

THE FUZZY FRONT END FOR INCREMENTAL, PLATFORM AND BREAKTHROUGH PRODUCTS AND SERVICES

Peter A. Koen

INTRODUCTION

The innovation process may be divided into three areas: the Fuzzy Front End (FFE), the New Product Development Portion (NPD) and commercialization as indicated in the figure 1. Most projects, once the concept is defined in the FFE, are managed in the NPD portion using the traditional “Stage Gate™” (Cooper, 2001) process. However, three separate strategies and processes are typically involved in the FFE for incremental, platform and radical projects. The objective of this chapter is to provide the reader with an overview of each of these strategies and processes.

<Insert figure 1>

WHAT IS THE FRONT END?

The FFE is defined by those activities that come before the more formal and well structured NPD process (Koen, et. al., 2002). Even though there is a continuum between the FFE and the new product development, the activities in the FFE are often chaotic, unpredictable and unstructured. In comparison, the new product development process is typically structured which assumes formalism with a prescribed set of activities and questions to be answered.

Most companies utilize either a formal “Stage Gate™” (Cooper, 2001) or “PACE® approach” (McGrath and Aklyama, 1996) for managing product development. A schematic of the “typical” five stage five gate model is shown in figure 2. Many companies consider the FFE to include the 1st 2 stages and is completed at Gate 3 with a business plan which includes the product specifications as well as detailed business and financial analysis. However, the traditional Stage Gate™ process was designed for incremental product development and “...may be inappropriate...” (Cooper, 2001, pg 151) when applied to platform or breakthrough projects.

<Insert figure 2>

WHAT ARE INCREMENTAL, PLATFORM AND BREAKTHROUGH PRODUCTS?

The Wheelwright and Clark (1992) typology shown in figure 3 may be used to characterize incremental, platform and breakthrough products. It characterizes products based on the extent of product and process change. Breakthroughs involve substantive product and process change. Incremental products require little product or process change. Between these two extremes are platform products. Incremental products are generally considered to be cost reductions, improvements to existing product lines, additions to existing platforms and repositioning of existing products introduced in markets well known to the company, with well-identified customer needs using technology in which the company already has expertise. Platform products (Meyer and Lehnerd, 1997) establish a basic architecture for a next generation product or process and are substantially larger in scope and resources than incremental projects. An example of a platform product would be Kodak's disposable single use 35 mm camera (called the fun-saver). An incremental extension would include a stretch version of the camera (i.e. panoramic) and a waterproof version. Breakthrough products (i.e. new to the company or new to the world) typically offer a 5-10 times or greater improvement in performance combined with a 30-50% or greater reduction in costs (Leifer, et. al. 2000). Breakthrough products typically involve high risk technologies (i.e. inventions yet to occur) while platform products involve less risky technologies. Polaroid's development of an instant film camera would be considered to be a breakthrough product involving the development of special chemicals which would allow the film to develop within a short period of time.

The FFE strategies and processes for each of these product categories are discussed in the next three sections.

<insert figure 3>

FUZZY FRONT END FOR INCRMENTAL PRODUCTS

New product ideas for incremental products are usually determined from the overall strategic planning process or as part of an idea suggestion program. Once identified they go through Stage 1 (see figure 2) – which is a “gentle” screen which evaluates the strategic fit, market attractiveness, technical feasibility and the identification of any killer variables. The gatekeepers are often not senior management, but technical and marketing people. Resources, people and monies, are assigned to the project to perform both an initial market and technical assessment. The purpose of this stage is to determine if the idea still looks feasible to pass through Gate 2 – which is a more rigorous screen. If the project passes through Gate 2 a detailed business case is developed which includes market definition and segmentation, product

positioning, product win statement, product specifications, market entry strategy, technology and operational strategy and a financial. In depth market investigations are done in this stage to understand both segmentation and customer needs. Competitive assessments along with intellectual property evaluations which determine both freedom to operate and ability to gain a competitive advantage are also analyzed. The developed business case is then evaluated in Gate 3, typically by a senior management team, and allowed to continue into product development if the project relative to other projects is expected to have the appropriate level of impact on the company's project portfolio. Most often the decisions on incremental projects are based on the financial attractiveness of the project. The gate committee will then empower a multi-function team to begin product development based on the specifications detailed in the stage 2 business case. An example of an incremental product might be the addition of a color screen to an existing PDA line, which in the past, only included black and white screens. Though the assumption is that the new screen would fit into the existing architecture (i.e. size, power characteristics and functionality) such that the new product can use essentially the same manufacturing line, parts and molds as the black/white PDA. This process flows nicely for incremental products which are already part of the overall strategic planning process. Incremental and unplanned ideas, which are out of the strategic planning cycle, often need to fight for resources to get through gate 1. Some companies have "seed-stage" funds available to gate 1 decision makers so that some resources may be applied to these early stage ideas. Without some resources it is often difficult for the new product idea to gain the market, customer and competitive knowledge so that it can survive a gate 2 review.

