

## PRODUCT PORTFOLIO MANAGEMENT BEST PRACTICES FOR NEW PRODUCT DEVELOPMENT: A REVIEW OF MODELS

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**Abstract:** The survival of any industrial organization depends on whether producing goods or services hinge on how innovative they have become in managing their product portfolio to craft new products that changes with the ever-changing tastes and needs of their customers. This study delves in to the models and theories that drive product portfolio management practices in a way that they support the successes of new product development. Our review is based on selected studies at the frontier of product management, summarized, and compared based on authors experiences, subsisting models, and theories with the results purely based on qualitative rather than quantitative approaches. The essence is to explore possible new theory or model in this field of research.

**Keywords:** product portfolio management, new product development, best practices.

### 1 Introduction

The development of new and improved products is crucial to the survival and prosperity of the modern corporation. On an average, new products launched often account for over a quarter companies' sales (Cooper & Edgett, 2003; Cooper, Edgett, & Kleinschmidt, 2004). In the words of Von Braun (1997), the product life cycles are getting rapidly shorter experiencing, on an average, about a 400 percent reduction over the past five to seven decades, which emphasis the outcomes of an exacerbating pace of new product development.

According to Patterson (1998), the expectation is that investments in new products to increase the growth for the business, in terms of increases in revenue and profits created by a steady stream of new products are needed to fund the growth of the business.

In addition, business leaders expect their new product efforts to increase the competitive strength of the firm, both now and in the future. However, not all the new product projects get to succeed, while not more than a half of the new product developed achieved their financial target, about that also get to be launched on schedule (see Cooper, 2005).

An effective new product development program is, nonetheless, a culmination of several factors.

Understanding why new products succeed and why some businesses are so much better at new product development is essential to effective new product management. The invention of new technology and research and development (R&D) are very vital, but these alone cannot ensure business success.

Effective portfolio planning and management activities are also needed to aim the new product program at a profitable and suitable future and to ensure the continuing effectiveness of current projects. New product expenses are often the largest investments that a business enterprise makes and, as with any investment, they should be managed carefully and with due diligence. Yet, in many firms, new product activities get too little mind share from business leaders.

The pivotal role that new product development plays in business strategies vis-à-vis the financial time and manpower resources deployed for its success brings to fore the quest for how best to manage products portfolio that will improve on the successes recorded on the development of new products as a strategy for business growth.

In the sections that follow, discussions that outline the new product development projects processes and the key activities pertaining to the effective tracking and management of these investments, which the business leadership team must own and carry out effectively, are presented.

## 2 New Product Development

The set of choices that businesses have to make when building a plan of action for converting a new product concept into a product are the new product strategy addressed in this section. Cooper (1990) posits that new product is able to help companies much more quickly and efficiently if planning precedes the commencement of the product development.

Put more succinctly, the plan addresses issues that, when resolved, can create value for desirable customers and can capture value for the developers' business unit (Roseneau, Griffin, Castellion and Anschuetz, 1996). He further asserted that a skillfully assembled development strategy can play a major role in developing a new product concept, which encompasses selecting the environment where the product will compete and explaining why it can win, thus helping to set direction and focuses the development work.

The first mention of new product development process was in 1966, which expressed that product development go far beyond just internal R&D but that every steps in the entire new products evolution process must be well laid out and planned (see Griffin,

2010). Sherman (1966) outlined a six-stage process that firms must follow in new product development, namely, exploration, screening, business analysis, development, testing, and commercialization. Their models included proceed and not to precede decisions that managements must make at every stage of the development process.

Since then significant amount of researches have been done in this area, prominent among the early scholar is Cooper (1990) who put forward the stage-gate process (see Fig. 1). Cooper (1990) concluded based on three case studies that an effective product development processes need to consist of a sequence of discrete stages, proactively integrate marketing and technical activities, allow for activities to be conducted in sequence at times and in parallel at other times, and provide for making incremental commitments to projects over time (see Cooper, 1976).

Over the decade that follows, Cooper and other renowned coauthors in the area of new product development further developed and refined what effective processes include, what impact each step had on the outcomes of new product, and how well various steps are carried out.

