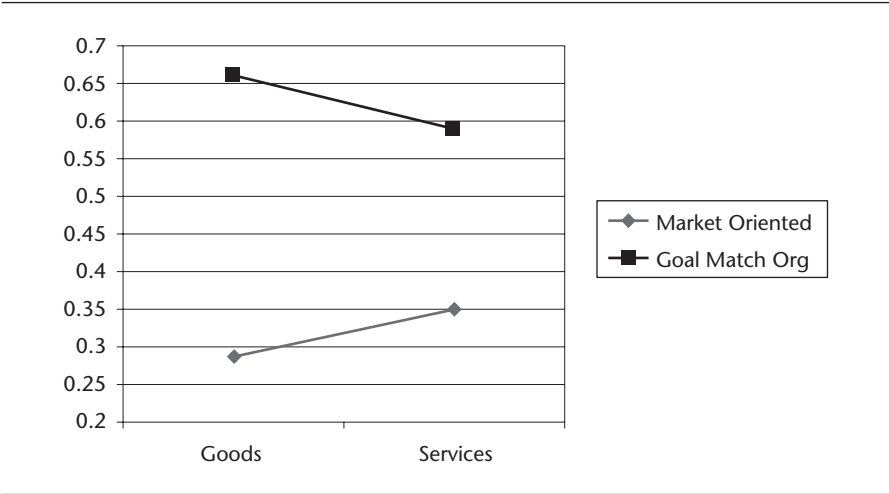


**FIGURE 25.4 LEADERSHIP OVERSIGHT AND FORMAL PROCESSES.**

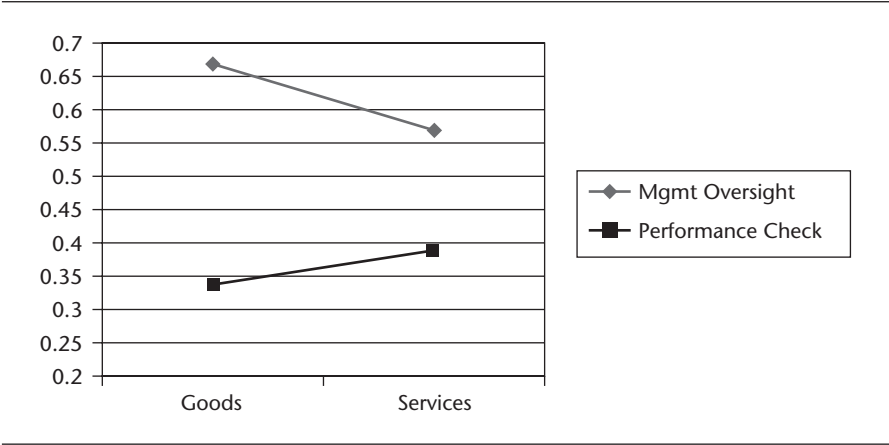


*Additional Important Differences.* The length of time an offering is on the market to be considered new is much shorter for services than for goods. Services firms also engage in fewer partnerships, but they do so in a more in-depth and lasting way.

**FIGURE 25.5 MARKET MATCHING AND GOAL ORIENTATION OF SERVICES AND GOODS DEVELOPMENT EFFORTS.**



**FIGURE 25.6 OVERSIGHT AND PERFORMANCE CHECKS.**



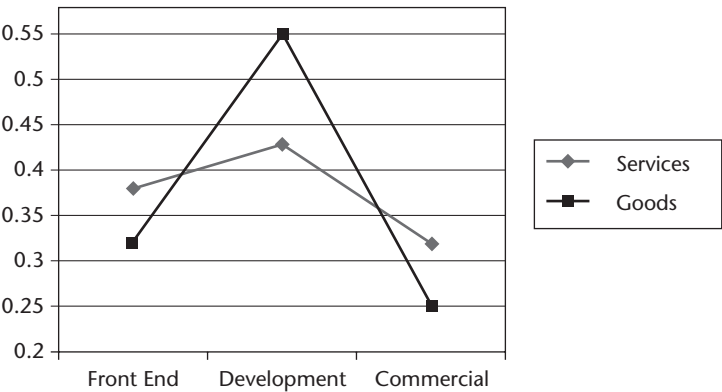
Services firms use full-time managers more than part-time managers. Goods developers use more part-time managers. Services firms use information technology more extensively than goods firms. Services firms also use more compensation for working on new offerings, but at the same time, they engage in less innovation-related celebrations.

Services manage performance more closely. Service developers check competitors and make more comparisons sooner than goods developers. Similarly, services check their business models as well as market acceptance sooner. Connected to checking competitors and customer acceptance sooner, service developers assess their financial performance earlier.

## 25.6 Front-End Development and Commercialization Level of Activity

Section 25.5 looks at the difference between specific indexes to describe the differences in development activities between goods and services companies. Another way to look at the differences is to order the indexes according to where they are on the development continuum. Table 25.4 identifies which indexes are at which stage of development. Aggregating and plotting the indices in Figure 25.7 reveals an important insight. Service developers spend significantly more energy at both the front end and the back end of innovation than goods developers. It is not surprising that goods developers spend more time in development; after all, physical products may take more time to build and test. This does not account for why goods developers do not spend as much time in the front end or in commercialization.

**FIGURE 25.7 SERVICES AND GOODS EFFORT DISTRIBUTION.**



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## 25.7 Summary

The difference between managing and delivering goods and services is well accepted. From the data presented here, it is clear that services and goods also differ in many specific ways in terms of their innovation practices and outcomes. One can no longer simply assume that goods development is the same as services development.

Services companies spend more effort in the beginning and final stages of innovation, while goods companies spend more effort in the middle. Service developers are more separated from the organization, using full-time managers, using less formal tools and structures and more teamwork, and checking with customers and the business model more than goods developers. Service developers use less process and reward people more.

While these data do not suggest that an entirely different system should be used to develop services, it does suggest that the existing system should be used differently. The advantage of developing services in half the time required for developing goods while maintaining the same sales and profits should interest product developers eager to increase their NPV return on investment.

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## Acknowledgment

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## CHAPTER TWENTY-SIX

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# THE EMERGENCE OF THE PRODUCT INNOVATION DISCIPLINE AND IMPLICATIONS FOR FUTURE RESEARCH

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C. Anthony Di Benedetto

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### 26.1 Introduction

The *Journal of Product Innovation Management (JPIM)* was first published in 1984 and enters its 30th year of publication in 2013. Since its inception, *JPIM* has been dedicated to publishing the best articles in new product development and product innovation research. As product innovation is a cross-disciplinary activity, *JPIM* has similarly always been cross-disciplinary in nature, and articles from marketing, technology management, design, engineering, and other functional areas are welcomed. *JPIM* is the academic publication of the Product Development & Management Association and also, since 1990, the publication arm of the International Product Development & Management Conference, presented by the European Institute for Advanced Studies in Management.

According to the statement of Aims and Scope listed in every issue of *JPIM*, the journal is “dedicated to the advancement of management practice in all functions related to product innovation,” whose “purpose is to bring theoretical structures and practical techniques to enable managers to operate at the cutting edge of effectiveness.” While the readership is largely academic, there are managers and consultants who also read and profit from *JPIM*, and all published articles are expected to contain a

section stating the managerial relevance of the research findings. In addition to being cross-disciplinary, *JPIM* is highly multinational, with a large percentage of authors, reviewers, and Editorial Board members being based in Europe and other parts of the world.

Over the past three decades, and through four editors (Blair Little for 1 year, Tom Hustad for 15 years, Abbie Griffin for 6 years, and myself), *JPIM* has evolved from a newcomer to a widely respected journal, considered by most universities as the top academic publication in innovation management and highly rated in citation indices. In fact, the history of *JPIM* as an academic journal parallels the history of product innovation as an area of academic research interest. The evolution of *JPIM* from its startup days through maturity provides a mirror to the evolution of product innovation into a mature academic discipline. This chapter traces the history of *JPIM* through several eras, showing how the quality and breadth of innovation research have increased throughout this time, and takes a look at opportunities and challenges in store for innovation researchers in the future.

*The Journal of Product Innovation Management is dedicated to the advancement of management practice in all functions related to product innovation. Its purpose is to focus on theoretical structures and practical techniques to enable managers to operate at the cutting edge of effectiveness.*

## 26.2 The Emergence of Product Innovation Research

The 1970s and 1980s were times of rapid growth in research interest in product innovation. Two seminal research projects were initiated in the early 1970s: Project SAPPHO in the United Kingdom (Rothwell, 1972; Rothwell, Freeman, Horsley, Jervis, Robertson, and Townsend, 1974) and Project NewProd in Canada (Calantone and Cooper, 1979, 1981). Both of these early studies were systematic empirical investigations into the causes of product success or failure. Another thought leader, Merle Crawford, published his influential article on product strategy in 1980 (Crawford, 1980) and wrote the first edition of the still-leading product management textbook in 1984 (as of this writing, the current edition is Crawford and Di Benedetto, 2011). Still, by 1984, it is fair to say that innovation was still a new discipline, and innovation research was still at an early stage. Academic researchers were studying relatively basic questions: Early

studies in *JPIM* tended to examine issues such as product success and failure, product strategy, teamwork and integration of the new product team, and so on. Academic research was largely survey based and drew primarily from the marketing and management literatures, and researchers were mostly North American based. In the intervening decades, we have witnessed a maturing of the innovation discipline. As researchers reached satisfactory answers to the most fundamental questions, more advanced questions were raised: This gave rise to the “waves” of research that are evident when comparing eras (to be elaborated below). Key constructs such as success, quality, and performance had been measured using rudimentary scales in some of the earlier studies; better multi-item scales and objective measures were now available. At the same time, *JPIM* has moved closer to its stated objective of being truly multidisciplinary. Whereas earlier issues had been marketing and management dominant, coverage of issues such as engineering, technology management, supply chain management, and product design greatly expanded. More young academics were doing their dissertation work in product innovation-related areas, with many of these authors based outside North America. With more authors and more streams of research to draw from, the number of manuscript submissions to *JPIM* literally doubled from 2003 to 2011.

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## 26.3 Waves of Innovation Research

A few recently published articles have examined the trajectory of *JPIM* and provide insights into the waves of innovation research through time. Al Page and Gary Schirr analyzed the topic areas studied in *JPIM* from 1984 to 2005, assessing which had received increasing and decreasing attention (Page and Schirr, 2008). Over that period, research topics that attracted much attention in the earliest years, such as success and failure factors and the phased new product development process, were declining in popularity, while other topics such as radical new product development and new product strategy were increasing in interest. A few topics, such as new product team integration, have remained consistently popular. This provides some evidence of the waves of research that have characterized the development of innovation into a mature research discipline.

Perhaps the best evidence of these waves is found in the study by Biemans, Griffin, and Moenaert (2010). This study, conducted in 2008 and published in 2010, was an attempt to identify the classic articles of *JPIM*. The authors divided the 20-year period from 1984 to 2003 into four 5-year



eras (no articles more recent than 2003 were considered, as the authors reasoned that newer articles could not yet be considered classics). Based on a survey of product researchers, a set of 64 finalists were selected for consideration as classic articles. In a later vote, these were subsequently narrowed down to the five most classic *JPIM* articles.

Table 26.1 categorizes the 64 candidate articles by topic and era, showing how the research focus has shifted through time. In Era 1 (1984–1988), the top articles were mostly focused on the new product/service process, R&D-marketing interface, new product success, organization, new product acceleration, and testing/research issues. Only minor differences in topic are evident in Era 2 (1989–1993). By Era 3 (1994–1998), however, the range of topics covered in the top articles has noticeably widened. Several new important topics emerged, such as supplier interaction, market orientation, radical innovation, and product champions. New product/service process was receiving less research attention, though new product strategy and R&D-marketing interface retained their importance. Finally, in Era 4 (1999–2003), the range expands even further. Top articles focused on topics such as consumer/user input, product portfolio decisions, creativity, global teams, sales forecasting, and product adoption. Radical innovation increased in importance, while new product/service process and R&D-marketing interface dropped out altogether. In sum, Table 26.1 shows research priorities shifting away from some topics, with others increasing in research interest, and also shows that the range of articles that could be considered major innovation topics was widening through time—evidence of a maturing research discipline.

Of the 64 candidate articles, the following 5 were voted as the classic articles of *JPIM* (Biemans et al., 2010):

1. M.M. Montoya-Weiss and R.J. Calantone, Determinants of new product performance: A review and meta-analysis. *JPIM* 11(5), 1994.
2. R.G. Cooper, New product strategies: What distinguishes the top performers? *JPIM* 1(3), 1984.
3. R.G. Cooper, Third-generation new product processes, *JPIM* 11(1), 1994.
4. A. Griffin and A.L. Page, PDMA success measurement project: Recommended measures for product development success and failure, *JPIM* 13(6), 1996.
5. A. Griffin, PDMA research on new product development practices: Updating trends and benchmarking best practices, *JPIM* 14(6), 1997.

**TABLE 26.1 THE CLASSIC ARTICLES OF JPIM: THE 64 CANDIDATES**

Subject	Era 1 1984–88	Era 2 1989–93	Era 3 1994–98	Era 4 1999–03
New Prod. Process/Protocol	3		1	
R&D-Marketing Interface	3	2	3	
New Prod. Strategy/Success	5	4	5	1
Organization/QFD	1	1	1	2
New Prod. Acceleration	1	3	1	2
New Service Process	1	2		
Test/Pretest/Research	2	2		2
Supplier Interaction			1	
Market Orientation			1	
Discontinuous/Radical			2	4
Product Champions			2	
User Input, Portfolio, Creativity, Global Teams, Forecasting, Adoption				1 each

Source: Adapted from Biemans et al. (2010).