Many companies maintain a web enabled idea generation process on their intranet so that any individual may submit ideas. This process works effectively if these ideas are reviewed periodically with frequent feedback, ideally within 2 weeks, to the submitter. Though many companies have become disenchanted with the process as it becomes overwhelmed with ideas and feedback lengthens to months or ceases to exist. Recently, several companies have been successful with web enabled idea generation with targeted "idea events." For example a company might be interested in hearing specifically about ideas for achieving a 10-15% cost reduction in a major product line. The "event" would be open to anyone in the company and would occur over a specific time period – say 2 months. Monetary incentives (i.e. a percentage of the cost savings) typically result in a large number of submissions – though can often distract key people from working on their own projects which may have an even larger pay back for the company.

FUZZY FRONT END FOR PLATFORM PRODUCTS

The traditional Stage Gate™ processes, discussed previously, was designed for a single product – not the development of a platform product which may require a multimarket, multiproduct plan which will share common architecture and have common systems and interfaces.

A classic example of a platform product was the development of a new common universal motor with a fixed width and variable length which can be used by Black and Decker in all of the their products (i.e. drills, sanders, circular saws, hedge trimmers, etc.) instead of the hundreds of different motors manufactured on different production lines. The result of this change in product architecture resulted in Black and Decker being able to market a lighter and more profitable drill at ½ the price. As a result Black and Decker gained dominant market share and drove many competitors out of business (Meyer and Zack, 1996). McGrath (2001, pg. 54) indicates that “...failures in high tech companies frequently can be traced to an incomplete platform strategy...”

The FFE for developing a new platform starts out with a strategic vision of where the company wants to develop products. This vision can come from the need to develop a new generation product to obsolete the current. For example, Xerox realized that digital technology was a major threat to their lens copier line and needed to develop a new generation of copiers and printers based on digital technology. Black and Decker (Meyer and Lehnerd, 1997), in the example indicated above, felt that they needed to dramatically revitalize their product line as a result of less expensive offshore manufacturers making inroads into their market, the rising cost of labor and materials which were decreasing their margins and higher standards of safety requiring major redesigns of their products. Back and Decker’s strategic vision was to redesign all of the power tools at the same time, redesign manufacturing to achieve a substantial cost advantage and meet the new regulatory requirements at no increase in price to the consumer. Alternatively the vision can come from the need to develop a new product platform so that the company may expand into a new market. An example here would be a strategic vision for Honda to use its competences in automobile engines to develop lawn mowers and motorcycles. Product strategies to meet the strategic vision in this later example are often supplemented with acquisition strategies when new market channels are needed.

The vision needs to be aligned with the business. Though, the strategic vision may be a catalysis for changing the business charter. For example, a product vision indicating the desire to develop motor cycles would require the business charter to change. Lynn and Akgun (2001)

indicate that an effective vision should have 3 components: 1) clarity (i.e. refers to having a well articulated and easy to understand target); 2) support (i.e. implies commitment from people throughout the organization to support the vision) and 3) stability (i.e. refers to having the vision remain stable over time).

Developing a platform and accompanying product strategy based on the strategic vision typically is done in the following 4 chronological steps. This effort should NOT be undertaken until there is consensus between the team and senior management on the strategic vision.

1. Segmenting and understanding the market. Before specific concepts can be developed the platform team needs to clearly understand how the market is segmented, the unmet customer needs in and strength of the competitors within each segment.
2. Developing initial product concepts. Product concepts which satisfy the needs and build on the core competencies, capabilities or channels of the company. A concept (Koen, et. al. 2002) is not a product, but a well defined form including both a written and visual description, which includes its primary features and customer benefits combined with some understanding of the technology needed. A product concept for the Black and Decker example could consist of rough sketches of a common motor and how it could integrate and be part of drills, sanders and circular saws. Ultimately the product concept needs to build on some unique skills of the company so that a competitive advantage and favorable margins may be achieved. Multiple product concepts are developed then reevaluated to assess their attractiveness to the market and the company.
3. Developing the product family. Once the initial concepts are determined a product family with its accompanying product roadmap (Wheelwright and Sasser, 1989) is developed. For example HP's Product roadmap of its ink jet printers consisted of its Deskjet (i.e. the initial offering) followed by the Deskjet Plus, the Deskjet writer for Macintosh and then the Deskjet 500, etc.
4. Determining the economic case. Ultimately a business case needs to be developed for the product platform which needs senior management approval. Although the first product released from the product platform may have a negative return on investment since it may have to absorb considerable R&D and operational expenses which are part of the overall platform plan. Traditional "hurdle rate" calculations need to be done on the product family with its stream of products based on a common architecture rather than on the initial offering.