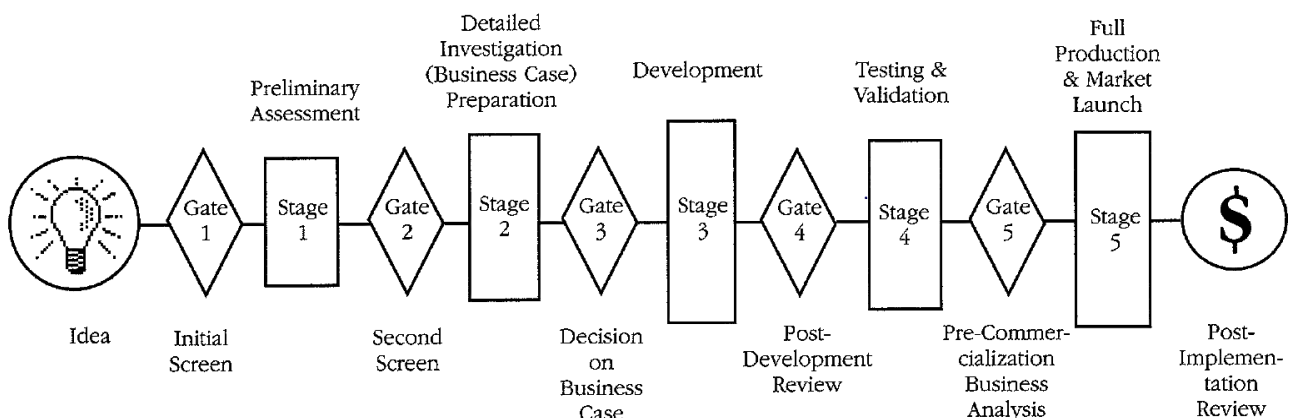


Figure 1. The stage-gate model  
(source: Cooper, 1990)

The main preoccupation of the Cooper's stage-gate process is providing a bespoke product development pathway from idea conception till production and launch of the product. In other words, it is a simplified linear illustration of the total process innovation

and commercialization. A major assumption of the model is the apparent linear nature of the process aligning with one of the objectives of developing formal new product development processes, which is to eliminate repetitions back into the earlier phases

of the process necessitated by infeasible or unimplementable concepts having proceeded far along the development path toward commercialization (Griffin, 2010). This approach among other researches in this area, however, presupposes new technology capabilities have been developed such that the new product development processes focus on tasks to be completed from the idea concept that is generated, when it is ready to go into initial screening.

Smith and Reinertsen (1991) argue that gaining product acceptance into the formalized process development structure and the front end of innovation, which are the two other aspects of new product development processes that generally fall outside the scope of (and most frequently precede) the more formalized new product development process stages represented by stage-gate types of processes, must also be considered in managing the overall innovation and new product development process.

Cooper and Kleinschmidt (1986) itemized 13 new product process activities to include initial screening, preliminary market assessment, preliminary technical assessment, detailed market study/market research, business and financial analysis, product development, in-house product testing, customers test of product, test markets/trial sell, trial production, pre-commercialization business analysis, production start-up, and market launch. These constitute a further expansion cum application of the well-publicized generalized stage-gate model for new product development.

Beyond the rhetoric of stage gate is the time-based management that Karagozoglu and Brown (1993) emphasized in their research as vital in new product development and suggested that some of the well-documented approaches to success of new product development need to be replaced with their time-based versions.

According to Calantone, Vickery and Dröge (1995), there is no one stop shop models and/or strategies for new product development as there is no roadmap proofing the right way to perform new product development. This is because industries differ in complexity and process and what suite one might not serve the other. And so, it is more highly unlikely that such a formula that will be applicable to all

firms could be developed, no single set of new product development activities or steps can be defined that will be appropriate for all firms.

Calantone, et al. (1995), however, proposed the possibility of developing an industry-specific framework that is industry based. Basing their research on identifying the relationship between the performance of specific innovation-related activities and overall business performance in the furniture industry, they further suggest that successful companies within an industry are likely to focus on certain essential new product development activities that allow them to achieve the best possible results within the constraints of their market.

This study also assesses the relationship between a firm's performance on a new product development activity and the importance assigned to that activity by the firm's chief executive officer (CEO). With the current emphasis on cross-functional teams, the study also seeks to determine whether performance on a given new product development activity is related to the assignment of responsibility for that activity.

In similar studies in the telecommunication industry, Barczak (1995) admits that the lifeblood for firms that hope to remain competitive in high-technology industries such as telecommunications is a continuous flow of new products. Agreeing with Von Braun (1997), he argued that firms must aggressively pursue the quest for more effective new product development as they are faced with rapidly shrinking product life cycles. Ongoing success in such industries is dependent on choosing the right mix of new product strategy, organizational structure, and new product development processes.