The list suggests several insights into innovation research. First, the discipline was mature enough even by 1994–1997 to have meta-analyses and benchmarking studies (articles 1, 4, and 5). Also, older articles have less of a current impact and newer ones are too new to be classic; hence, the list is dominated by mid-1990s studies. Bob Cooper’s 1984 Project New-Prod study (article 2), the forerunner of all *JPIM* product process studies and originally published in the first volume of *JPIM*, is a notable exception.

## 26.4 New and Emerging Research Topics in Innovation

To extend the work of Biemans et al. (2010), let us consider 2004 to the present day as Era 5 of innovation research. The trends evident in Table 26.1 have continued unabated since 2003; the range of topics covered in *JPIM* has widened to include topics of all different kinds related to innovation. For example, in recent years, we have witnessed an increase in articles on emerging topics such as smart products, entrepreneurial product development, mass customization, open innovation, transnational product development, product architecture, the role of the industrial designer on the new product team, and many others. A sampling of new and emerging topics is presented in Table 26.2.

**TABLE 26.2 NEW AND EMERGING TOPICS IN INNOVATION  
RESEARCH IN ERA 5**

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Market Orientation
Internationalization/Transnational NPD
Organizational Learning
High-Tech Product Innovation
High-Tech Service Innovation
Agent-Based Modeling
Knowledge Management/Transfer
Product Architecture
Mass Customization
Open Innovation/Suppliers and Other Partners
NPD in Nonprofits
Product Innovation Charter
Entrepreneurial NPD
Innovation Strategy Change
Information Technology Use in NPD
Smart Products
Intellectual Property and Technology Transfer
Transformational Leadership
Network Externalities and Technology Acceptance
Market Visioning
Innovation in Environmental Turbulence

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This trend is well illustrated by taking two recent issues of *JPIM* and considering the range of topics included. Randomly, March 2010 and July 2011 were selected. The March 2010 issue included nine articles with the following titles:

- Global New Product Development and Behavioral Environment of the Firm
- Resources and Competitor Orientation as Enablers of Competitive Reaction
- Senior Management Policy, Manufacturing Involvement, and Performance
- Interpersonal Cohesiveness in New Product Development Teams
- Corporate Mind-Set and New Product Launch Strategy
- Psychometric Assessment of Concept Testing
- Resource Planning, Product Development Complexity, and Capacity to Launch
- Effects of Social Influences and Network Topology on Innovation Diffusion
- Disruptive Innovation and Disruptive Intellectual Asset Strategy

The July 2011 issue contained the following 11 articles:

- Commercializing Technological Innovation: Failures in High-Tech Markets
- The Impact of Fit Measures on the Consumer Evaluation of New Co-Branded Products
- Are Virtual Markets Efficient Predictors of New Product Success?
- Information Use in New Product Development in the Chemical Industry
- Does Strategic Planning Enhance or Impede Innovation and Firm Performance?
- Configurations of Collaborative Intensity as Predictors of Performance
- Aesthetic Design as an Element of New Service Development and Performance
- Sustainable Product and Market Development for Subsistence Marketplaces
- Determinants of Alliance Portfolio Complexity and Effect on Innovative Performance
- Championship Behaviors and Innovation Success
- Effects of Shape-Typeface Congruence on Brand Perception and Price Expectations

Two observations can be drawn, judging from the titles. First, the number of quality articles has noticeably increased (a typical issue in the mid-1990s contained three or four articles). Second, the range of topics per issue has become extremely wide (in May 2010, everything from global new product development and launch strategy to concept testing and disruptive innovation), far wider than would have been seen in earlier eras, yet every one of these topics is legitimately an innovation research area. These observations point to the remarkable transition, over the past three decades, of innovation from academic research in its earliest stages to a full-fledged, robust, mature academic discipline. Exciting times, indeed, to be an innovation researcher.

Further evidence of the unparalleled growth of innovation as an academic discipline is found in the number and range of special issues published by *JPIM*. Special issues should serve two functions: as a compendium of all of the best current research on an emerging topic of interest and as a stimulus and resource for spurring continued research on this topic. Recent special issue topics have been quite diverse and have included new product design, disruptive innovation, global launch, technology commercialization, virtual teams, agent-based modeling, product development and the base of the pyramid, new product decision making, and many more.

Finally, a review article by Durisin, Calabretta, and Parmeggiani (2010) provides further support for the maturity of innovation research. These authors examined the most frequently cited books and articles in *JPIM* during the early era (defined as 1984–1988, slightly differently than the one in Section 26.3) and a later era (1999–2004). What is noticeable in this review is that in the early era, innovation researchers relied mostly on general innovation textbooks that cover a range of topics; in the later era, researchers referred most often to journal articles appearing in *JPIM* and related journals. Further, several key articles have emerged that have become influential for the discipline's intellectual structure, such as Montoya-Weiss and Calantone (1994), Griffin and Page (1996), and Griffin (1997). Not surprisingly, there is much overlap between the list by Durisin et al. (2010) and the list of classic articles identified by Biemans et al. (2010). Durisin et al. (2010) also argued that later articles show increased methodological rigor and use more complete theoretical models, including a greater number of contingency factors.

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## 26.5 Summary

So, what can be concluded about innovation research, and what are the challenges and opportunities for the future? To summarize the above findings, one can state the following observations about innovation research as presented in the pages of *JPIM*:

- The range of topics has widened to include topics of all kinds related to innovation (the overemphasis on marketing and management issues is disappearing).
- Basic questions have been replaced by more complex questions.
- Simpler methodologies and operationalizations have been replaced by more, and more complex, ones.
- Influential classic articles have emerged, and the current literature builds on previous innovation literature as well as that derived from related disciplines.

All of these are indications of the maturation of the academic discipline of innovation.

During this maturation process, *JPIM* has simultaneously been increasingly recognized as the leading innovation management journal and among the top-quality business journals. The best-known ranking used by

North American universities is the Thomson Impact Factor, where *JPIM* is usually found at the top among industrial engineering journals and among the top business journals. Internationally, *JPIM* is ranked as an A journal in the German ranking system (Alfabetisches Ranking) used in all German-speaking universities and also as an A journal in an Italian list developed at Bocconi University in Milan. It has received the highest possible score on the lists used by Scandinavian and Polish universities, and is viewed as an A publication in British and Dutch schools as well. In his ranking of technology and innovation management journals using several different criteria, Linton (2006) found *JPIM* to be at or near the top in most categories. In Franke and Schreier's (2008) meta-analysis of journal rankings that included rankings by many different schools, *JPIM* is shown to rank very high, generally No. 1 or No. 2 among all technology management schools. Finally, in an interesting study using rankings based on actual citations using the Google Scholar search engine, *JPIM* ranked seventh among all marketing journals, behind highest-tier journals such as the *Journal of Marketing*, *Journal of Consumer Research*, *Journal of Marketing Research*, and *Marketing Science* (Touzani and Moussa, 2010). The authors reasoned that *JPIM*'s high ranking in their system is due to its interdisciplinary nature. That is, *JPIM* scores high using the Google Scholar metric because academics from many research disciplines (marketing, management, engineering, etc.) find it a useful reference.

Still, several challenges remain. From Volume 1 of *JPIM* to the present time, we have been responsive to managers and practitioners. We research areas of interest to practitioners, and all articles contain managerial as well as theoretical implications. It is up to reviewers to identify and stay ahead of trends among the practitioners rather than being reactive to them. As a good recent example, open innovation was already a popular topic among managers in the early 2000s due to Henry Chesbrough's book on the subject (2003); yet, the first mention of open innovation in *JPIM* was in 2006 (Emden, Calantone and Droge 2006), and only later did it pick up traction in the academic literature. Furthermore, academic researchers need to continue to expand into related research disciplines and continue to improve their methodologies. Recent special issues in product design and base of the pyramid product development are two recent examples that continue to increase the scope of innovation research as covered in *JPIM*. Further, the interaction between innovation researchers and those in related research areas can be improved. For example, a study of knowledge inflows and outflows in *JPIM* (Biemans, Griffin, and Moenaert, 2007) found that *JPIM* authors frequently cite strategic management publications

such as the *Strategic Management Journal* or *Academy of Management Journal*, but they, in turn, do not often cite *JPIM*. The reverse is true for management of technology journals such as the *International Journal of Technology Management*. While *JPIM* authors cite articles in these journals, technology management authors are far more likely to cite *JPIM*. To a lesser extent, the same happens for management information systems journals. Inequalities in inflows and outflows suggest possible areas for improvement in communication with colleagues in related research disciplines.

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## APPENDIX

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# ABOUT THE PRODUCT DEVELOPMENT AND MANAGEMENT ASSOCIATION (PDMA)

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The Product Development and Management Association (PDMA) is a global nonprofit professional association seeking to accelerate the contribution that innovation makes to the economic and professional growth of people, businesses, and societies around the world. Founded in 1976, the PDMA has grown to become recognized as the leading advocate for innovation and product development knowledge, practice, and community.

*Innovation* has become a buzz word in recent years. It appears in virtually every corporate vision statement and is touted as the key to success in virtually every annual report. PDMA takes a specific view of what constitutes innovation: it is the process of discovering, developing, and successfully delivering novel ideas for goods and services to the marketplace. The main purpose of the PDMA is to help bring more innovations to fruition by providing resources for professional development, information, collaboration, and promotion of new product development and management.

PDMA is a community of people passionate about developing innovative new goods and services, which combines the expertise of three groups:

- Academics—faculty and students who study, research, and report on product development from a university setting
- Practitioners—professionals who work in firms of various sizes, from sole proprietorships to multinational corporations, trying to deliver new goods and services to the market
- Solution Providers—firms and consultants who provide tools and/or guidance on how to manage innovation systems and processes

PDMA brings these constituencies together into one community, where thousands of members can form, expand, test, modify, analyze, systematize, and evolve ideas and practices. Established best practices are collected in a body of knowledge that is accessible to those who would benefit from it. Further, in the rapidly evolving and highly competitive environment that is the global marketplace, PDMA alerts members to *next practices* in innovation, even before they can be established as *best practices*. PDMA helps product developers and managers to stay informed about what works to accelerate innovation, what acts to inhibit it, and what emerging ideas might lead to the next breakthrough. The PDMA aims to capture, organize, codify, and disseminate such knowledge to people, businesses, and societies around the world that seek to grow professionally and economically through new product and service development.

The development of new goods and services involves an integrated set of unique activities. The PDMA is the only organization that focuses on addressing this challenge by providing:

- Local communities of innovators through chapters and affiliates
- International conferences
- Publications
- Certification as a New Product Development Professional (NPDP)
- Unbiased research concerning new product development best practices
- Awards and scholarships to support rigorous academic research
- Online access to a global virtual community and knowledge repository
- Volunteer opportunities for personal and professional growth

The PDMA brings together a very diverse membership. Whereas most professional associations are focused on a particular industry or job function, the PDMA brings together those who share a common passion and aptitude for innovation. Members come from all industries, from aircraft manufacturing to commercial banking to candy distribution. Members come from all levels, from students to CEOs. Members come from all functions, from marketing to R&D to engineering to sales to finance. Members come from over 30 countries around the globe. The recognition that bringing innovative and valuable new goods and services to market is what creates jobs, fuels growth, and improves standards of living is the common tie that binds the members of the organization together. This unique diversity of the PDMA allows for fertile cross-pollination of ideas and perspectives.

PDMA fills a void in the business world. Innovators can become isolated within their profession, within their industry, or within their geographic location. PDMA serves as an access point, a conduit of communication

between global innovators. The interaction among this diverse group accelerates the rate of learning. Fostering collaboration among different people in the innovation space enables higher- quality, more valuable, and more successful innovation efforts. Connection builds knowledge, and knowledge facilitates connection.

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## Chapters and Affiliates

As a global community of innovators, PDMA offers a large number of chapters and affiliates that build product development networks and create professional learning opportunities at a local community level. Participation in a local chapter or affiliate organization builds professional relationships that enable product developers and researchers to grow professionally, build strong development skills, and navigate the professional world. Events held by chapters and affiliates provide opportunities for both networking and learning. These local organizations produce a variety of events, from meetings offering an insightful and interactive presentation by an expert in one of the many fields of product development to full-day summits featuring keynotes and breakouts that explore product development in depth.

Because these events are locally produced, they can be customized to the particular interests of a geographic region while still operating in a global context. This creates a focused network of innovators who are especially knowledgeable about the opportunities and challenges unique to their area while encouraging worldwide connections and learning. Combining the local community and the global vision of PDMA helps prepare professionals to effectively manage the constantly changing conditions of the global marketplace.

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## International Conferences

**Annual Global Conference on Product Innovation Management.** At the PDMA's Annual Global Conference, executives, practitioners, and solution providers gather to learn from one another and from innovation thought leaders about best practices, emerging practices, research findings, and case studies. It is the only global conference created by product development professionals for product development professionals. From dynamic keynote speakers to deep-dive laboratories, from executive panel discussions to interactive breakout sessions, product development professionals will be challenged and educated in a way that they can immediately apply

to their work, becoming more effective and efficient at profitably delivering new goods and services to market. The Annual Global Conference is a great opportunity to build a global network of product development professionals while learning from some of the brightest minds in the field.

**Annual Research Forum.** Held in conjunction with the Annual Global Conference, the Annual Research Forum delivers the latest research findings in product development and management. Researchers from around the world gather for interactive presentations and discussions. Practitioners benefit from the conventional-wisdom-defying knowledge that is presented, giving them a competitive edge on the job. Academic researchers have the opportunity to learn new methodologies, understand and debate challenging new findings, and gain practical insight from practitioners. Relationships of great value are established for future collaboration and exchange.

