

SETTING THE **PACE**[®] IN PRODUCT DEVELOPMENT



REVISED EDITION

A GUIDE TO PRODUCT AND CYCLE-TIME EXCELLENCE[®]



MICHAEL E. McGRATH

Setting the ***PACE***[®]
in Product Development
Revised Edition

Setting the *PACE*® in Product Development Revised Edition

A Guide to *Product And*
Cycle-time Excellence®

Michael E. McGrath

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*We dedicate this book to the clients of
Pittiglio Rabin Todd & McGrath
— past, present, and future*

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Preface

Pittiglio Rabin Todd & McGrath (PRTM) initially developed the *Product And Cycle-time Excellence*® (PACE®) product development process in 1986. Mike Anthony, Amram Shapiro, and I published the initial version of this book in 1992 to describe PACE. Since then, many companies have used it as the best-practice model for improving their product development processes. This new version of the book updates the best practices in PACE by incorporating new insights gained over several years.

In many ways PACE has become the de facto standard process reference model for product development. It provides a common framework, standard terminology, industry-wide process benchmarks, a way of updating best practices, and a process for continuous improvement.

Numerous companies have implemented PACE concepts, and PRTM has assisted more than 140 of them in their implementation. In fact, of the approximately \$100 billion invested in R&D (research and development) by American companies in 1995, those using PACE account for more than \$15 billion, or 15% of the total. This number is increasing as more and more companies are applying PACE to improve product development. When PACE originated back in 1986, American and European companies were trying to catch up to Japanese companies that had achieved a competitive advantage by implementing new manufacturing processes based on just-in-time (JIT) principles. We decided to identify the next operational process improvement that had the potential to change the competitive balance of industries. It was product development.

At that time most companies didn't even recognize product development as a process, but they were acutely aware of the need to improve the way they did product development. No company was satisfied with its development effectiveness. Also at that time, there were no standard process reference models for a highly effective product development process. So we developed, tested, and refined PACE.

All of the concepts, techniques, and management practices contained in PACE are not necessarily new or unique. Over the last five to ten years, many

people have been trying to solve the problems associated with product development. Leading academics, such as Steve Wheelwright and Kim Clark at Harvard and Steve Rosenthal at Boston University, have done and continue to do some excellent research and writing in this area. Associations such as the PDMA (Product Development & Management Association) conduct research and conferences to promote the improvement of product development. Likewise, many very capable people in industry have advanced some of the management practices over the last five years.

There are two unique aspects of PACE. First, the PACE concepts, techniques, and management practices have subtle differences that make them more practicable and successful in actual implementation. Readers are encouraged to read each chapter carefully and not jump hastily to the conclusion that it must be exactly the same as something similar. Secondly, PACE is a complete framework. The individual elements, including the subtleties, work together to create a successful approach to improving product development.

This book, as was also the case with the earlier version, differs from the many other excellent books on product development in that it is empirically based rather than theoretically based. On any given day, PRTM is working with 20 to 25 major companies, helping them implement PACE. This extensive practical experience is generalized in PACE's best practices, and provides a practical complement to the excellent theoretical research done by others.

PACE's rapid acceptance has been fueled by the dramatic benefits that companies have achieved. We have found the following benefits to be typical:

- Time-to-market improvements of 40% to 60%
- Wasted product development reductions of 50% to 80%
- Product development productivity increases of 25% to 30%
- New product revenue (as a percentage of all revenue) increases of as much as 100%

These benefits are generally achieved by implementing the PACE project management elements: phase reviews, Core Teams, structured development, and development tools and techniques. These elements are essential to fast, high-quality, predictable project execution and constitute the first major stage of improvement. Our additional experience in implementing these has further validated the effectiveness of the original concepts. They work. Accordingly, we have made only minor modifications to the chapters (Chapters 3–6) that describe them, but we have added some thoughts in each of these chapters on where companies tend to go wrong.

Having successfully implemented the PACE project management elements and achieved the benefits described, companies then need to focus on the elements of cross-project management: product strategy, pipeline management, and technology management. We define these as the second major stage of improvement. The chapters (Chapters 7–9) describing these three elements have been completely rewritten to reflect rapidly evolving thought in this area.

The benefits derived from the cross-project management elements are less quantitative but more strategic. Managing product strategy as a process enables faster, more profitable growth. Pipeline management helps companies to deploy and balance resources to support multiple strategies. Technology management transforms technology development into an enabler for executing product strategies and achieving rapid, predictable time-to-market.

In Chapter 10, we describe the stages that companies typically go through in improving their product development processes. This framework helps companies position themselves along the stages of improvement and enables them to set targets for further improvement.