Another new ways to product development that tends to be more customer oriented and feedback driven is the role played by social networks (Leenders and Dolfsma, 2016). Taking a look at the measures and approaches of social network, Leenders and Dolfsma (2016) discuss the role of social networks in new product development. They argue that social networks are inherently multilevel and consider the following four levels: networks inside a firm, networks that cross firm boundaries, networks between firms, and networks that reside outside of the firm that could impact the nature of new product a busi-

ness could venture into. Hence, suggesting the likelihood of the future of innovation and new product development been shaped by that inspired by insights and methods from social network analysis.

### 3 Product Development Strategy

Strategy according to Mintzberg, Ahlstrand and Lampel (2005) pertains to the selection of a specific position, “an effective strategist can sometimes find a place to stand in a deep lake; alternatively, ineffective ones sometimes drawn in lakes that are on average shallow”.

This underscore the importance of selecting appropriate strategies in developing new products, given the fact that product failure is not a function of how much is expended on the project.

Castellion (2005) outlined a number of questions that product idea’s developers must answer in developing new products: Who the target customers of the new product are? Which three of the four critical benefits of the product create enough value for target customers to choose to buy new product rather than competing offering? And how those benefits could be produced cost effectively and at correct price?

He further stated that the two critical strategic decisions that product development groups must make on a daily basis are value creation for the product customers and business units having an acceptable share of value created.

The main objective of new product strategy is to provide a unifying direction. It mostly notes any fascinating development areas that are not within the limit of the proposed new product; it clearly specifies those areas where effort is to proceed; and it adds any other direction appropriate and relevant to the firm, as in the Mohawk strategy. Crawford (1972) put together a review of representative strategy statements that constitutes the main consideration in the new product development.

- Technology/Market Mix

Johnson and Jones (1957) and Booz, Allen and Hamilton (1968) came up with a classic review of what rapidly became known as BAH method of organizing the new product function. Their article contained a table shown in Fig. 2 that are usually contained in every plan of businesses that sought to develop new products.

The table presents a diagrammed alternative available for new product activity as a  $3 \times 3$  matrix. This table structurally depicts the possible nine combinations of market and technology. Some, all, or none of these combinations may be used, as the applicability of each of the options may differ from business to business. Unless it values new and improved products for their own sake, any management will want to study thoroughly the various cost–return relationships and stipulate those which it wants to stress and those it wishes to avoid (Crawford, 1972).

	No Technological Change	Improved Technology	New Technology
No Market Change	No Activity	Reformulation	Replacement
Strengthened Market	Remerchandising	Improved Product	Line Extension
New Market	New Use	Market Extension	Diversification

Figure 2. Options in market-technology mix  
(source: Johnson and Jones, 1957)

- **Market Width Consideration**

The last row of the matrix, New Market, provides the third dimension into the considerations the table does not include. Here due consideration must be accorded to the target customers and the market where the proposed new product to be developed will be sold. Specific product categories have different industrial, institutional, and consumer, of domestic and foreign, that must be taking cognizance of. Businesses with many new products will usually cover these dimension as most industrial firms prefer institutional markets to consumer products. The involvement in foreign markets is usually deliberate and, in most situations, so is choosing broad product categories. It is absolutely a major concern in new product development as the ability to sell the product itself determines the success or otherwise of the product.

- **Innovation**

Innovation is at the heart of new product development. There are choices that organization faces in the form of innovative activities that they like to indulge themselves in. This is the third and last dimension on which most management have made commitments not because strategic direction is conscious desired so much as because innovative research requires different scientific staffs. There is the choice of product development staff imitates either another organization's new technology and/or idea, modify, and try to personalize it in some way. Or having the organization commit every of its value to making such technological process from inception to finish. This has different implication for the form of products that arise from this as well as for the culture of the business.

Illustrations of both techniques can be found in Levitt (1966)'s Innovative Imitation, an article in which the world's leading opponent of myopic marketing vigorously pleads for the option of imitation, though it too requires thoughtful development as well as faithful executions. If a management wants to assume the high-risk and/or pay-off character of innovative development, all persons in positions to influence company activities should know it. This applies to imitation as well, or to any blend of the two.