**Jointly Sponsored Conferences.** PDMA collaborates with external organizations to jointly sponsor conferences on product development and innovation. Some of these conferences are live face-to-face events that allow for interactive learning and networking. Others are virtual online events that maximize scheduling flexibility. All are excellent means of building greater skills in product development that will reap beneficial returns on innovation investment.

**Webcasts.** PDMA enables members and nonmembers alike to attend virtual meetings and presentations through regular webcasts. With diverse topics and dynamic speakers, product development professionals can interact with world-class thought leaders to increase their skill base, gain new ideas, and build on new insights.

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## Publications

***The Journal of Product Innovation Management (JPIM).*** PDMA's prestigious academic research journal has won many awards, including being recognized as one of the Top Ten Academic Business Journals. *JPIM* delivers the latest research findings on the theory and practice of effective innovation management from the leading academic researchers in the field from around the world. Meticulously reviewed and rigorously researched, each article provides insights for academics and practitioners alike, establishing proven strategies, tactics, and practices that deliver on innovation efforts.

***Visions.*** PDMA's award-winning trade magazine is geared to the product developer who wants to understand the latest theories and practices in a way that can be quickly digested and immediately applied on the job. Articles are written by academics, solution providers, and practitioners, who share

their experiences and lessons learned in applying tools, processes, and strategies to their development efforts. With accessible, leading-edge knowledge, *Visions* helps members to succeed in their work, to stay in touch with industry news, and to be aware of PDMA events and opportunities.

**Connections.** PDMA's monthly e-newsletter communicates the latest happenings within the organization on both local and international levels. Featuring condensed articles and relevant news in a convenient electronic format, *Connections* helps keep members connected with the product development community while managing busy schedules.

**The PDMA Glossary.** In any professional field, certain terminology will be used. Given the breadth of industries and job functions that PDMA serves, there is a potential for confusion about what exactly certain terms mean. Words like *innovation* are used in so many different ways that it can be difficult to effectively communicate some of the central ideas that PDMA promotes. PDMA has published a glossary of such terms on its website to define them precisely and eliminate confusion: [www.pdma.org](http://www.pdma.org). It is a living document that incorporates new terminology as the knowledge in the field continually grows. Reviewing the terms alone can increase a member's expertise in the field.

**Books.** This third edition of *The PDMA Handbook of New Product Development* is a comprehensive collection of information that spans the many different topics included in good product development practices. PDMA also publishes three topical deep-dive *ToolBooks*, all of which explore in detail specific tools used by product developers in all phases of the development process. PDMA also offers a unique overview of the product development field with *New Product Development for Dummies*, which provides an excellent overview of product development knowledge. This collection of books will help get those new to the field off to a fast and effective start while serving as an ongoing reference for those who are more experienced. Whether readers are engaged in day-to-day management or long-term strategic planning, these publications are of great value.

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## NPDP Certification

New Product Development Professional (NPDP) certification, a credential that confirms mastery of new product and service development principles and best practices, sets one apart as an expert and leader in the field. PDMA certifies individuals as being New Product Development Professionals, recognizing successful product development education, experience, and competence in six key areas of product development:

- Strategy
- Portfolio management
- Product development process
- Tools and metrics
- Market research
- Teams, people, and organizational issues

Candidates with appropriate professional experience can become certified by passing the NPDP Exam, which demonstrates competence in all of the above areas. Candidates may pursue self-study through reference texts outlined in the *PDMA Study Guide*, or they may participate in training courses that are available from Registered Education Providers, at some local chapters, and at the PDMA Annual Global Conference.

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## PDMA Foundation Best Practices Survey

The PDMA Foundation Best Practices Survey on new product development is, as of 2012, in its fourth generation as the longest-running and most in-depth survey of its kind. Since 1990, the PDMA Research Foundation has captured new product development best practices from over 1,000 business units. This rich source of data is analyzed by leading academic professionals to identify trends in new product development best practices and to definitively identify those practices that separate the most successful innovation organizations from the rest.

The survey provides product developers with insight into where their organizations may make improvements. It delivers benchmarking data that identify performance gaps and define improvement metrics. Knowing the practices used by the most successful firms, identifying emerging practices that offer competitive edges, and understanding performance differences among industries, firm sizes, and technology bases all enable product developers to improve their performance and gain a competitive edge in their innovation efforts.

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## Awards

**Outstanding Corporate Innovator (OCI) Award.** This award is the only innovation award that recognizes organizations for sustained, quantifiable business results from new products and services. Since 1988, using a rigorous review process, PDMA has identified organizations that demonstrate the ability to consistently create and capture value through innovation based on:

- Sustained success in launching new products over a five-year time frame
- Significant company growth from new products
- Well-defined new product development practices and processes
- Distinctive innovative characteristics and intangibles

Winners are presented the prestigious award at the Annual Global Conference, where the winning firms share their best practices with the PDMA membership. Presentations from many past winners are archived on the PDMA website for ongoing access to the best historical approaches to sustained and successful new product development.

**Crawford Fellows.** The PDMA confers honorary recognition to a very select group of individuals who have made unique and significant contributions to advancing the field of new product development. This honor is named after the founder of the PDMA, Professor Emeritus C. Merle Crawford.

**Thomas P. Hustad JPIM Best Paper Award.** Each year, the Board of Directors of the PDMA and the Editorial Board of the *Journal of Product Innovation Management* award the article they feel most advances the state of the art of new product development and management the Thomas P. Hustad JPIM Best Paper Award. The award winner is announced at the PDMA Annual Global Conference and is named for the founder and first editor of JPIM, Professor Emeritus Thomas P. Hustad.

**Dave L. Wilemon Research Proposal Award.** Syracuse University has established with the PDMA the David L. Wilemon Research Award. David L. Wilemon is one of the original founders of the PDMA; he served as one of its first presidents, acted as an inaugural member of the *Journal of Product Innovation Management's* Editorial Board, and has been a thought leader in innovation and new product development through his significant service, research, and teaching. This award is presented to researchers and PhD candidates at accredited universities and colleges for the best proposal in the PDMA Research Competition.

**PDMA Research Competition.** PDMA provides two grants to conduct academic research on the topic of product development and innovation management. Proposals are reviewed in a competitive, double-blind fashion on topic importance, conceptual development, methodological rigor, originality, and fit with the PDMA mission. Grants are awarded to those whose research will contribute significantly to the field of product development and/or to the practice of product development management. The grants encourage collaboration between academics and practitioners by supporting voluntary survey research among members. A summary of the findings in any such research is reported to PDMA respondents, providing

early insights into what may work and what may not in the practice of new product development.

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## Website

PDMA hosts an interactive website, [www.pdma.org](http://www.pdma.org), to help disseminate knowledge and build global collaboration networks. Through resources such as blogs, electronic publications, references, white papers, interactive forums, and an online store, PDMA can keep members up-to-date on the latest information in new product development knowledge.

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## Volunteer Opportunities

Volunteer opportunities exist within PDMA at both the local and global levels. Whether they are interested in providing leadership for a local organization, planning and producing a conference, writing articles for a publication, or serving on a committee, there are options available for those who would like to promote the field of new product development to others. By contacting a local chapter, a global affiliate, or the international headquarters, product developers can discover ways to help accelerate the contribution that innovation makes to the economic and professional growth of people, businesses, and societies around the world.

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## Membership and Further Information

Interested in learning more about PDMA or in joining the organization? Please feel free to contact the association with any questions or comments.

Product Development & Management Association

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## NEW PRODUCT DEVELOPMENT GLOSSARY

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**Accidental Discovery:** New designs, ideas, and developments resulting from unexpected insight, which is obtained either inside or outside the organization.

**Adaptable Products:** Products that respond and adapt to their users or to changes in their surroundings over time.

**Adoption Curve:** The phases that consumers or markets go through when deciding to adopt a new product or technology. At the individual level, each consumer must move from a cognitive state (becoming aware of and knowledgeable about the product or technology) to an emotional state (liking and then preferring the product or technology) and then to a conative, or behavioral, state (deciding and then purchasing the product or technology). In the marketplace, the new product or technology is purchased first by the innovators, who generally constitute about 2.5 percent of the market. Early adopters (13.5 percent of the market) are the next to buy, followed by the early majority (34 percent), the late majority (34 percent), and finally, the laggards (16 percent).

**Affinity Charting:** A bottom-up technique for discovering connections between pieces of data. An individual or a group starts with one piece of data (say, a customer need). They then look through the rest of

their data (say, statements of other customer needs) to find other data (needs) similar to the first and place it in the same group. As they come across pieces of data that differ from those in the first group, they create a new category. The result is a set of groups where the data contained within a category are similar, and the groups all differ in some way. See also *Qualitative Cluster Analysis*.

**Alliance:** Formal arrangement with a separate company for purposes of development, and involving exchange of information, hardware, intellectual property, or enabling technology. Alliances involve shared risk and reward (for example, codevelopment projects).

**Alpha Test:** Preproduction product testing to find and eliminate the most obvious design defects or deficiencies. Alpha testing is usually done in a laboratory setting or in some part of the developing firm's regular operations. In some cases, it may be done in controlled settings with lead customers. See also *Beta Test* and *Gamma Test*.

**Analogical Thinking:** Involves attempting to solve a problem in one domain or area by looking at solutions to other problems in other domains whose situation resembles that of the current problem. A common approach is to look to nature to see how it solves the same problem.

**Analytical Hierarchy Process (AHP):** A decision-making tool for complex multicriteria problems where both qualitative and quantitative aspects of a problem need to be incorporated. AHP clusters the information for decision making, according to its common characteristics, into a hierarchical arrangement similar to a family tree or affinity chart.

**Analyzer:** A firm that follows an imitative innovation strategy where the goal is to get to market with an equivalent or slightly better product quickly once someone else opens the market. Sometimes called an *imitator* or a *fast follower*.

**Anticipatory Failure Determination (AFD):** A failure analysis method. In this process, developers start from a particular failure of interest as the intended result and try to devise ways to ensure that the failure always happens reliably. Then the developers use that information to develop ways to better identify steps to avoid the failure.

**Applications Development:** The iterative process through which software is designed and written to meet the needs and requirements of the user base or the process of improving or developing new products.

**Architecture:** See *Product Architecture*.

**Asynchronous Groupware:** Software that is used to help people work as groups but does not require those people to work at the same time.

**Audit:** When applied to new product development, an appraisal of the effectiveness of the processes by which the new product was developed and brought to market.

**Augmented Product:** The core product, plus all other sources of product benefits, such as service, warranty, and image.

**Autonomous Product:** An adaptable product that is able to operate in an independent and goal-directed way without user input.

**Autonomous Team:** A self-sufficient project team with very little, if any, link to the funding organization. Often used as an organizational model to bring a radical innovation to the marketplace. Sometimes called a *tiger team*.

**Awareness:** A measure of the percentage of target customers who are aware that the new product exists. Awareness is variously defined, including recall of the brand, recognition of the brand, and recall of key features or positioning.

**Backup:** A project that moves forward, either in synchrony or with a moderate time lag, for the same marketplace as the lead project and provides an alternative asset should the lead project fail in development. A backup has essentially the same mechanism of action performance as the lead project. Normally, a company would not advance both the lead and the backup project through to the marketplace because they would compete directly with each other.

**Balanced Scorecard:** A comprehensive performance measurement technique that balances four performance dimensions: (1) customer views of how the company is performing; (2) internal views of how well the company is doing in what it must excel at; (3) innovation and learning performance; and (4) financial performance.

**Benchmarking:** Collecting process performance data from several organizations to allow the company to assess their performance individually and across organizations. The data that are collected are normally considered confidential.

**Benefit:** A product attribute expressed in terms of what the user gets from the product rather than its physical characteristics or features. Benefits are often paired with specific features, but they need not be.

**Best Practices:** Methods, tools, or techniques that are associated with improved performance. In new product development, no one tool or technique ensures success; however, a number of them are associated with a higher probability of achieving success. Best practices are at least somewhat context specific. Sometimes they are called *effective practices*.

- Best Practice Study:** A process of studying successful organizations and selecting the best of their actions or processes for emulation. In new product development, it means finding the best process practices and adapting and adopting them for internal use.
- Beta Test:** An external test of preproduction products. The purpose is to evaluate the product's functionality across a variety of field situations before sale to the general market in order to find those system faults that are more likely to appear during actual use. See also Field Testing.
- Brainstorming:** A group method of creative problem solving frequently used in product concept generation. There are many variations in format, each with its own name. The basis of all of these methods is the use of a group of people to creatively generate a list of ideas related to a particular topic. As many ideas as possible are listed before any critical evaluation is performed.
- Brand:** A name, term, design, symbol, or any other feature that identifies one seller's good or service as distinct from those of other sellers. A brand may identify one item, a family of items, or all items of that seller. A trademark provides legal protection for a brand.
- Brand Development Index (BDI):** A measure of the relative strength of a brand's sales in a geographic area. Computationally, BDI is the percentage of total national brand sales that occur in an area divided by the percentage of U.S. households that reside in that area.
- Breadboard:** A proof-of-concept modeling technique that shows how a product will work but not how it will look.
- Break-Even Point:** The point in the commercial life of a product when cumulative development costs are recovered through accrued profits from sales.
- Business Analysis:** An analysis of the business surrounding a proposed project. Usually includes financial forecasts in the form of discounted cash flows, net present values, or internal rates of returns.
- Business Case:** The results of the up-front homework found in market, technical, and financial analyses. Ideally, they are defined just before the "go to development" decision (gate). The business case defines the product and project, including the project's justification and the action or business plan.
- Business-to-Business:** Transactions with nonconsumer buyers such as manufacturers, resellers (distributors, wholesalers, jobbers, and retailers, for example), and institutional, professional, and governmental organizations. Often referred to as *industrial* businesses.