This updated version contains contributions from many people beyond Mike, Amram, and myself, reflecting the breadth and depth of PRTM's PACE consulting experience. For that reason there are more authors in this version. Each chapter identifies the author or authors of that chapter.

Many hundreds of man-years of consulting by PRTM consultants have continually enhanced the PACE methodologies, and it is impossible to acknowledge them all by name. Of special note, however, I would like to remember the contributions of Ted Pittiglio, one of PRTM's founders, to the development of PACE during its critical growing years. Ted passed away in 1994, but his contributions continue.

In completing this updated version we again have many people to thank. In particular, I would like to acknowledge the contributions of our world-class support staff, especially Beth Reed, who patiently pulled together the pieces of this book from many people.

Most of all, we would like to express our appreciation to the firm's clients. The challenges we tackle together with them continue to inspire us to push the state of the art farther and farther.

Michael E. McGrath
Pittiglio Rabin Todd & McGrath
Weston, Massachusetts
January 1996

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CHAPTER 1

The Dramatic Change Taking Place in Product Development

Michael E. McGrath

In the first edition, published in 1992, we declared that product development would be the industrial battleground of the 1990s and into the next century, just as manufacturing was the industrial battleground of the 1970s and 1980s. Not only has this happened, but the impact is even greater than we had imagined.

The advantages that come from cutting time-to-market in half and consistently developing better products are so significant that the competitive balance in some industries is changing in favor of companies that can achieve these goals first. Companies introducing more new products, reacting faster to market and technology changes, and developing superior products are winning the battle over competitors.

There are many similarities between the change that took place in manufacturing in previous decades and the change taking place in product development today. Each is significant enough to achieve a real competitive advantage and is sustainable through continual improvement. In each case, the opportunity stems from redefining the underlying process using new management concepts.

The benefits attained by improving product development can be strategically significant, including increased revenue, improved development productivity, and operational efficiencies. Understanding the expected benefits establishes the performance levels that companies should expect from improving their product development processes. This is important because some companies mistakenly think that they have already made sufficient changes to

their product development processes, even though they have not seen a significant performance improvement.

Benefits of a More Effective Product Development Process

For most companies, improving the product development process will have a greater strategic impact than any other improvement they can make. They will grow faster. They will react to opportunities and threats faster than their competitors. They will significantly improve product development productivity and increase efficiencies in other operational areas as well.

Faster time-to-market is the most visible improvement, but as time-to-market improves, many other benefits result. And time-to-market has been steadily improving.

A 1995 benchmarking study on product development showed an average improvement in time-to-market of almost 10% from 1992 to 1994.¹ However, this average improvement was not the result of every company improving by 10%; it came from a small percentage of companies making significant improvements while the rest made little or none. As can be seen in Figure 1-1, the best-in-class companies (top 20%) had a time-to-market of 50% or less of the other companies in their industry. While this difference varies a little by

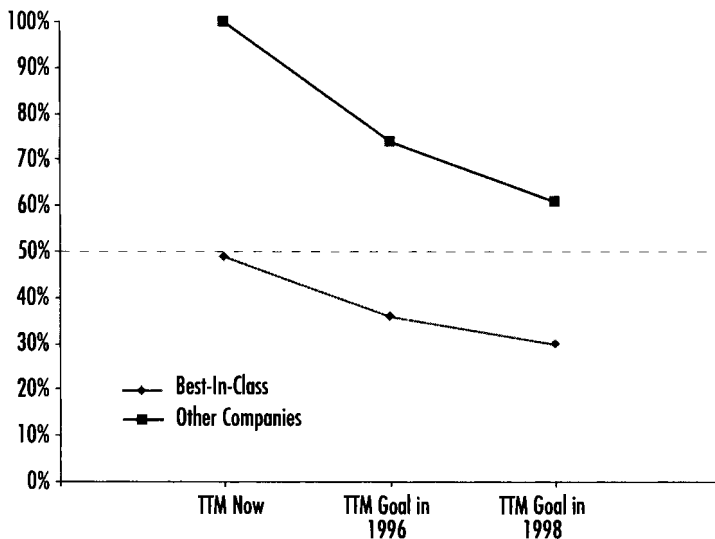


FIGURE 1-1 Comparative improvement in time-to-market (TTM) in technology-based companies.