It may be more complicated than a simple innovation/imitation choice. Ansoff and Stewart (1967) outlined a four-point scale of orientation:

- a) "first to market" – based on strong R&D, technical leadership, and risk taking,
- b) "follow the leader" – based on strong development resources and the ability to act quickly as the market starts its growth phase,
- c) "applications engineering" – based on product modification to fit the needs of customers in mature markets,
- d) "me-too" – based on superior manufacturing efficiency and cost control (Ansoff and Stewart, 1967).

- **Price Quality**

Financial and economic considerations usually precede new product development as the new product to be developed must pay for itself and also add to the returns of the organization. The product must speak to the value it creates to the customer. Value comes from either the price or the quality, and product developer of a business must choose which way to follow that will not contradict the culture and reputation of the business they seek to promote in the new product been developed.

Organizations that seek to promote good value creation must prepare and market products that represent superior values to customers and improve those values from time to time. Not only that those products must be made of sound value and come from superior quality ingredients and/or materials.

Amazingly, many firms' new product development represents a complete opposite, whose new product position is far from quality/price spectrum. It goes on to clarify this by pointing out, among other things, the need to restrict the number of products that are modified copies of the ones that are already on the market for which low price would be a primary or tempting strategy.

- **Promotional Requirements**

The limitation of the range of options available in this is the diversity of marketing tools, even though it has become customary for marketing departments to orient to those new products that match

current promotional strategy or marketing resources structure. Hence, it is imperative to include in the strategy statement what sort of promotional requirements that the new product been developed will demand pay more attention to that which may not be currently existing or not in the current practice of the organization. As often, R&D units do not know this unless they are told.

- Internal/External Capabilities

New product development demands an organization to do an SWOT (strengths, weaknesses, opportunities, and threats) analysis of its strengths and capabilities. Therefore, preparing a strategy statement provides the opportunity to decide whether R&D facilities and personnel of the firm will be cut down based on the outcome of such analysis.

The extent to which activities are to continue will solely depend on the management to decide; if the need for major R&D output is to be sustained, the expansion of in-house facilities is not only justified but mandated. The strategy must allow for condition where R&D expansion may not be possible or desirable.

- Competitive Situations to Be Sought or Avoided

Competitive circumstances in markets being evaluated is one classification of caveats that is inevitably presented in a new product situation which is often not stated. This could be quite disappointing unless it is clarified and disclosed. Not only that it could set-off businesses against each other unintentionally becoming a subject of avoidable confrontation especially in an industry with a dominant market leader.

A relatively modest innovation in one such market was highly profitable. There are good competitive situations, for any company, and there are bad ones. Situations should be so designated, depending on their strategic value.

- Production Requirements

Where production requirements get accidentally omitted from new products development strategy, they soon get incorporated. The business, for instance, that expands to new facilities commonly builds beyond its present needs and then promptly undertakes a search for new products to manufacture.

Where capacity becomes incompatible poses a great challenge for the success of the launch.

- Patent Requirements

Patent requirements and the level of protection desirable for the new product to be developed is indeed another consideration in the strategy statement of companies' new product development. Though this applies differently to the nature and size of firms, it is imperative that the level of protection required is guaranteed.

- Speed

In a competitive market environment in an ever-changing world, the time involved in new product development is of the essence. Meanwhile, most businesses recognize the futility and costliness of hurrying things up as product development is often a long-term proposition.

Management must, however, find a way of mediating this, like place a priority on expediting developmental process, and be willing to take the enormous risks associated with such situations. They can be said to have a short-term time dimension on their new product value system. Competitors and small companies alike are often on standby as predators to imitate new inventions.

- Risk/Failure Factors

It is important to make it an uppermost priority that new products development philosophies avoid failure. New product to be developed should uphold a strategy in which the firm should not give room to the inevitability of failure on new products. The development and market launch expenses should be streamlined so it can be modest, so that one success out of every three attempts can be highly profitable.

Marketing department has a lot to do in ensuring the success or failure of the process. This strategy works best, however, when the chief marketing effort is advertising, because frequent new product failures play havoc with sales force morale and customer confidence.

Occasionally, the failure factor is functional, not total. A firm may want to avoid production hazards or may feel ill-equipped to undertake technically complex quality control procedures.

- Pay Back Conditions

Product development must account for the payback period of the entire project when it becomes commercialized. More often than not, R&D staff are least aware of the financial involvement of the new products been developed until such particular idea or completed product is reject because of excessive cash drain it would impose or that it slows down the payback period.

Most firms' financial conditions change from time to time, from periods of cash prosperity to periods of cash stringency, yet, the many people involved down the line in new product development are rarely informed of these conditions.