- Buyer:** The purchaser of a product or service, whether or not he or she will be the eventual user. Especially in business-to-business markets, a purchasing agent may contract for the purchase of a product or service, yet never benefit from the function(s) purchased.
- Buyer Concentration:** The degree to which buying power is held by a relatively small percentage of the total number of buyers in the market.
- Cannibalization:** That portion of the demand for a new product that comes from decreasing the demand for (sales of) a current product the firm markets.
- Capacity Planning:** A forward-looking activity that checks the skill sets and effective resource capacity of the organization. For product development, the objective is to manage the flow of projects through development such that none of the functions (skill sets) creates a bottleneck to completion on time. It is necessary in optimizing the project portfolio.
- Center of Excellence:** A geographic or organizational group with a recognized technical, business, or competitive competency.
- Certification:** A process for formally recognizing that someone has mastered a body of knowledge on a subject. In new product development, the PDMA has created and manages a certification process for becoming a New Product Development Professional (NPDP).
- Champion:** A person who takes a passionate interest in seeing that a particular process or product is fully developed and marketed. This informal role varies from situation to situation. In some situations, it calls for little more than making the firm aware of the opportunity. In extreme cases, the champion must force a project past strongly entrenched internal resistance of either company policy or powerful objecting parties.
- Charter:** A project team document defining the context, specific details, and plans of a project. It includes the first business case, problem and goal statements, constraints and assumptions, and the preliminary plan and scope. Periodic reviews with the sponsor ensure alignment with business strategies. See also Product Innovation Charter.
- Checklist:** A list of items used to remind an analyst to think of all relevant considerations. It is frequently used as a tool of creativity in concept generation, as a consideration list in concept screening, and to ensure that all suitable tasks have been completed in any stage of the product development process.

**Chunks:** The building blocks of product architecture. They are made up of inseparable physical basic units. Also known as *modules* or *major subassemblies*.

**Clockspeed:** The evolution rate of different industries. High clockspeed industries, like electronics, see multiple generations of products within short time periods, perhaps even within 12 months. In low clockspeed industries, like the chemical industry, a generation of products may last as long as 5 or even 10 years. High clockspeed industries may be used to understand the dynamics of change that will in the long run affect all industries.. This is similar to the use of fruit flies, because of their short life spans, to understand the dynamics of genetic change in a speeded-up genetic environment.

**Cognitive Modeling:** A method for producing a computational model for how individuals solve problems and perform tasks that is based on psychological principles. The modeling process outlines the steps a person goes through in solving a particular problem or completing a task by allowing one to predict how long it will take or the types of errors an individual may make. Cognitive models are frequently used to discover ways to improve a user interface in order to minimize interaction errors or time by anticipating user behavior.

**Cognitive Walkthrough:** Once a model of the steps or tasks a person must go through to complete a task is constructed, an expert can role play the part of a user to cognitively “walk through” the user’s expected experience. Results from this walkthrough can help make human-product interfaces more intuitive and increase product usability.

**Collaborative Product Development:** When two firms work together to develop and commercialize a specialized product. The smaller firm may contribute technical or creative expertise, while the larger firm is more likely to contribute capital, marketing, and distribution capabilities. When two firms of more equal size collaborate, they may each bring some specialized technology capability to the table in developing a complex product or system that requires expertise in both technologies. Collaborative product development has several variations. In customer collaboration, a supplier partners with a key or lead customer. In supplier collaboration, a company partners with the provider(s) of technologies, components, or services to create an integrated solution. In collaborative contract manufacturing, a company contracts with a manufacturing partner to produce the intended product. Collaborative development (also known as *codevelopment*) differs from simple outsourcing in the depth of the partnership; that is, the collaborative firms are linked to deliver the final solution to the intended customer.

- Colocation:** Physically locating project personnel in one area, enabling more rapid and frequent decision making and communication among them.
- Commercialization:** The process of taking a new product from development to market. It may include production launch and ramp-up, marketing materials and program development, supply chain development, sales channel development, training development, training, and service and support development.
- Competitive Intelligence:** Methods and activities for transforming disaggregated public competitor information into relevant and strategic knowledge about competitors' position, size, efforts, and trends. The term refers to the broad practice of collecting, analyzing, and communicating the best available information on competitive trends occurring outside one's own company.
- Computer-Aided Design (CAD):** A technology that allows designers and engineers to use computers for their design work. Early programs enabled two-dimensional design. Current programs allow designers to work in three dimensions and in either wire or solid models.
- Computer-Aided Engineering (CAE):** Using computers in designing, analyzing, and manufacturing a product or process. Sometimes refers more narrowly to using computers at just the engineering analysis stage.
- Computer-Enhanced Creativity:** Using specially designed computer software that aids the process of recording, recalling, and restoring ideas to speed up new product development.
- Concept:** A clearly written and possibly visual description of the new product idea that includes its primary features and consumer benefits, combined with a broad understanding of the technology needed.
- Concept Generation:** The processes by which new concepts or product ideas are generated. Sometimes called *idea generation* or *ideation*.
- Concept Optimization:** A research approach that evaluates how specific product benefits or features contribute to a concept's overall appeal to consumers. Results are used to select those benefits and features that produce the most appealing concept from the consumer's perspective.
- Concept Statement:** A verbal or pictorial statement of a concept that is prepared for presentation to consumers to get their reaction before development.
- Concept Study Activity:** The set of product development tasks in which a concept is examined to determine if there are large unknowns about the market, the technology, or the production process.
- Concept Testing:** The process by which a concept statement is presented to consumers for their reactions. These reactions can be used either

to let the developer estimate the sales value of the concept or to make changes to the concept to improve its potential sales value.

**Concurrency:** Carrying out separate activities of the product development process at the same time rather than sequentially.

**Concurrent Engineering (CE):** When product design and manufacturing process development occur concurrently in an integrated fashion, using a cross-functional team, rather than sequentially by separate functions. CE is intended to cause the development team to consider all elements of the product life cycle from conception through disposal, including quality, cost, and maintenance, from the project's outset. Also called *simultaneous engineering*.

**Conjoint Analysis:** A quantitative market research technique that discovers how consumers make trade-offs between a few different features or benefits.

**Consumer:** The most generic and all-encompassing term for a firm's targets. The term is used in either the business-to-business or household context and may refer to the firm's current customers, competitors' customers, or current nonpurchasers with similar needs or demographic characteristics. The term does not distinguish between whether the person is a buyer or a user target. Only a fraction of consumers will become customers.

**Consumer Market:** The buying of goods and services by individuals and for household use (rather than for use in business settings). Consumer purchases are generally made by individual decision makers, either for themselves or for others in the family.

**Consumer Need:** A problem the consumer would like to have solved. What a consumer would like a product to do.

**Consumer Panels:** Specially recruited groups of consumers whose longitudinal category purchases are recorded via the scanner systems at stores.

**Contextual Inquiry:** A market research method that uses a combination of techniques from anthropology and journalism. It is a customer needs discovery process that observes and interviews users of products in their environment.

**Contingency Plan:** A plan to cope with events whose occurrence, timing, and severity cannot be predicted.

**Continuous Improvement:** The review, analysis, and rework directed at incrementally improving practices and processes. Also called *Kaizen*.

**Continuous Innovation:** A product change that allows improved performance and benefits without changing either consumption



patterns or behavior. The product's general appearance and basic performance do not functionally change.

**Continuous Learning Activity:** The set of activities involving an objective examination of how a product development project is progressing or how it was carried out. Its purpose is to allow process changes that simplify its remaining steps or improve the product being developed or its schedule. See also Learning Organization.

**Contract Developer:** An external provider of product development services.

**Controlled Store Testing:** A method of test marketing where specialized companies are employed to handle product distribution and auditing rather than using the company's normal sales force.

**Convergent Thinking:** A technique used late in the early phase of idea generation. It helps reduce the high volume of ideas created through divergent thinking to a small group of ideas or a single idea on which more effort and analysis will be focused.

**Cooperation (Team Cooperation):** The extent to which team members actively work together in reaching team level objectives.

**Coordination Matrix:** A summary chart that identifies the key stages of a development project, the goals and key activities within each stage, and who (what function) is responsible for each.

**Core Benefit Proposition (CBP):** The central benefit or purpose for which a consumer buys a product. The CBP may come either from the physical good or service or from augmented dimensions of the product. See also Value Proposition.

**Core Competence:** A competence that a company does better than other firms. This competence provides a distinct competitive advantage and contributes to gaining and keeping customers.

**Corporate Culture:** The "feel" of an organization. Culture arises from the belief system through which an organization operates. Corporate cultures are variously described as being authoritative, bureaucratic, and entrepreneurial. Corporate culture often impacts the firm's ability for getting things done.

**Cost of Goods Sold (COGS or CGS):** The direct costs (labor and materials) associated with producing a product and delivering it to the marketplace.

**Creativity:** "An arbitrary harmony, an expected astonishment, a habitual revelation, a familiar surprise, a generous selfishness, an unexpected certainty, a formable stubbornness, a vital triviality, a disciplined freedom, an intoxicating steadiness, a repeated initiation, a difficult

delight, a predictable gamble, an ephemeral solidity, a unifying difference, a demanding satisfier, a miraculous expectation, and accustomed amazement” (George M. Prince, *The Practice of Creativity*, 1970). Creativity is the ability to produce work that is both novel and appropriate.

**Criteria:** Statements of standards used by decision makers at decision gates. They define the dimensions of performance necessary to achieve or surpass for product development projects to continue in development. In total, these criteria reflect a business unit’s new product strategy.

**Critical Assumption:** An explicit or implicit assumption in the new product business case that, if wrong, could undermine the viability of the opportunity.

**Critical Path:** The set of interrelated activities that must be completed for the project to be finished successfully. Mapped onto a chart showing how long each task takes and which tasks cannot be started before other tasks are completed, the critical path is the set of linkages through the chart representing the longest necessary path. The critical path determines how long a project will take.

**Critical Path Scheduling:** A project management technique, often incorporated into various software programs, that puts all important steps of a given new product project into a sequential network based on task interdependencies.

**Critical Success Factors:** Those critical few factors that are necessary for, but don’t guarantee, commercial success.

**Cross-Functional Team:** A team consisting of representatives from the various functions involved in product development, usually including members from all key functions required to deliver a successful product, and typically including marketing, engineering, manufacturing/operations, finance, purchasing, customer support, and quality. The team is empowered by the departments to represent each function’s perspective in the development process.

**Crossing the Chasm:** Making the transition to a mainstream market from an early market dominated by a few visionary customers (sometimes also called *innovators* or *lead adopters*). This concept typically applies to adopting new market-creating, technology-based products and services.

**Customer:** One who buys or uses the firm’s products or services.

**Customer-Based Success:** The extent to which a new product is accepted by customers and the trade.

**Customer Needs:** Problems to be solved. These needs, either expressed or yet to be articulated, provide new product development opportunities for the firm.

**Customer Perceived Value (CPV):** The result of the customer's evaluation of all the benefits and costs of an offering compared to that customer's perceived alternative. It is the basis on which customers decide to buy.

**Customer Site Visits:** A qualitative market research technique for uncovering customer needs. It involves going to a customer's work site and watching a person perform functions associated with the customer needs that the firm wants to fulfill. Then that person is debriefed about what he or she did, why those things were done, the problems encountered while trying to perform the function, and what worked well.

**Customer Value Added Ratio:** The ratio of worth what paid for (WWPF) for the company's products to WWPF for the competitors' products. A ratio above 1 indicates superior value compared to the competitors.

**Cycle Time:** The length of time for any operation from start to completion. In terms of new product development, it is the time required to develop a new product from the early initial idea to initial market sales. Precise definitions of the start and end points vary from one company to another and may vary from one project to another within the company.

**Dashboard:** A colored graphical presentation resembling a car dashboard that shows an individual project's status or a portfolio's status by project. Typically, red is used to flag urgent problems, yellow to flag impending problems, and green to signal on projects on track.

**Database:** An electronic gathering of information organized in some way to make it easy to search, discover, analyze, and manipulate.

**Decision Screens:** Sets of criteria that are applied as checklists or screens at new product decision points. The criteria may vary by stage in the process.

**Decision Tree:** A diagram used for making decisions in business or computer programming. The "branches" of the tree diagram represent choices with associated risks, costs, results, and outcome probabilities. By calculating the outcomes (profits) for each of the branches, the best decision for the firm can be determined.

**Decline Stage:** The fourth and last stage of the product life cycle. Entry into this stage is generally caused by technology advances, consumer or user preference changes, global competition, environmental changes, or regulatory changes.

**Defenders:** Firms that stake out a product turf and protect it by whatever means, not necessarily by developing new products.

**Deliverable:** The output (such as test reports, regulatory approvals, working prototypes, or marketing research reports) that shows that a project has achieved a result. Deliverables may be specified for the commercial launch of the product or at the end of a development stage.

**Delphi Processes:** A technique that uses iterative rounds of consensus development across a group of experts to arrive at a forecast of the most probable outcome for some future state.

**Demographic:** An objective description of a human population. Characteristics include gender, age, education level, and marital status.

**Derivative Product:** A new product based on changes to an existing product that adjusts, refines, or improves some product features without affecting the basic product architecture or platform.