Typically the platform plan, with its first product is evaluated at Gate 3, with subsequent incremental extensions following the traditional Stage Gate™ process. The overall process

typically is an intensive effort that involves 3 -5 people for often as much as 6 months. Though the project can often be shortened to 2 – 3 months if many of the members of the team are committed on a full time basis. The reader is referred to several classic books (Meyer and Lehnerd, 1997; McGrath, 2001) and a several articles on platform development (Meyer and Mugge, 2001; Meyer and DeTore, 1999; Meyer and Seliger, 1998).

FUZZY FRONT END FOR BREAKTHROUGH PRODUCTS

Breakthrough products (i.e. new to the company or new the world) typically begin either with a strategic vision or are identified and persevered by an individual/product champion (Markham, 2002).

Examples of breakthrough products which have occurred as a result of a strategic vision are Tagamet and Corning's catalytic converter. Tagamet (Nayak and Ketteringham, 1986), the 1st billion drug in the pharmaceutical industry began with vision of developing a new class of drug, called H₂ antagonists, for healing ulcers more quickly and painlessly than previous drugs. Smith Kline and French agreed to support this vision. The project began in 1964 with a budget of \$2.5 million. The product was not released until 1976, 12 years after the initial effort. This project succeeded as a result of the brilliance and tenacity of the research team combined with a senior management vision which was clear, stable and supported. Corning achieved a huge success in developing the successful ceramic substrate for catalytic converters. Corning senior management set forth a compelling vision to develop the next generation of catalytic converters when they realized the huge potential as a result of the reduced emission requirement of the Clean Air Act. These factors were so compelling that Corning, in 1970, directed hundreds of scientists and engineers to focus on this single challenge. The resulting product has been used on more than 300 million automobiles. Technology development in these high risk projects are often managed by a Technology Stage Gate (Elred and Shapiro, 1996; Elred and McGrath, 1997; Ajamian and Koen, 2002) process which involves many of the characteristics of the traditional Stage Gate™ process, but encompass methodologies to manage the risk and uncertainty of dealing with discoveries which have not yet occurred. Standard financial methods for analyzing these types of projects do not work well. A summary of risk methodologies and other techniques are discussed by Koen, et. al. (2002).

Many discoveries are accidental and often establish entirely new markets. Perhaps the classic example was the development of the 3M Notepad (Nayak and Ketteringham, 1986) whose journey began when Spence Silver recognized that he had invented an unusual glue

which was more tacky than adhesive. Silver invented this unique adhesive in 1968. Despite visiting almost every division in 3M he could not find any use for it. In fact he had to wage a battle even to get the invention patented – which 3M reluctantly did – but only in the US. It was not until 1974 when Art Fry, a colleague of Silver's, dropped his hymn book and the slips of paper that he had used to mark places in the hymn book fluttered to the floor. Art Fry had his “eureka” moment and envisioned the concept which is now a huge business for 3M.

While accidental discoveries are a common occurrence in most companies it is critical that the culture of a company allows individual's freedom to try their ideas without sacrificing their career. While 3M did not financially support Silver's quest when he first discovered this unique adhesive – they did not prevent him from trying to find an opportunity – provided he still meet his expected duties. Perhaps this is best described as a “caring” organization (Krough, 1998). Care may be thought of as the way parents think of their children. In another words, the culture needs to value the individual and provide a degree of trust that he or she will do the right thing. Care could be considered the soil in which accidental discoveries need to germinate in. Without it they will quickly die. And even with it only a few seeds will germinate into truly breakthrough products. Zein and Buckler (1997), in their study of 13 innovative companies, found that these companies valued the individual and had an environment that was conducive to high personal motivation. Similarly, Prather (2000) based in his work at DuPont found that trust and openness that allows people to speak their minds and offer contrasting opinions was important for maintaining an environment conducive to innovation. In summary, an organization that values and trusts the individual is a necessary condition for allowing individual discoveries which may lead to a breakthrough, which may or may not be aligned with the strategy of the corporation, to germinate.