New product program may not probably align with every tone of the company's financial condition but should ensure that proceeds thereof is adequate to augment the business financial position. And as such the product development strategy does have the flexibility to absorb some of the setbacks. Meanwhile, the development departments of high-prestige firms often harbor a few product ideas that are idle for lack of glamour but can generate cash for a short term.

- Minimum Sales

Any new product that is unable to breakeven may not be worth the pains of going through the rigor of product development processes. Although it applies only to those situations where a sizable, fixed expense commitment attaches to the new product, it, nevertheless, is not too uncommon to hear management border about the minimum sales that could be made for the product to breakeven.

Developing products in industry where this reality must be recognized is ethical drugs where each new item is usually detailed to doctors and hospitals at least once. Each drug firm is able to estimate the share of fixed costs entailed in the initial sales approach and quickly come up with the minimum level of sales necessary to support it.

- Need for Basic Research

Basic research provides advance fundamental knowledge of the new product to be produced and as such overly expensive while making without the assurance of any positive outcome from the process.

The inclusion of provision stipulating the immediate rejection of any idea that necessitates it are avoided by most firms in their strategy statement. Questions as to whether the idea of a new product is desirable are often asked even by those firms with research programs addressed to significant knowledge breakthroughs.

Whether or not such research project will be activated should from the onset be based on a careful appraisal of research opportunities; thus, they are not arbitrary in the sense of casual or flippant. Research design is a gamble, as is all strategy; any resource commitment decision necessarily rejects certain alternatives (Crawford, 1972).

Merely making something that others have created and selling them at lower price is not the strategy of innovative imitation and there is nothing innovative about it. That is the strategy of Me-Too in play. New product development innovation must be borne out of a renewed research effort, that is driven by the desire to change the status quo while seeking to ensure that the customers are better serviced without compromising the going concern need of the business.

- Product/Service Relatedness

Firms are increasingly relating their products to systems of use or service. So, developing new products must be modeled in that direction. Products that are complementary and interrelated to existing business and existing product should be prioritized in considering what new product to develop and in what market such product would be sold.

For instance, a business that manufactures instrument could fair well if it decides to develop but analog digital instruments and sell them as parts of total measuring and control systems. Other firms have decided that service is their best chance of differentiation and so seek products with a high service commitment. Still others push in precisely the opposite direction.

#### 4 Portfolio Management in New Product Development

One cannot overemphasis the strategic importance of new product development in any industrial organ-

ization whether producing goods or services. Kavadias and Chao (2007) argue that developing the right new products is critical to the firm's success and is often cited as the key to a sustained competitive advantage. The strategy an industrial firm elects for its product development program is increasingly viewed as a critical element of the firm's total corporate strategy.

New product development and technology bear an integral relationship to an industrial company's strategic direction by helping to define the range of its possibilities (Cooper, 1985; Kantrow, 1980). As important as this might be, managing the portfolio of products is even much more important as such business is faced with multifaceted decisions in innovation initiatives in a portfolio. And companies that missed the right choices with respect to their new product development portfolio faces a great danger of losing their competitive advantage (Kavadias and Chao, 2007).

Hence, according to Cooper, Edgett, and Kleinschmidt (1999), effective portfolio management is vital to successful product innovation. Portfolio management is about making strategic choices about which markets, products, and technologies that business should invest in. It also borders on resource allocation, for instance, how much will the business spend on R&D, scarce engineering, as well as marketing resources (Cooper et al., 1999; Kavadias & Chao, 2007).

In addition, portfolio management also involves project selection as to which new product or development projects to be chosen from the many opportunities the business is confronted with. And it deals with striking the right balance between the resources or capabilities that a business has and the numbers of projects to be executed.

According to Cooper et al. (1999), portfolio management is a dynamic decision process, whereby a business's list of active new product and R&D projects is constantly updated and revised. In this process, new projects are evaluated, selected, and prioritized; existing projects may be accelerated, terminated, or deprioritized; and resources are allocated and reallocated to the active projects. The portfolio decision process is characterized by uncertain and changing information, dynamic opportunities,

multiple goals and strategic considerations, interdependence among projects, and multiple decision-makers and locations.

A vital question in the product innovation battleground is, "how should corporations most effectively invest their research and development and new product development resources?" That is, what portfolio management is all about: resource allocation to achieve corporate product innovation objectives (Kavadias & Chao, 2007).