**Design for the Environment (DFE):** The systematic consideration of environmental safety and health issues over the product's projected life cycle in the design and development process.

**Design for Excellence (DFX):** The systematic consideration of all relevant life cycle factors, such as manufacturability, reliability, maintainability, affordability, and testability, in the design and development process.

**Design for Maintainability (DFMt):** The systematic consideration of maintainability issues over the product's projected life cycle in the design and development process.

**Design for Manufacturability (DFM):** The systematic consideration of manufacturing issues in the design and development process, making easy the fabrication of the product's components and their assembly into the overall product.

**Design of Experiments (DOE):** A statistical method for evaluating multiple product and process design parameters simultaneously rather than one parameter at a time.

**Design to Cost:** A development method that treats costs as an independent design parameter rather than an outcome. Cost objectives are established based on customer affordability and competitive constraints.

**Design Validation:** Tests to ensure that the product or service conforms to defined user needs and requirements. These tests may be performed on working prototypes or using computer simulations of the finished product.

**Development:** The functional part of the organization responsible for converting product requirements into a working product. Also, a

phase in the overall concept-to-market cycle in which the new product or service is developed for the first time.

**Development Change Order (DCO):** A document used to implement a change during product development. It spells out the needed change, why the change is needed, and the effects on time to market, development cost, and the cost of producing the final product. This document is attached to the project's charter as an addendum.

**Digital Mock-Up:** An electronic model of the product created with a solids modeling program. Mock-ups can be used to check for interface interferences and component incompatibilities. Using a digital mock-up can be less expensive than building physical prototypes.

**Discontinuous Innovations:** Previously unknown products that establish new consumption patterns and behavior changes. Examples include the initial introduction of microwave ovens and cell phones.

**Discounted Cash-Flow (DCF) Analysis:** One method for providing an estimate of the current value of future incomes and expenses projected for a project. Future cash flows for a number of years are estimated for the project and then discounted back to the present using forecasted interest rates.

**Discrete Choice Experiment:** A quantitative market research tool used to model and predict customer buying decisions.

**Dispersed Teams:** Product development teams that have members working at different locations, in different time zones, and perhaps even in different countries.

**Distribution:** The method and partners used to get the product (or service) from where it is produced to where the end user can buy it.

**Divergent Thinking:** Technique used early in the initial phase of idea generation that expands thinking processes to generate, record, and recall a high volume of new or interesting ideas.

**Dynamically Continuous Innovation:** A new product that changes behavior but not necessarily consumption patterns. Examples include Palm Pilots, electric toothbrushes, and electric hair curlers.

**Early Adopters:** For new products, these are customers who, relying on their own intuition and vision, buy into new product concepts very early in the life cycle. For new processes, these are organizational entities that are willing to try out new processes rather than just maintaining the old ones.

**Economic Value Added (EVA):** The value added to or subtracted from shareholder value during the life of a project.

**Empathic Design:** A five-step method for uncovering customer needs and sparking ideas for new concepts. It involves going to a customer's

work site and watching as he or she performs functions associated with the customer needs your firm wants to solve. Then the customer is debriefed about what he or she did, why those things were done, the problems encountered while trying to perform the functions, and what worked well. By spending time with customers, the team develops empathy for the problems customers encounter while trying to perform their daily tasks. See also Customer Site Visits.

**Engineering Design:** A function in the product creation process in which a good or service is configured and a specific form is determined.

**Engineering Model:** The combination of hardware and software intended to demonstrate the simulated functioning of the intended product as currently designed.

**Enhanced New Product:** A form of derivative product. Enhanced products include those with additional features not previously found on the base platform, which provide increased value to consumers.

**Entrance Requirement:** The document(s) and reviews required before any phase of a stages and gates development process can be started.

**Entrepreneur:** A person who initiates, organizes, operates, assumes the risk, and reaps the potential reward for a new business venture.

**Environmental Sustainability:** Akin to green new product development, a focus on developing products whose environmental impact is much lower than that of conventional or competitive products. This includes such considerations as materials saving, material sourcing, energy efficiency, demanufacturability, recyclability, and reduced use of hazardous materials. It can also refer to the internal processes by which products are developed in an effort to conserve natural resources.

**Ethnocentric Strategy:** A situation in which country of headquarters domestic attitudes and mode of operations dominate the entire organization.

**Ethnography:** A descriptive, qualitative market research methodology for studying the customer in his or her environment. Researchers spend time in the field watching customers and their environment to gain a deep understanding of customers' lifestyles and cultures. See Customer Site Visits.

**Evaluative Market Research:** Focused on evaluating and refining concepts such as attribute and concept testing.

**Event:** Marks the point in time when a task is completed.

**Event Map:** A chart identifying important probable or certain events in the future that is used to map out potential responses to these events.

**Excursion:** An idea generation technique to force discontinuities into the idea set. Excursions consist of three generic steps: (1) step away from the task; (2) generate disconnected or irrelevant material; (3) force a connection back to the task.

**Exit Requirement:** The document(s) and reviews required to complete a stage of a stages and gates development process.

**Exit Strategy:** A planned process for deleting a product or product line from the firm's portfolio. It includes plans for clearing inventory out of the supply chain pipeline at minimum loss, continuing to provide for after-sales parts supply and maintenance support, and converting customers of the deleted product line to a different one.

**Experience Curve:** The relationship between total costs and cumulative production in which each time the cumulative volume of production of a product doubles, total value-added costs (for example, sales, administration) fall by a constant percentage.

**Explicit Customer Requirement:** What the customer asks for in a product.

**Factory Cost:** The cost of producing the product in the production location including materials, labor, and overhead.

**Failure Mode Effects Analysis (FMEA):** A technique used at the development stage to discover the different ways in which a product may fail and to evaluate the outcomes of each type of failure.

**Failure Rate:** The percentage of a firm's new products that make it to full market commercialization but fail to achieve the objectives set for them.

**Feasibility Determination:** The set of product development tasks in which major unknowns (technical or market) are examined to produce knowledge about how to resolve or overcome potential problems as well as to clarify task limits. Sometimes called *exploratory investigation*.

**Feature:** The solution to a consumer need or problem. Features provide benefits to consumers. A handle (feature) allows a laptop computer to be carried easily (benefit). Usually any one of several different features will be chosen to meet a customer need. For example, a carrying case with shoulder straps is another feature that allows a laptop computer to be carried easily.

**Feature Creep:** The tendency for designers or engineers to add more capability, functions and features to a product as development proceeds than were originally intended. These additions often cause schedule slip, development cost increases, and product cost increases.

**Field Testing:** Product use testing with users from the target market in the context in which the product will be used.



- Financial Success:** The extent to which a new product meets its profit, margin, and return on investment goals.
- Firefighting:** An unplanned diversion of scarce resources and the reassignment of some of them to fix problems discovered late in a product's development cycle.
- Firm-Level Success:** The total impact of the firm's competence in developing and commercializing new products. Several different specific measures may be used to estimate performance.
- First to Market:** The first product to create a new product category or a large subdivision of a category.
- Flexible Gate:** A permissive or permeable gate in a Stage-Gate™ process that is less rigid than the traditional "go-stop-recycle" gate. Flexible gates are useful in shortening the time to market. A permissive gate is one in which the next stage is authorized even though some work in the almost-completed previous stage has not yet been finished. A permeable gate is one in which some work in a later stage is authorized before a large amount of work in the prior stage is completed.
- Focus Groups:** A qualitative market research technique in which 8 to 12 market participants are gathered in one room for a discussion under the leadership of a trained moderator. Discussion focuses on a consumer problem, product, or potential solution to a problem. The results of these discussions are not projectable to the general market.
- Forecast:** A prediction, over some defined time, of the success or failure of implementing a business plan's decisions stemming from an existing strategy.
- Function:** (1) An abstract description of work that a product must perform to meet customer needs. A function is something the product or service must do. (2) A term describing an internal group performing a basic business capability such as engineering.
- Functional Elements:** The individual operations that a product performs. These elements are often used to describe a product schematically.
- Functional Pipeline Management:** Optimizing the flow of projects through all functional areas in the context of the company's priorities.
- Functional Schematic:** A schematic drawing that is made up of all the functional elements in a product. It shows the product's functions as well as how material, energy, and signal flow through the product.
- Functional Testing:** Testing either an element of or the complete product to determine whether it will function as planned and as actually used when sold.
- Fuzzy Front End:** The messy "getting started" period of product development, when the product concept is still very fuzzy. Preceding



the more formal product development process, it generally consists of three tasks: strategic planning, concept generation, and especially pretechnical evaluation. These activities are often chaotic, unpredictable, and unstructured. In comparison, the subsequent new product development process is typically structured, predictable, and formal, with prescribed sets of activities, questions to be answered, and decisions to be made.

**Fuzzy Gates:** Conditional or situational rather than full “go” decisions. Their purpose is to try to balance timely decisions and risk management. Conditional decisions are go, subject to a task’s being successfully completed by a future specified date. Situational gates have some criteria that must be met for all projects and others that are only required for some projects. For example, a new-to-the world product may have distribution feasibility criteria that a line extension will not have.

**Gamma Test:** A longer-term product use test in which the developers measure the extent to which the item meets the needs of the target customers, solves the problems(s) targeted during development, and leaves the customers satisfied.

**Gantt Chart:** A horizontal bar chart used in project scheduling and management that shows the start date, end date, and duration of tasks within the project.

**Gap Analysis:** (1) The difference between projected outcomes and desired outcomes. In product development, the gap is frequently measured as the difference between expected and desired revenues or profits from currently planned new products if the corporation is to meet its objectives. (2) A market research technique that maps products of a given market and tries to identify market opportunities represented by those areas on the map where no products are found.

**Gate:** The point at which a management decision is made to allow the product development project to proceed to the next stage, to recycle back to the current stage to better complete some of the tasks, or to terminate. The number of gates varies by company.

**Gatekeepers:** The group of managers who serve as advisors, decision makers, and investors in a Stage-Gate™ process. Using established business criteria, this multifunctional group reviews new product opportunities and project progress and allocates resources accordingly at each gate. This group is also commonly called a *product approval committee* or a *portfolio management team*.

**Generative Market Research:** Market research focused on uncovering unmet needs and discovering new opportunities.

**Geocentric Strategy:** Worldwide orientation, with no concept of national markets, operations integrated, coordinated, and rationalized worldwide.

**Glocalization:** A combination of the words *globalization* and *localization* used to describe a product or service that is developed and distributed globally but is also fashioned to accommodate the user or consumer in a local market. This means that the product or service may be tailored to conform with local laws, customs, or consumer preferences.

**Graceful Degradation:** When a product, system, or design slides into defective operation a little at a time. Graceful degradation provides ample opportunity to take corrective preventive action or protect against the worst outcomes of failure before it happens. The opposite is catastrophic failure.

**Green New Product Development:** Akin to environmental sustainability, focuses on developing products whose environmental impact is much lower than that of conventional or competitive products. This includes such considerations as materials saving, material sourcing, energy efficiency, demanufacturability, recyclability, and reduced use of hazardous materials. It can also refer to the internal processes by which products are developed in an effort to conserve natural resources

**Gross Rating Points (GRPs):** A measure of the overall media exposure of consumer households (reach times frequency).

**Groupware:** Software designed to facilitate group efforts such as communication, workflow coordination, and collaborative problem solving. The term generally refers to technologies relying on modern computer networks (external or internal).

**Growth Stage:** The second stage of the product life cycle. This stage is marked by a rapid surge in sales and market acceptance of the good or service. Products that reach the growth stage have successfully “crossed the chasm.”

**Heavyweight Team:** An empowered project team with enough resourcing to complete the project. Personnel report to the team leader and are colocated as practical.

**Hunting for Hunting Grounds:** A structured methodology for completing the fuzzy front end of new product development.

**Hunting Ground:** A discontinuity in technology or the market that opens up a new product development opportunity.

**Hurdle Rate:** The minimum return on investment or internal rate of return percentage that a new product must meet or exceed as it goes through development.

**Idea:** The most embryonic form of a new product or service. It often consists of a high-level view of the envisioned solution to a problem identified by an individual, a team, or a firm.

**Idea Exchange:** A divergent thinking technique that provides a structure for building on different ideas in a quiet, nonjudgmental setting in order to encourage reflection.

**Idea Generation (Ideation):** All of the activities and processes that lead to creating broad sets of solutions to consumer problems. These techniques may be used in the early stages of product development to generate early product concepts. They also may be used in the intermediate stages for overcoming implementation problems, in the later stages for planning the launch, and in the postmortem stage to better understand success and failure in the marketplace.

**Idea Merit Index:** An internal metric used to impartially rank new product ideas.

**Implementation Team:** A team that converts the ideas and good intentions of the “should-be” process into practical reality.

**Implicit Product Requirement:** What the customer expects in a product but does not ask for and may not even be able to explain.

**Incremental Improvement:** A small change made to an existing product that serves to keep the product fresh in the eyes of customers.

**Incremental Innovation:** An innovation that improves the delivery of a current benefit but produces neither a behavior change nor a change in consumption.

**Industrial Design (ID):** The professional service of creating and developing concepts and specifications that optimize the function, value, and appearance of products and systems for the mutual benefit of both the user and the manufacturer (refer to the Industrial Design Society of America, [www.idsa.org](http://www.idsa.org)).

**Information:** Knowledge and insight, often gained by examining data.

**Information Acceleration:** A concept testing method employing virtual reality. In it, a virtual buying environment is created that simulates the information available (product, societal, political, and technological) in a real purchase situation at some time several years or more in the future.