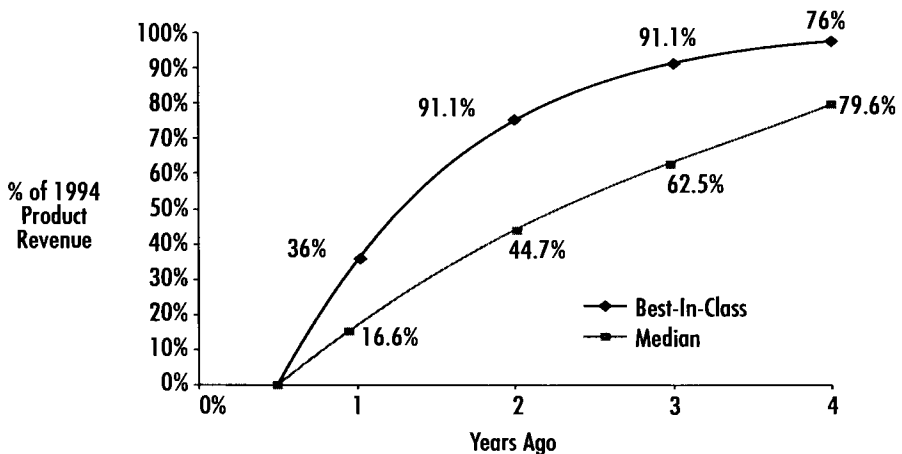
industry, it was almost 50% in all technology-based industries. Figure 1-1 also shows the trend expected. While other companies expect to improve time-to-market by 40% by 1998, they will still not be where the best-in-class companies are today, and the best-in-class will continue to get even better.

In our experience, most companies can cut time-to-market in half with a better product development process. For example, the Codex division of Motorola cut its average product development time by 46% over a two-year period.² Similarly, Bolt, Beranek and Newman dramatically reduced time-to-market by 50%–60% for the first product developed with its new process.³

Increased Revenue

In most companies, significant improvements in time-to-market can fuel revenue growth, at least until competitors catch up by improving their own product development processes. Alternatively, if competitors are able to improve their product development process first, a company may see a decline in revenue.

Figure 1-2 clearly illustrates this difference in electronic systems companies.⁴ The best-in-class companies have a much higher concentration of new products. Two years out, 75.3% of their revenue comes from new products, compared to a median of 44.7%. An increased level of new products usually



Note: New products are those introduced in the past 2 years

FIGURE 1-2 New product revenue as a percentage of total revenue in electronic systems companies.

leads to faster growth. It may also produce more profit, since new products can frequently be priced higher.

Higher new product revenue comes from increased product life-cycle revenue, increased market penetration, success in time-sensitive markets, and more successful products.

Increased product life-cycle revenue

A significant improvement in time-to-market increases revenue throughout a product's life cycle. Figure 1-3 illustrates how this happens. The lightly shaded curve represents a typical product life cycle of approximately four years, with a ramp-up in the beginning, a peak after two and one-half years, and then a ramp-down until the product is terminated or replaced by a newer product.

When a product is first introduced, early adopters are the primary customers. The broader base of customers beyond early adopters may be reluctant to try new products too early. Some customers are interested in trying one before they buy more, and more potential customers need to become aware of the new product before sales begin to climb. The image and reputation of the product need to develop.

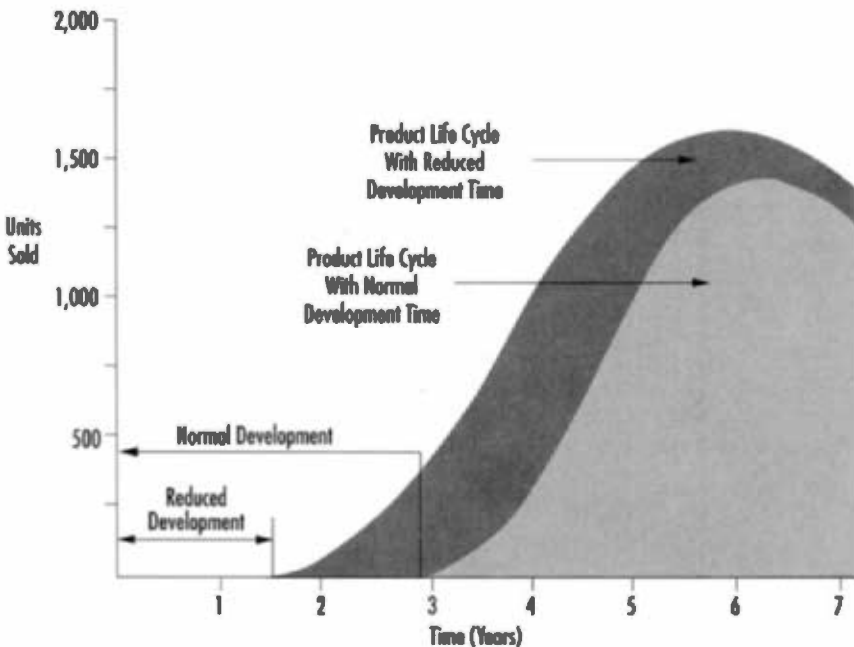


FIGURE 1-3 Product life-cycle curves with normal and faster time-to-market.