Today's new product projects decide tomorrow's product and market profile of a business/industry. It has been estimated that over 50% of a firm's current sales come from new products introduced in the market within the previous five years. Like stock market portfolio managers, senior executives who optimize their R&D investments have a much better opportunity of winning in the long run.

But how do winning companies manage their R&D and product innovation portfolios to achieve higher returns from their investments? There are many different approaches with no easy answers. However, it is a problem that every company addresses to produce and maintain leading edge products. Portfolio management for new products is a dynamic decision process wherein the list of active new products and R&D projects is constantly revised. In this process, new projects are evaluated, selected, and prioritized. Existing projects may be accelerated, killed, or deprioritized and resources are allocated (or reallocated) to the active projects.

The problematic area in new product portfolio management has been that the recent years have witnessed a heightened interest in portfolio management, not only in the technical community but in the chief executive officer's office as well. Despite its growing popularity, recent benchmarking studies have identified portfolio management as the weakest area in product innovation management (see Cooper, Edgett and Kleinschmidt, 1997; Cooper, et al., 1999; McNally, Durmuşoğlu and Calantone, 2013). Executive teams confess that serious Go/Kill decision points rarely exist and, more specifically, criteria for making the Go/Kill decision are nonexistent. As a result, companies are experiencing too many projects for the limited resources available!



While the portfolio methods vary greatly from company to company, overall, the goals of portfolio management are the common denominator across firms that executives are trying to achieve. According to “best-practice” research (see Cooper, et al., 1997, 1999), five main goals dominate the thinking of successful firms:

- 1) Value maximization, allocating resources to maximize the value of the portfolio via a number of key objectives such as profitability, ROI, and acceptable risk. A variety of methods are used to achieve this maximization goal, ranging from financial methods to scoring models.
- 2) Balance, achieving a desired balance of projects via a number of parameters: risk versus return; short term versus long term; and across various markets, business arenas, and technologies. Typical methods used to reveal balance include bubble diagrams, histograms, and pie charts.
- 3) Business strategy alignment, ensuring that the portfolio of projects reflects the company’s product innovation strategy and that the breakdown of spending aligns with the company’s strategic priorities. The three main approaches are top-down (strategic buckets); bottom-up (effective gatekeeping and decision criteria), and top-down and bottom-up (strategic check).
- 4) Pipeline balance, obtaining the right number of projects to achieve the best balance between the pipeline resource demands and the resources available. The goal is to avoid pipeline gridlock (too many projects with too few resources) at any given time. A typical approach is to use a rank-ordered priority list or a resource supply and demand assessment.
- 5) Sufficiency, ensuring the revenue (or profit) goals set out in the product innovation strategy are achievable, given the projects currently underway. Typically, this is conducted via a financial analysis of the pipeline’s potential future value.

When implemented properly and conducted on a regular basis, portfolio management is a high-impact, high-value activity: it is able to maximize the return on your product innovation investments, maintains business competitive position, achieves efficient and effective allocation of scarce resources, forges

a link between project selection and business strategy, achieves focus, communicates priorities, achieves balance, and enables objective project selection top performers to emphasize the link between project selection and business strategy.

Product portfolio management is important because companies without effective new product portfolio management and project selection face a slippery road downhill. Many of the problems that plague new product development initiatives in businesses can be directly traced to ineffective portfolio management.

According to benchmarking studies conducted by Cooper et al. (2004), some of the problems that arise when portfolio management is lacking are projects are not high value to the business, portfolio has a poor balance in project types, resource breakdown does not reflect the product innovation strategy, a poor job is done in ranking and prioritizing projects, there is a poor balance between the number of projects underway and the resources available, and projects are not aligned with the business strategy.

For these reasons, too many companies have too many projects underway (often the wrong ones), resources are spread too thin and across too many projects, projects are taking too long to get to market, and the pipeline has too many low-value projects. Hence, portfolio management is about doing the right projects. If a business picks the right projects, the result is an enviable portfolio of high-value projects: a portfolio that is properly balanced and, most importantly, supports your business strategy.

## 5 Summary

New product is no doubt vital for the going concern of an organization to be guaranteed. Businesses are expected to innovate and develop new products to the ever-changing taste and needs of their customers. There are existing models for new products development; prominent among this is the Cooper’s stage-gate process.

However, empirical evidence found that there is no one-stop-shop model for new product development, as such each industry must have to identify what

model applies to it and adapt it to their peculiarity. Beyond new product development is the ability to manage the product line to make them meet the goal of the development, making product portfolio management inevitable.

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