**Informed Intuition:** Using the gathered experiences and knowledge of the team in a structured manner.

**Initial Screening:** The first decision to spend resources (time or money) on a project. The project is born at this point. Sometimes called *idea screening*.

**In-Licensed:** The acquisition from external sources of novel product concepts or technologies for inclusion in the aggregate new product development portfolio.

**Innovation:** (1) A new idea, method, or device. (2) The act of creating a new product or process, which includes invention and the work required to bring an idea or concept to final form.

**Innovation Engine:** The creative activities and the people who actually think of new ideas. It represents the synthesis phase in which someone first recognizes that customer and market opportunities can be translated into new product ideas.

**Innovation Strategy:** The firm's positioning for developing new technologies and products. One categorization offered by Miles and Snow<sup>1</sup> divides firms into four categories: (1) prospectors (those who lead in technology, product and market development, and commercialization, even though an individual product may not lead to profits); (2) analyzers (fast followers, or imitators, who let the prospectors lead but have a product development process organized to imitate and commercialize quickly any new product a prospector has put on the market); (3) defenders (those who stake out a product's turf and protect it by whatever means, not necessarily by developing new products); (4) reactors (those who have no coherent innovation strategy).

**Innovative Problem Solving:** Methods that combine rigorous problem definition, pattern-breaking generation of ideas, and action planning that results in new, unique, and unexpected solutions.

**Integrated Architecture:** A product architecture in which most or all of the functional elements map into a single chunk or a few chunks. It is difficult to subdivide an integrally designed product into partially functioning components.

**Integrated Product Development (IPD):** A philosophy that systematically employs an integrated team drawn from multiple functional disciplines to effectively and efficiently develop new products that satisfy customer needs.

**Intellectual Property (IP):** Information, including proprietary knowledge, technical competencies, and design information, that provides commercially exploitable competitive benefit to an organization.

**Intelligent Product:** A product that is able to collect, process, and produce information through the use of information and communication technologies.

**Interlocking Teams:** Multiple component teams linked through an internal oversight team. This arrangement is designed to create structure and common goals in an unstructured environment.

**Internal Rate of Return (IRR):** The discount rate at which the present value of the future cash flows of an investment equals the cost of the investment. The discount rate with a net present value of zero.

**Intrapreneur:** The large-firm equivalent of an entrepreneur. Someone who develops new enterprises within the confines of a large corporation.

**Introduction Stage:** The first stage of a product's commercial launch and the product life cycle. This stage is generally seen as the point of market entry, user trial, and product adoption.

**ISO-9000:** A set of five auditable standards of the International Standards Organization that establishes the role of a quality system in a company and is used to assess whether the company can be certified as compliant with the standards. ISO-9001 deals specifically with new products.

**Issue:** A certainty that will affect the outcome of a project, either negatively or positively. Issues require investigation of their potential impacts and decisions about how to deal with them. Open issues are those for which suitable actions have not been taken, while closed issues are ones the team has dealt with successfully.

***Journal of Product Innovation Management:*** The premier academic journal in the field of innovation, new product development, and management of technology. The journal, which is owned by the PDMA, is dedicated to the advancement of management practice in all of the functions involved in the total process of product innovation. Its purpose is to bring to managers and students of product innovation the theoretical structures and the practical techniques that will enable them to operate at the cutting edge of effective management practice.

**Kaizen:** A Japanese term describing a process or philosophy of continuous, incremental improvement.

**Launch:** The process by which a new product is introduced to the market for initial sale.

**Lead Users:** Users for whom finding a solution to a need is so important that they have either modified a current product or invented a new product to meet the need themselves. These users' solutions are new product opportunities because they potentially foreshadow the needs most of the marketplace will have in the future.

**Learning Curve:** The relationship between cumulative production and labor costs in which each time the cumulative volume of production of a product doubles, the unit production time decreases by a constant percentage.

**Learning Organization:** An organization that continuously tests, updates, and transforms the experience of those in the organization into improved work processes and knowledge that is accessible to the whole organization and relevant to its core purpose. See Continuous Learning Activity.

- Life Cycle Cost:** The total cost of acquiring, owning, and operating a product over its useful life. Associated costs may include the purchase price, training expenses, maintenance expenses, warrantee costs, support, disposal, and profit loss due to repair downtime.
- Lightweight Team:** New product team charged with successfully developing a product concept and delivering it to the marketplace. Resources are generally not dedicated, and the team depends on the technical functions for the necessary resources to accomplish the work.
- Line Extension:** A form of derivative product that adds or modifies features without significantly changing the product's functionality.
- Long-Term Success:** The new product's performance in the long run or at some large fraction of the product's life cycle.
- "M" Curve:** An illustration of the volume of ideas created over a given amount of time. The illustration often looks like two arches from the letter M.
- Maintenance Activity:** The set of product development tasks aimed at solving initial market and user problems with the new product or service.
- Manufacturability:** The extent to which a new product can be easily and effectively made at minimum cost and with maximum reliability.
- Manufacturing Assembly Procedure:** Procedural documents normally prepared by manufacturing personnel that describe how a component, subassembly, or system will be put together to create a final product.
- Manufacturing Design:** The method for determining the manufacturing process that will be used to make a new product.
- Manufacturing Test Specification and Procedure:** Documents prepared by development and manufacturing personnel that describe the performance specifications of a component, subassembly, or system that will be met during the manufacturing process. The documents also describe the procedure by which the specifications will be assessed.
- Market Conditions:** The characteristics of the market in which a new product will be placed, including the number of competing products, level of competitiveness, and growth rate.
- Market Development:** Taking current products to new consumers or users. This effort may involve making some product modifications.
- Market-Driven:** Allowing the marketplace to direct a firm's product innovation efforts.
- Market Research:** Information about the firm's customers, competitors, or markets. Information may be obtained from secondary sources (already published and publicly available) or primary sources

(customers themselves). Market research may be qualitative or quantitative. See Qualitative Market Research and Quantitative Market Research.

**Market Segmentation:** The act of dividing an overall market into groups of consumers with similar needs. Each of the groups differs from others in the market in some way that is important to the design or marketing of the product.

**Market Share:** A company's sales in a product area as a percentage of the total market sales in that area.

**Market Testing:** The product development stage in which the new product and its marketing plan are tested together. A market test simulates the eventual marketing mix and takes many different forms, only one of which bears the name *test market*.

**Maturity Stage:** The third stage of the product life cycle. This is the stage in which sales begin to level off due to market saturation. It is a time when heavy competition, alternative product options, and (possibly) changing buyer or user preferences start to make it difficult to achieve profitability.

**Metrics:** A set of measures used to track product development and allow a firm to determine the impact of process improvements over time. These measures generally vary by firm. They may include measures characterizing both aspects of the process, such as time to market and duration of particular process stages. They may also include outcomes from product development such as the number of products commercialized per year and the percentage of sales due to new products.

**Modular Architecture:** A product architecture in which each functional element maps into its own physical chunk. Different chunks perform different functions; the interactions between the chunks are minimal, and they are generally well defined.

**Monitoring Frequency:** The frequency with which performance indicators are measured.

**Morphological Analysis:** A matrix tool that breaks a product down by needs met and technology components, allowing for targeted analysis and idea creation.

**Multifunctional Team:** A group of individuals brought together from the different functional areas of a business to work on a problem or process that requires the knowledge, training, and capabilities across the areas to complete the work successfully. See also Cross-Functional Team.

**Needs Statement:** Summary of consumer needs and wants, described in customers' terms, to be addressed by a new product.



**Net Present Value (NPV):** Method used to evaluate comparable investments in different projects by discounting the current and projected future cash inflows and outflows back to the present value based on the firm's discount rate or cost of capital.

**Network Diagram:** A graphical diagram with boxes connected by lines that shows the sequence of development activities and the interrelationship of each task with another. Often used with a Gantt Chart.

**New Concept Development Model:** A theoretical model that provides for a common terminology and vocabulary for the fuzzy front end of development. The model consists of three parts: (1) the uncontrollable influencing factors; (2) the controllable engine that drives the activities in the fuzzy front end; and (3) five activity elements: opportunity identification, opportunity analysis, idea generation and enrichment, idea selection, and concept definition.

**New Product:** A term indicating many opinions and practices, but most often defined as a product (either a good or a service) new to the firm marketing it. Excludes products that are only changed in the way they are promoted to the market.

**New Product Development (NPD):** The overall process of strategy, organization, concept generation, product and marketing plan creation and evaluation, and commercialization of a new product. Also often referred to as *product development*.

**New Product Development Process (NPD Process):** A disciplined and defined set of tasks and steps that describe the normal means by which a company repetitively converts embryonic ideas into salable products or services.

**New Product Development Professional (NPDP):** An NPDP is certified by the PDMA as having mastered the body of knowledge in new product development, as proven by performance on the certification test. To qualify for the NPDP certification examination, a candidate must hold a bachelor's or higher college degree (or an equivalent degree) from an accredited institution and must have spent a minimum of two years working in the new product development field.

**New Product Idea:** A preliminary plan or purpose of action for formulating new products or services.

**New Product Introduction (NPI):** The launch or commercialization of a new product in the marketplace. Takes place at the end of a successful product development project.

**New-to-the-World Product:** A good or service that has never before been available to either consumers or producers. The automobile was new to the world when it was introduced, as were microwave ovens and pet rocks.



- Nominal Group Process:** A brainstorming process in which members of a group first write their ideas individually and then participate in group discussion about each idea.
- Nondestructive Test:** A test of the product that retains the product's physical and operational integrity.
- Nonproduct Advantage:** Elements of the marketing mix that create a competitive advantage other than the product itself. These elements can include marketing communications, distribution, company reputation, technical support, and associated services.
- Offshoring:** A type of outsourcing that involves the relocation of a company's business process or processes to a foreign country. Typically, this is done to access a lower-cost operation.
- Operations:** A term that includes manufacturing but is much broader, usually including procurement, physical distribution, and, for services, management of the offices or other areas where the services are provided.
- Operator's Manual:** The written instructions to the users of a product or process. These may be intended for the ultimate customer or for the use of the manufacturing operation.
- Opportunity:** A business or technology gap that a company or individual achieves by design or accident. If the gap is closed, the company or individual can capture a competitive advantage, respond to a threat, solve a problem, or ameliorate a difficulty.
- Outsourcing:** The firm's decision to buy a good or service from someone else rather than produce it themselves.
- Outstanding Corporate Innovator Award:** An annual PDMA award given to firms acknowledged through a formal vetting process as being outstanding innovators. The basic requirements for receiving this award, which is given yearly by the PDMA, are (1) sustained success in launching new products over a five-year time frame; (2) significant company growth from new product success; (3) a defined new product development process that can be described to others; and (4) distinctive innovative characteristics and intangibles.
- Pareto Chart:** A bar graph with the bars sorted in descending order used to identify the largest opportunity for improvement. Pareto charts distinguish the "vital few" from the "useful many."
- Participatory Design:** A democratic approach to design that does not simply make potential users the subjects of user testing, but also empowers them to be part of the design and decision-making process.
- Payback:** The time, usually in years, from some point in the development process until the commercialized product or service has recovered

its costs of development and marketing. While some firms take the point of full-scale market introduction of a new product as the starting point, others begin the clock at the start of development expense.

**Payout:** The profits and their timing expected from commercializing a new product.

**Perceptual Mapping:** A quantitative market research tool used to understand how customers think of current and future products. Perceptual maps are visual representations of the positions that sets of products have in consumers' minds.

**Performance Indicators:** Criteria on which the performance of a new product in the market are evaluated.

**Performance Measurement System:** The system that enables the firm to monitor the relevant performance indicators of new products in the appropriate time frame.

**PERT (Program Evaluation and Review Technique):** An event-oriented network analysis technique used to estimate project duration when there is a high degree of uncertainty in estimates of duration times for individual activities.

**Physical Elements:** The components that make up a product. These can be both components (or individual parts) and minor subassemblies of components.

**Pilot Gate Meeting:** A trial, informal gate meeting usually held at the launch of a Stage-Gate™ process to test the design of the process and familiarize participants with the Stage-Gate™ process.

**Pipeline (Product Pipeline):** The scheduled stream of products in development for release to the market.

**Pipeline Alignment:** The balancing of project demand with resource supply.

**Pipeline Inventory:** Production of a new product that has not yet been sold to end consumers but that exists within the distribution chain.

**Pipeline Management:** A process that integrates product strategy, project management, and functional management to continuously optimize the cross-project management of all development-related activities.

**Pipeline Management Enabling Tools:** The decision-assistance and data-handling tools that aid in managing the pipeline. The decision-assistance tools allow the pipeline team to perform trade-offs systematically without losing sight of priorities. The data-handling tools deal with the vast amount of information needed to analyze project priorities, understand resource and skill set loads, and perform pipeline analysis.