Sales climb substantially if the new product satisfies customers. Early adopters will continue purchasing, and more conservative customers will begin to follow their lead. New competitors may enter the market at this point, and existing competitors will introduce new product features in an attempt to expand the total market.

Eventually sales growth slows as the product enters a state of relative maturity. After a period of little or no growth, sales eventually decrease in the face of improved products from competitors or replacement products. At this point, most companies cease manufacturing and selling the product.

When a new product is brought to market earlier, it not only generates incrementally higher sales in the initial period but also maintains higher sales throughout its life cycle. This can be seen graphically in Figure 1-3, in which the darker-shaded curve shows product sales with a reduction of 45% in development time. Frequently there is a misconception that the only sales difference occurs during the time period from when the product could have been on the market to when it was actually introduced. While there are earlier revenues, there are also higher revenues at every stage of the product's life. Whenever a product is released to market, it follows a life-cycle curve. Incremental revenue accumulates every year until the peak is reached, and the peak is frequently higher for the earlier entry. Only in the last half of the life cycle may the rates converge.

Increased market penetration as a result of being first to market

A product that is first to market has the potential to establish a leadership position in the market. This potential can arise from three sources: being the first to respond to a new market opportunity, being the first to apply new technology, or being able to respond more quickly to changes in the market. The vice-chairman of Conner Peripherals, Bill Schroeder, stated this succinctly: "The first guy to market cleans up."⁵

Apple Computer was the first to respond to the opportunity for improving ease of use in personal computers with the Lisa and then the Macintosh computers. The Lisa did not succeed because of its high price, but Apple was able to deliver the same icon-based user interface in the lower-priced Macintosh before any other similar interface hit the market. This enabled it to significantly differentiate its personal computer and capture a specific segment of the market. If another personal computer company had beaten Apple to market with a user-friendly graphical interface, the Macintosh would have been much less successful.

Motorola (the former Codex division) was able to beat competitors to market with a new modem (CyberSURFER) that enabled connection to Internet and other on-line services over cable TV lines. Personal computers can run on the World Wide Web 1,000 times faster using this product. Motorola developed CyberSURFER in twelve months and immediately received significant orders from the major cable operators.

In some volume-sensitive industries, the competitor who captures significant market share first is likely to be the low-cost producer. Costs continue to decline with experience, and second-tier competitors can never be as profitable.

Being first to market, however, does not always guarantee success. EMI developed the original CAT scanner but did not have the support and service necessary to be successful. Competitors such as GE and Technicon offered better service and support and were capable of developing a successful product. In 1979 EMI received the Nobel prize for the CAT scanner, but the company had to be acquired in order to be saved.

Success in time-sensitive markets

In some industries, the windows of market opportunity remain open for only a short time. In these cases, the ability to make any sales at all depends on time-to-market. Customer-specific components such as custom semiconductor devices fall into this category. If a company can develop the component in time for it to be designed into the customer's end product, then the company may be able to get that customer's business; if it can't, a competitor gets it. Time-to-market and predictability become sources of significant competitive advantage in industries such as these.

The computer workstation market is an example of a time-sensitive market. Most workstations are purchased by systems integrators, companies that integrate their own proprietary equipment and applications software into a system that they sell to specific users. While the life cycle of a new generation of workstations may be three to four years, the systems integrator selects the workstation around which it will build its system very quickly after the release of a new generation.

Sun Microsystems believes that it has only a year to convince customers to buy its new products. If customers select Sun in that first year, they are likely to continue to order products for another three or four years. If Sun is late by a year, however, the company feels it has missed the market. At the end of 1985, Sun introduced the Sun 3 product line to replace the Sun 2 product line introduced in 1983. The Sun 3 was developed in approximately one year, giving Sun a significant advantage. Because it came to market sooner, more systems integrators selected it as the basis for their systems. Sun Microsystems' revenue skyrocketed from \$115 million in 1985 to more than \$1 billion in three years. Sun's market share also leaped from 16% to 28%, while that of its major competitor, Apollo, dropped from 51% to 31%.

More successful products

Our experience in improving product development processes has also shown dramatic improvement in the success of new products. This stems from some of the aspects of a better process, such as the synergy of having people work more closely together, the design improvements of a more methodical process,