CONCLUSIONS

The overall objective of this chapter was to provide the reader with a more holistic view of the FFE and an understanding that it includes not only incremental idea generation, but platform and breakthrough development. The Stage Gate™ process is an effective tool for accelerating incremental product development. However, it cannot be directly used for the FFE of platform or breakthrough products. Platform products need to begin with a strategic vision which will lead to a family of products based on an in-depth understanding of the market and how the companies core competencies and capabilities may be used to build competitive advantage. A robust method for developing new and sustaining existing platforms is typically

associated with the most innovative companies. Breakthroughs start out with a similar strategic vision, but are usually associated with technologies which require new discoveries. These projects may be managed during the discovery efforts by the Technology Stage Process. Many breakthrough discoveries occur by accident. However, these innovations can only succeed in a caring organization.

REFERENCES

Ajamian, G. and Koen, P.A., "Technology Stage Gate: A Structured Process for Managing High Risk, New Technology Projects," In P. Belliveau, A Griffen and S. Sorermeyer, eds. *PDMA Toolbook for New Product Development*. New York: John Wiley and Sons, 267 - 295, 2002.

Booz, Allen and Hamilton, Inc. *New Product Management for the 1980's*. New York: Booz Allen and Hamilton, Inc., 1982.

Cooper, R. G. *Winning at New Products*, 3rd addition, Perseus Publishing, Cambridge, MA 2001.

Koen, P.A. Ajamian, G., Boyce, S., Clamen, A., Fisher, E., Fountoulakis, S., Johnson A., Puri. P., Seibert, R., "Fuzzy-Front End: Effective Methods, Tools and Techniques," In P. Belliveau, A Griffen and S. Sorermeyer, eds. *PDMA Toolbook for New Product Development*. New York: John Wiley and Sons, 2 -35, 2002.

Leifer, R., McDermott, C.M., O'Connor, G.C., Peters, L.S., Rice, M. and R. W. Veryzer. *Radical Innovation*. Massachusetts: Harvard Business Press, (2000).

Lynn, G.S. and Akgun, A.E., "Project visioning: Its components and impact on new product success." *Journal of Product Innovation Management*, 18:374 – 387, (2001).

Markham, S.K., "Product Champions: Crossing the Valley of Death," In P. Belliveau, A Griffen and S. Sorermeyer, eds. *PDMA Toolbook for New Product Development*. New York: John Wiley and Sons, 119 - 140, 2002.

McGarth, M.E., *Product Strategy for High-Technology Companies*," 2nd addition McGraw-Hill, NY, 2001.

McGrath, M.E. and C. L. Akiyama "PACE: An Integrated Process for Product and Cycle Time Excellence." In M.E. McGrath, eds. *Setting the PACE in Product Development*, Butterworth and Heinemann, Boston, 1996.

Meyer, M. H. and DeTore, A., "Product development for services," *Academy of Management Executive*, 13(3): 64 – 76 (1999).

Meyer, M. H. and Seliger, R., "Product Platforms in Software Development," *Sloan Management Review*, 40(1): 61 – 63, 1998.

Meyer, M.H. and Lehnerd, L., *The Power of Product Platforms*, New York: The Free Press, 1997

Meyer, M.H., and Mugge, P.C., "Make Platform Innovation Drive Enterprise Growth," *Research Technology Management*, 44 (1): 25 – 39 (2001).

Nayak, P. R. and J. M. Kettingham. *Breakthroughs*. San Diego, CA: Pfeiffer and Co., 1994
von Krogh, G., "Care in Knowledge Creation," *California Management Review*, 40:3 133 – 153, 1998.

Prather, C.W. "Keeping Innovation Alive After the Consultants Leave," *Research Technology Management* 43 (5): 17-22 (September-October 2000).

Wheelwright, S. C. and Clark, K. B., "Revolutionizing Product Development," Free Press, NY, 1992.

Wheelwright, S.C. and Sasser, W.E. "The new product development map," *Harvard Business Review*, 112-125 (May – June 1989),

Zien, K.A. and Buckler, S.A. From experience dreams to market: crafting a culture of innovation. *Journal of Product Innovation Management*, 14:274-287 (1997).