- Pipeline Management Process:** Consists of three elements: pipeline management teams, a structured methodology, and enabling tools.
- Pipeline Management Teams:** The teams of people at the strategic, project, and functional levels responsible for resolving pipeline issues.
- Platform Product:** The design and components that are shared by a set of products in a product family. From this platform, many derivative products can be designed. See also Product Platforms.
- Polycentric Strategy:** The lack of a single dominant strategy; host-country orientations dominate within each country.
- Portfolio:** Commonly considered a set of projects or products that a company is investing in and making strategic trade-offs against. See also Product Portfolio and Project Portfolio.
- Portfolio Criteria:** The set of criteria against which the business judges both proposed and currently active product development projects to create a balanced and diverse mix of ongoing efforts.
- Portfolio Management:** A process by which a business unit decides on the mix of active projects, staffing, and budget allocated to each project currently being undertaken. See also Pipeline Management.
- Preproduction Unit:** A product that looks and acts like the intended final product but is made either by hand or in pilot facilities rather than by the final production process.
- Process Champion:** The person responsible for the daily promotion of and encouragement to use a formal business process throughout the organization. This person is also responsible for the ongoing training, innovation input, and continuous improvement of the process.
- Process Managers:** The operational managers responsible for ensuring the orderly and timely flow of ideas and projects through the process.
- Process Map:** A workflow diagram that uses the x-axis for process time and the y-axis to show participants and tasks.
- Process Mapping:** The act of identifying and defining all of the steps, participants, inputs, outputs, and decisions associated with completing any particular process.
- Process Maturity Level:** The amount of movement of a reengineered process from the “as-is” map, which describes how the process operated initially, to the “should-be” map of the desired future state of the operation.
- Process Owner:** The executive manager responsible for the strategic results of the new product development process. This includes process throughput, quality of output, and participation within the organization.

**Process Reengineering:** A discipline used to measure and modify organizational effectiveness by documenting, analyzing, and comparing an existing process to the “best-in-class” practice and then implementing significant process improvements or installing a whole new process.

**Product:** Term used to describe all goods, services, and knowledge sold. Products are bundles of attributes (features, functions, benefits, and uses) and can be tangible, as in the case of physical goods; intangible, as in the case of those associated with service benefits; or a combination of the two.

**Product and Process Performance Success:** The extent to which a new product meets its technical performance and product development process performance criteria.

**Product Approval Committee (PAC):** The group of managers who serve as advisors, decision makers, and investors in a Stage-Gate™ process; often a company’s new product development executive committee. Using established business criteria, this multifunctional group reviews new product opportunities and project progress and allocates resources accordingly at each gate.

**Product Architecture:** The way in which the functional elements are assigned to the physical chunks of a product and the way in which those physical chunks interact to perform the overall function of the product.

**Product Definition:** A description of the product, including the target market, product concept, benefits to be delivered, positioning strategy, price point, product requirements, and design specifications.

**Product Development:** The overall process of strategy, organization, concept generation, product and marketing plan creation and evaluation, and commercialization of a new product.

**Product Development & Management Association (PDMA):** A not-for-profit professional organization whose purpose is to seek out, develop, organize, and disseminate leading-edge information on the theory and practice of product development and product development processes. The PDMA uses local, national, and international meetings and conferences, educational workshops, and publications to achieve its purposes. Among its publications are a quarterly newsletter (*Visions*), a bimonthly scholarly journal (*Journal of Product Innovation Management*), *The PDMA Handbook of New Product Development*, and *The PDMA ToolBook for New Product Development*. The PDMA sponsors research proposal and dissertation proposal competitions. The association also manages

the certification process for New Product Development Professionals ([www.pdma.org](http://www.pdma.org)).

**Product Development Checklist:** A predetermined list of procedures and disciplines responsible for completing those activities used as a guideline to ensure that all the tasks of product development are considered before commercialization.

**Product Development Portfolio:** The collection of new product concepts and projects that the firm is able to develop, are most attractive to the firm's customers, and meet the firm's short- and long-term objectives. Its intent is to spread risk and diversify investments.

**Product Development Process:** A disciplined and defined set of tasks, steps, and phases that describe the normal means by which a company repetitively converts embryonic ideas into salable products or services.

**Product Development Strategy:** The strategy that guides the product innovation program.

**Product Development Team:** A multifunctional group of individuals chartered to plan and execute a new product development project.

**Product Discontinuation:** Withdrawing or removing a product or service from the market because it no longer provides an economic, strategic, or competitive advantage in the firm's portfolio of offerings.

**Product Discontinuation Timeline:** The process and the time frame in which a product is carefully withdrawn from the market. The product may be discontinued immediately after the decision is made or the process may take a year or more, depending on the nature and conditions of the market and the product.

**Product Failure:** A product development project that does not meet the objective of its charter or the needs of the marketplace.

**Product Family:** The set of products that have been derived from a common product platform. Members of a product family normally have many common parts and assemblies.

**Product Innovation Charter (PIC):** The summary statement of the strategy that will guide a department or project team in their efforts to create a new product. The PIC specifies the arena in which the project will operate, its goals and objectives, and the general approaches to be used. It may apply to a single project or to a program of projects.

**Product Interfaces:** Internal and external interfaces impacting the product development effort, including the nature of the interface, action required, and timing.

**Product Life Cycle:** The four stages that a new product is thought to go through from birth to death: introduction, growth, maturity, and

decline. Whether products go through this cycle in any predictable way is controversial.

**Product Life-Cycle Management:** Changing the features and benefits of the product, elements of the marketing mix, and manufacturing operations over time to maximize the profits obtainable from the product over its life cycle.

**Product Line:** A group of products marketed by an organization to one general market. The products have some common characteristics, customers, and uses, and may also share technologies, distribution channels, prices, services, and other elements of the marketing mix.

**Product Management:** Ensuring over time that a product or service profitably meets the needs of customers by continually monitoring and modifying the elements of the marketing mix, including the product and its features, the communications strategy, distribution channels, and price.

**Product Manager:** The person responsible for overseeing all the activities that concern a particular product. Sometimes called a *brand manager* in consumer packaged goods firms.

**Product Plan:** Detailed summary of all the key elements involved in a new product development effort, such as product description, schedule, resources, financial estimates, and interface management plan.

**Product Platforms:** Underlying structures or basic architectures that are common across a group of products or that will be the basis of a series of products commercialized over many years.

**Product Portfolio:** The set of products and product lines the firm has placed in the market.

**Product Rejuvenation:** The process by which a mature or declining product is altered, updated, repackaged, or redesigned to lengthen its life cycle and extend the sales demand.

**Product Requirements Document:** The contract between, at a minimum, the marketing and development functional departments that describes completely and unambiguously the necessary attributes (functional performance requirements) of the product to be developed. It also includes information about how achievement of the attributes will be verified (i.e., through testing).

**Product Superiority:** Differentiation of a firm's products from those of competitors, achieved by providing consumers with greater benefits and value. This is one of the critical success factors in commercializing new products.

**Program Manager:** The organizational leader charged with responsibility for executing a portfolio of new product development projects.

- Project Leader:** The person responsible for managing an individual new product development project through to completion. He or she is responsible for ensuring that milestones and deliverables are achieved and that resources are utilized effectively. See also Team Leader.
- Project Management:** The set of people, tools, techniques, and processes used to define the project's goal and plan all the work necessary to reach that goal. This set also leads the project and support teams, monitors progress, and ensures that the project is completed in a satisfactory way.
- Project Pipeline Management:** Fine-tuning resource deployment smoothly for projects during ramp-up, ramp-down, and midcourse adjustments.
- Project Plan:** A formal approved document used to guide both project execution and control. The project plan documents planning assumptions and decisions, facilitates communication among stakeholders, and specifies the approved scope, cost, and schedule deadlines.
- Project Portfolio:** The set of projects in development at any point in time. These will vary in their degree of newness or innovativeness.
- Project Sponsor:** The authorization and funding source of the project. The person who defines the project goals and to whom the final results are presented, typically a senior manager.
- Project Strategy:** The goals and objectives of an individual product development project. They include how that project fits into the firm's product portfolio, who the target market is, and what problems the product will solve for those customers.
- Project Team:** A multifunctional group of individuals chartered to plan and execute a new product development project.
- Prospectors:** Firms that lead in technology, product, and market development and commercialization, even though an individual product may not lead to profits. Their general goal is to be first to market with any particular innovation.
- Protocol:** A statement of the attributes (mainly benefits; features only when required) that a new product is expected to have. A protocol is prepared prior to assigning the project to the technical development team. The benefits statement is agreed to by all parties involved in the project.
- Prototype:** A physical model of the new product concept. Depending on their purpose, prototypes may be nonworking, functionally working, or both functionally and aesthetically complete.
- Psychographics:** Characteristics of consumers that, rather than being purely demographic, include their attitudes, interests, opinions, cultures, and lifestyles.



**Pull-Through:** The revenue created when a new product or service positively impacts the sales of other products or services.

**Qualitative Cluster Analysis:** An individual- or group-based process using informed intuition for clustering and connecting data points.

**Qualitative Marketing Research:** Research conducted with a small number of respondents, either in groups or individually, to gain an impression of their beliefs, motivations, perceptions, and opinions. It is frequently used to define consumers' initial needs and obtain their initial reactions to ideas and concepts. Results are not representative of the market in general or projectable. Qualitative marketing research is used to show why people buy a particular product, whereas quantitative marketing research reveals how many people buy it.

**Quality:** The collection of attributes that, when present in a product, means that a product has conformed to or exceeded customer expectations.

**Quality Assurance/Compliance:** Function responsible for monitoring and evaluating development policies and practices to ensure that they meet company and applicable regulatory standards.

**Quality by Design:** The process used to design quality into the product, service, or process from the inception of product development.

**Quality Control Specifications and Procedures:** Documents that describe the procedures by which a finished subassembly or system will be evaluated and the specifications that a finished subassembly or system must meet before being judged ready for shipment.

**Quality Function Deployment (QFD):** A structured method employing matrix analysis for linking what the market requires to how it will be accomplished in the development effort. This method involves a multifunctional team agreeing on how customer needs relate to product specifications and the features that meet those needs. By clearly linking these aspects of product design, QFD minimizes the possibility of omitting important design characteristics or interactions across design characteristics. QFD is also an important mechanism in promoting multifunctional teamwork. Developed and introduced by Japanese auto manufacturers, QFD is widely used in the automotive industry.

**Quantitative Market Research:** Consumer research, often consisting of surveys, conducted with a large enough sample of consumers to produce statistically reliable results that can be used to project outcomes to the general consumer population. It is used to determine the importance of different customer needs, performance ratings of and satisfaction with current products, probability of trial, repurchase



rate, and product preferences. These techniques are used to reduce the uncertainty associated with many other aspects of product development.

**Radical Innovation:** A new product, generally containing new technologies, that significantly changes behaviors and consumption patterns in the marketplace.

**Rapid Prototyping:** Any of a variety of processes that avoid tooling time in producing prototypes or prototype parts and therefore allow (generally nonfunctioning) prototypes to be produced within hours or days rather than weeks. These prototypes are frequently used to quickly test the product's technical feasibility or consumer interest.

**Reactive Products:** Products with the ability to react to their environment in a stimulus-response manner. They are different from adaptive products in that their reactions to the environment are merely direct responses.

**Reactors:** Firms that have no coherent innovation strategy. They develop new products only when forced to by the competitive situation.

**Realization Gap:** The time between first perception of a need and the launch of a product that fills that need.

**Regiocentric Strategy:** The domination of regional headquarters, regional products, and brand management teams in a region.

**Render:** Process that industrial designers use to visualize their ideas by putting their thoughts on paper using various combinations of color markers, pencils and highlighters, or computer visualization software.

**Reposition:** To change the position of a product in the minds of customers, either on failure of the original positioning or in reaction to changes in the marketplace. Most frequently, products are repositioned by changing the marketing mix rather than redeveloping the product.

**Resource Matrix:** An array that shows the percentage of each nonmanagerial person's time that is to be devoted to each of the current projects in the firm's portfolio.

**Resource Plan:** Detailed summary of all forms of resources required to complete a product development project, including personnel, equipment, time, and finances.

**Responsibility Matrix:** A matrix indicating the specific involvement of each functional department or individual in each task or activity within each stage.

**Return on Investment (ROI):** A standard measure of project profitability representing the discounted profits over the life of the project expressed as a percentage of the initial investment.

**Rigid Gate:** A review point in a Stage-Gate™ process at which all the prior stages' work and deliverables must be complete before work in the next stage can begin.

**Risk:** An event or condition that may or may not occur but that, if it does occur, will impact the ability to achieve a project's objectives. In new product development, risks may take the form of market, technical, or organizational issues.

**Risk Acceptance:** An uncertain event or condition for which the project team has decided not to change the project plan. A team may be forced to accept an identified risk when they are unable to identify any other suitable response to the risk.

**Risk Avoidance:** Changing the project plan to eliminate a risk or to protect the project's objectives from any potential impact due to the risk.

**Risk Management:** The process of identifying, measuring, and mitigating the business risk in a product development project.

**Risk Mitigation:** Actions taken to reduce the probability and/or impact of a risk to below some threshold of acceptability.

**Risk Tolerance:** The level of risk that a project stakeholder is willing to accept. Tolerance levels are context specific. That is, stakeholders may be willing to accept different levels of risk for different types of risk, such as risks of project delay, price realization, and technical potential.

**Risk Transference:** Actions taken to shift the impact of a risk and the ownership of the risk response actions to a third party.

**Roadmapping:** A graphical multistep process used to forecast future market and/or technology changes and then plan the products to address these changes.

**Robust Design:** Designing products to make them less sensitive to variations, including manufacturing variation and misuse, and increasing the probability that they will perform as intended.

**“Rugby” Process:** A product development process in which stages are partially or heavily overlapped rather than sequential, with crisp demarcations between one stage and its successor.

**S-Curve (Technology S-Curve):** Technology performance improvements tend to progress over time in the form of an S curve. When a technology is first invented, its performance improves slowly and incrementally. Then, as experience with the new technology accrues, the rate of performance increase grows and technology performance increases. Finally, some of the performance limits of a new technology start to be reached and performance growth slows. At some point, the

limits of the technology may be reached and further improvements are not made. Often, the technology then becomes vulnerable to a substitute technology that is capable of making additional performance improvements. The substitute technology is usually on the lower, slower portion of its own S curve and quickly overtakes the original technology when performance accelerates during the middle (vertical) portion of the S curve.

**Scanner Test Markets:** Special test markets that provide retail point-of-sale scanner data from panels of consumers to help assess the product's performance. They were first widely used in the supermarket industry.

**Scenario Analysis:** A tool for envisioning alternate futures so that a strategy can be formulated to respond to future opportunities and challenges.

**Screening:** The process of evaluating and selecting new ideas or concepts to put into the project portfolio. Most firms now use a formal screening process with evaluation criteria that include customer, strategy, market, profitability, and feasibility dimensions.

**Segmentation:** The process of dividing a large, heterogeneous market into more homogeneous subgroups. Each subgroup, or segment, holds similar views about the product, and it values, purchases, and uses the product in similar ways.

**Senior Management:** The level of executive or operational management above the product development team that has approval authority or controls resources important to the development effort.

**Sensitivity Analysis:** A calculation of the impact that an uncertainty might have on the new product business case. It is conducted by setting upper and lower ranges on the assumptions involved and calculating the expected outcomes.

**Services:** Products, such as an airline flight or insurance policy, that are intangible or at least substantially so. If totally intangible, they are delivered directly from producer to user, cannot be transported or stored, and are instantly perishable. Service delivery usually involves customer participation in some important way. Services cannot be sold in the sense of ownership transfer, and they have no title of ownership.

**Short-Term Success:** The new product's performance shortly after launch, well within the first year of commercial sales.

**Should-Be Map:** A version of a process map depicting how a process will work in the future. A revised "as-is" process map, it is the result of the team's reengineering work.

**Simulated Test Market:** A form of quantitative market research and pretest market in which consumers are exposed to new products and

to their claims in a staged advertising and purchase situation. Output of the test is an early forecast of expected sales or market share based on mathematical forecasting models, management assumptions, and input of specific measurements from the simulation.

**Six Sigma:** A level of process performance that produces only 3.4 defects for every 1 million operations.

**Slip Rate:** Measures the accuracy of the planned project schedule according to the formula:  $\text{Slip Rate} = ([\text{Actual Schedule}/\text{Planned Schedule}] - 1) * 100\%$ .

**Social Sustainability:** Includes human rights, labor rights, and internal corporate governance. It is the idea that future generations should have the same or greater access to social resources as the current generation and that this access should be equitable.

**Specification:** A detailed description of the features and performance characteristics of a product. For example, a laptop computer's specification may read as a 90 megahertz Pentium, with 16 megabytes of RAM and 720 megabytes of hard disk space. It should also have 3.5 hours of battery life and a weight of 4.5 pounds, with an active matrix 256 color screen.

**Speed to Market:** The length of time it takes to develop a new product from an early initial idea to initial market sales. Precise definitions of the start and end points vary from one company to another and may vary from one project to another within the company.

**Sponsor:** An informal role in a product development project, usually performed by a high-ranking person in the firm who is not directly involved in the project. The sponsor is also ready to extend a helping hand if needed or provide a barrier to interference by others.

**Stage:** One group of concurrently accomplished tasks with specified outcomes and deliverables.

**Stage-Gate™ Process:** A widely employed product development process that divides the effort into distinct time-sequenced stages separated by management decision gates. Multifunctional teams must successfully complete a prescribed set of related cross-functional tasks in each stage before obtaining management approval to proceed to the next stage of product development. The framework of the Stage-Gate™ process includes work-flow and decision-flow paths and defines the supporting systems and practices necessary to ensure the process's ongoing smooth operation.

**Staged Product Development Activity:** The set of product development tasks carried out in stages, beginning when it is believed that there

are no major unknowns and ending with the first production of the salable product.

**Standard Cost:** See Factory Cost.

**Stop-Light Voting:** A convergent thinking technique by which participants vote their idea preferences using colored adhesive dots. Also called *preference voting*.

**Strategic Balance:** Balancing the portfolio of development projects along one or more of many dimensions such as focus versus diversification, short versus long term, high versus low risk, and extending existing platforms versus developing new platforms.

**Strategic New Product Development (SNPD):** The process that ties new product strategy to new product portfolio planning.

**Strategic Partnering:** An alliance or partnership between two firms (often one large corporation and one smaller entrepreneurial firm) to create a specialized new product. Typically, the large firm supplies capital and the necessary product development, marketing, manufacturing, and distribution capabilities, while the small firm supplies specialized technical or creative expertise.

**Strategic Pipeline Management:** Strategic balancing that entails setting priorities among the numerous opportunities and adjusting the organization's skill sets accordingly to deliver products.

**Strategic Plan:** Establishes the vision, mission, values, objectives, goals, and strategies of the organization's future state.

**Strategy:** The organization's vision, mission, and values. One subset of the firm's overall strategy is its innovation strategy.

**Subassembly:** A collection of components that can be put together as a single assembly to be inserted into a larger assembly or final product. Often the subassembly is tested for its ability to meet some set of explicit specifications before inclusion in the larger product.

**Success:** A product that meets its goals and performance expectations. Product development success has four dimensions. At the project level, there are three dimensions: financial, customer-based, and product technical performance. The fourth dimension is the new product's contribution to overall firm success.

**Support Service:** Any organizational function whose primary purpose is not product development but whose input is necessary to the successful completion of product development projects.

**Sustainable New Product Development:** This includes not only the environmental impact of a new product but also its long-term social and economic ramifications.

**System Hierarchy Diagram:** The diagram used to represent product architectures. This diagram shows how the product is broken into its chunks.

**Systems and Practices:** Established methods, procedures, and activities that either drive or hinder product development. These may relate to the firm's day-to-day business or may be specific to product development.

**Systems and Practices Team:** Senior managers representing all functions who work together to identify and change those systems and practices hindering product development and who establish new tools, systems, and practices for improving product development.

**Target Cost:** A cost objective established for a new product based on consideration of customer affordability. Target cost is treated as an independent requirement that must be satisfied along with other customer requirements.

**Target Market:** The group of consumers or potential customers selected for marketing. This market segment is most likely to buy the products within a given category. These consumers are sometimes called *prime prospects*.

**Task:** The smallest describable unit of accomplishment in completing a deliverable.

**Team:** The group of people who take part in the product development project. Often each team member represents a function, department, or specialty. Together they represent the full set of capabilities needed to complete the project.

**Team Leader:** The person leading the new product team. He or she is responsible for ensuring that milestones and deliverables are achieved but may not have any authority over project participants.

**Team Spotter's Guide:** A questionnaire used by a team leader (or team members) to diagnose the quality of the team's functioning.

**Technology-Driven:** A new product or new product strategy based on the strength of a technical capability. It is sometimes called *solutions in search of problems*.

**Technology Roadmap:** A graphic representation of technology evolution or technology plans mapped against time. It is used to guide new technology development for or technology selection in developing new products.

**Technology Stage Gate (TSG):** A process for managing the technology development efforts when there is high uncertainty and risk. The process brings a structured methodology for managing new

technology development without thwarting the creativity needed in this early stage of product development. It is specifically intended to manage high-risk technology development projects when there is uncertainty and risk that the technology discovery may never occur and therefore that the ultimate desired product characteristics might never be achieved.

**Technology Transfer:** The process of converting scientific findings from research laboratories into useful products by the commercial sector. It may also be considered as the process of transferring technology between alliance partners.

**Test Markets:** Launching a new product in one or more limited geographic regions in a very controlled manner and measuring the consumer response to the product and its launch. When multiple geographic areas are used in the test, different advertising or pricing policies may be tested and the results compared.

**Think Links:** Stimuli used in divergent thinking to help participants make new connections using seemingly unrelated concepts from a list of people, places, or things.

**Think Tanks:** Environments, often isolated from normal organizational activities, created by management to generate new ideas or approaches to solving organizational problems.

**Thought Organizers:** Tools that help categorize information associated with ideas so that the ideas can be placed into groups that can be more easily compared or evaluated.

**Three R's:** The fundamental steps of Record, Recall, and Reconstruct that most creative persons use when generating new product ideas.

**Threshold Criteria:** The minimum acceptable performance targets for any proposed product development project.

**Thumbnail:** The most minimal form of sketching, usually using pencils, to represent a product idea.

**Time to Market:** The length of time it takes to develop a new product from an early initial idea to initial market sales. Precise definitions of the start and end points vary from one company to another and may vary from one project to another within the company.

**Tone:** The feeling, emotion, or attitude most closely associated with using a product. The appropriate tone is important to include in consumer new product concepts and advertising.

**Total Quality Management (TQM):** A business improvement philosophy that comprehensively and continuously involves all of an organization's functions in improvement activities.



**Tracking Studies:** Surveys of consumers (usually conducted by telephone) following the product's launch to measure consumer awareness, attitudes, trial, adoption, and repurchase rates.

**Trade-off Analysis:** Determining the effect of decreasing one or more key factors and simultaneously increasing one or more other key factors in a decision, design, or project. It explores the cost of relaxing one goal in order to achieve an increase in another goal. A structured, disciplined process helps to do this properly.

**Trialability:** The perceived degree to which an innovation may be tried on a limited basis and is positively related to acceptance. A high level of trialability can accelerate acceptance because small-scale testing reduces risk.

**Triple Bottom Line:** Instead of just determining business success from a profit-and-loss point of view, the triple bottom line measures the financial, social, and environmental performance of the corporation over a period of time.

**TRIZ:** The acronym for the Theory of Inventive Problem Solving, which is a Russian systematic method of solving problems and creating multiple alternative solutions. It is based on an analysis and codification of technology solutions from millions of patents. The method enhances creativity by getting individuals to think beyond their own experience and to reach across disciplines in order to solve problems using solutions from other areas of science.

**Uncertainty Range:** The spread between the high (best case) and low (worst case) values in a business assumption.

**User:** Any person who uses a product or service to solve a problem or obtain a benefit, whether or not he or she purchases it. Users may consume a product, such as using shampoo to clean their hair or eating potato chips to assuage hunger between meals. Alternatively, users may not directly consume a product, but may interact with it over a long period of time, like a family owning a car, with multiple family members using it for many purposes over a number of years. Products also are employed in the production of other products or services, where the users may be the manufacturing personnel who operate the equipment.

**Utilities:** The weights derived from conjoint analysis that measure how much a product feature contributes to the purchase interest or preference.

**Value:** Customers look for "value for money" and generally determine the value of a new product by comparing its benefits to its price. The



formula is: Value to Customer = (Perceived Value a New Product Offers, as Judged by the Customer) – (Price).

**Value-Added:** The act or process by which tangible product features or intangible service attributes are bundled, combined, or packaged with other features and attributes to create a competitive advantage, reposition a product, or increase sales.

**Value Analysis:** A technique for analyzing systems and designs. Its purpose is to help develop a design that satisfies users by providing the needed user requirements in sufficient quality at an optimum (minimum) cost.

**Value Chain:** As a product moves from raw material to finished good delivered to the customer, value is added at each step in the manufacturing and delivery process. The value chain indicates the relative amount of value added at each of these steps.

**Value Proposition:** A short, clear, simple statement of how and on what dimensions a product concept will deliver value to prospective customers. The essence of value is embedded in the trade-off between the benefits a customer receives from a new product and the price the customer pays for it.

**Vertical Integration:** A firm's operation across multiple levels of the value chain. In the early 1900s, Ford Motor Company was extremely vertically integrated, as it owned forests and operated logging and wood-finishing and glass-making businesses. They made all of the components that went into the automobiles, as well as most of the raw materials used in those components.

**Virtual Customer:** A set of Web-based market research methods for gathering voice-of-the-customer data in all phases of product development.

**Virtual Product Development:** Paperless product development. All designs and analyses are computer-based.

**Virtual Reality:** Technology that enables a designer or user to enter and navigate a computer-generated three-dimensional environment. Users can change their viewpoint and interact with the objects in the scene in a way that simulates real-world experiences.

**Virtual Team:** Dispersed teams that communicate and work primarily by electronic means.

**Vision:** An act of imagining, guided by both foresight and informed discernment, that reveals the possibilities as well as the practical limits in new product development. It depicts the most desirable future state of a product or organization.

**Visionary Companies:** Leading innovators in their industries, they rank first or second in market share, profitability, growth, and shareholder performance. A substantial portion (e.g., 30 percent or more) of their sales are from products introduced in the last three years. Many firms want to benchmark these firms.

**Visions:** The new product development practitioner-oriented magazine of the PDMA.

**Voice of the Customer (VoC):** A process for eliciting needs from consumers that uses structured in-depth interviews to lead interviewees through a series of situations in which they experienced and found solutions to the set of problems being investigated. Needs are obtained through indirect questioning by coming to understand how the consumers found ways to meet their needs and, more important, why they chose the particular solutions they found.

**We-ness:** The feeling of belonging to a group, whether it is a large collection of people, a small social group, or a family.

**Workflow Design Team:** Functional contributors who work together to create and execute the work-flow component of a Stage-Gate™ system. They decide how the firm's Stage-Gate™ process will be structured, what tasks it will include, what decision points will be included, and who is involved at all points.

**Worth What Paid For (WWPF):** The quantitative evaluation by a customer of the question "Considering the products and services that your vendor offers, are they worth what you paid for them?"

**Acknowledgment:** Sources for definitions in this glossary include the PDMA Board of Directors; the editors and authors of *The PDMA ToolBook for New Product Development* (Wiley, 2002); the editors and authors of *The PDMA Handbook of New Product Development*, 1st and 2nd eds. (Wiley, 1996, 2004) PDMA Research Foundation; and PDMA members.

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