FIGURES

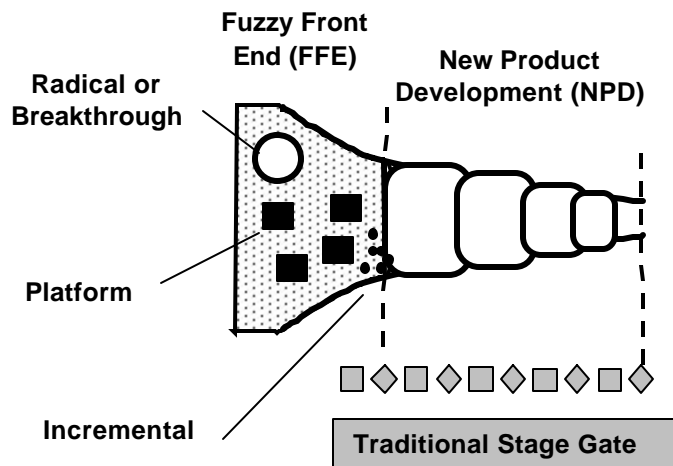


Figure 1. The innovation process may be broken into three parts: the Fuzzy Front End (FFE), new product development (NPD) and commercialization.

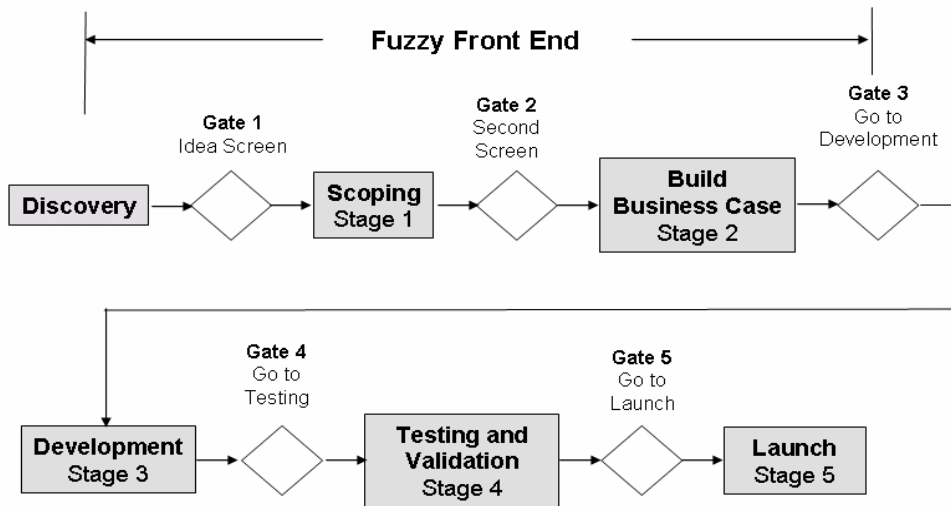


Figure 2. Typical five stage, five gate model of Stage Gate™. (Copyright needed from Cooper's book, Winning at New Products).

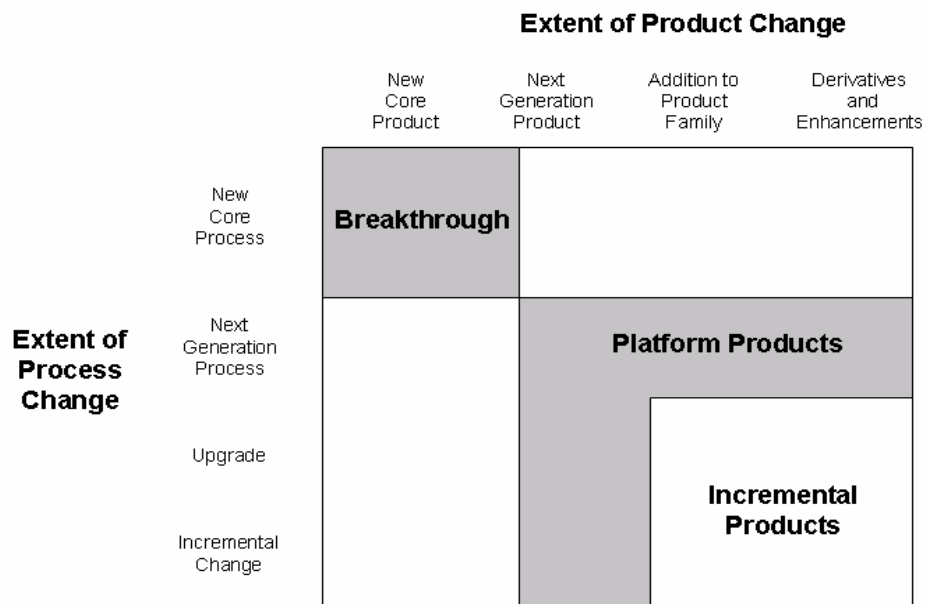


Figure 3. Typology of new products (Wheelwright and Clark, 1992) indicating the differences between incremental, platform and breakthrough products. (Copyright permission needed from Wheelwright and Clark's book).