Portfolio Management:
Fundamental for New Product Success

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There are two ways for a business to succeed at new products: *doing projects right*, and *doing the right projects*. Most new product prescriptions focus on the first route – for example on effective project management, using cross-functional teams, and building in the voice of the customer. Portfolio management, the topic of this chapter, focuses on *the second route*, namely on *doing the right projects*.

A vital question in product innovation management is this: How should the corporation most effectively invest its R&D and new product resources? That is what portfolio management is all about: resource allocation to achieve corporate new product objectives. Much like a stock market portfolio manager, those senior executives who manage to optimize their R&D investments – to define the right new product strategy for the firm, select the winning new product projects, and achieve the ideal balance of projects – will win in the long run[1].

A Roadmap for the Chapter

This chapter first outlines the four goals in portfolio management together with the various tools and techniques for achieving each goal:

- The first goal is to *maximize the value* of the portfolio for a given resource expenditure, and so various financial models, risk and probability models and a scoring model approach are presented as ways to realize this goal.
- The next goal is *balance* – the *right mix of projects*. Here the emphasis is on visuals and graphics: bubble diagrams, including the popular risk-reward diagram, as well as other variants of bubble diagrams; and more traditional charts, such as pie charts, which reveal the spending breakdowns in the portfolio.
- Achieving a *strategically aligned* portfolio is the third goal, and both bottom up approaches (where careful selection of individual projects results in a strategic portfolio) and top down method, such as strategic buckets, where the business's strategy drives the portfolio, are described.
- The final goal is achieving the *right number of projects* for the limited resources available, and while most techniques do deal with resources constraints, resource capacity analysis is presented as a possible solution here.

An assessment of popularity and results achieved reveals that the most popular portfolio methods aren't necessarily the best, and indeed financial approaches yield the poorest portfolio.

Recommended approaches for portfolio management in your business are highlighted next. Two fundamentally different approaches are described – both use the same tools highlighted above and described in detail later in the chapter, but the way the tools are applied is quite different:

1. The "Gates Dominate": approach
2. The "Portfolio Reviews Dominate" approach.

The pros and cons of the two approaches are outlined, along with some of the operational details of their use.

[1] This article is forthcoming as a chapter in The PDMA ToolBook for New Product Development, Wiley & Sons, 2002.

What Is Portfolio Management?

Doing the *right projects* is more than simply individual project selection; rather it's about the *entire mix* of projects and new product or technology investments that your business makes. Portfolio management is formally defined as follows [5,9]:

> Portfolio management is a dynamic decision process, whereby a business's list of active new product (and development) projects is constantly up-dated and revised. In this process, new projects are evaluated, selected and prioritized; existing projects may be accelerated, killed or de-prioritized; and resources are allocated and re-allocated to 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. The portfolio decision process encompasses or overlaps a number of decision-making processes within the business, including periodic reviews of the total portfolio of all projects (looking at all projects holistically, and against each other), making Go/Kill decisions on individual projects on an on-going basis, and developing a new product strategy for the business, complete with strategic resource allocation decisions.

New product portfolio management sounds like a fairly mechanistic exercise of decision-making and resource allocation. But there are many unique facets of the problem which make it perhaps the most challenging decision-making faced by the modern business:

- First, new product portfolio management deals with *future events* and opportunities; thus much of the information required to make project selection decisions is at best uncertain, and at worst very unreliable.

- Second, the decision environment is a very *dynamic* one: the status and prospects for projects in the portfolio are ever changing, as new information becomes available.

- Next, projects in the portfolio are at *different stages* of completion, yet all projects compete against each other for resources, so that comparisons must be made between projects with different amounts and "goodness" of information.

- Finally, *resources* 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 not totally seamless.

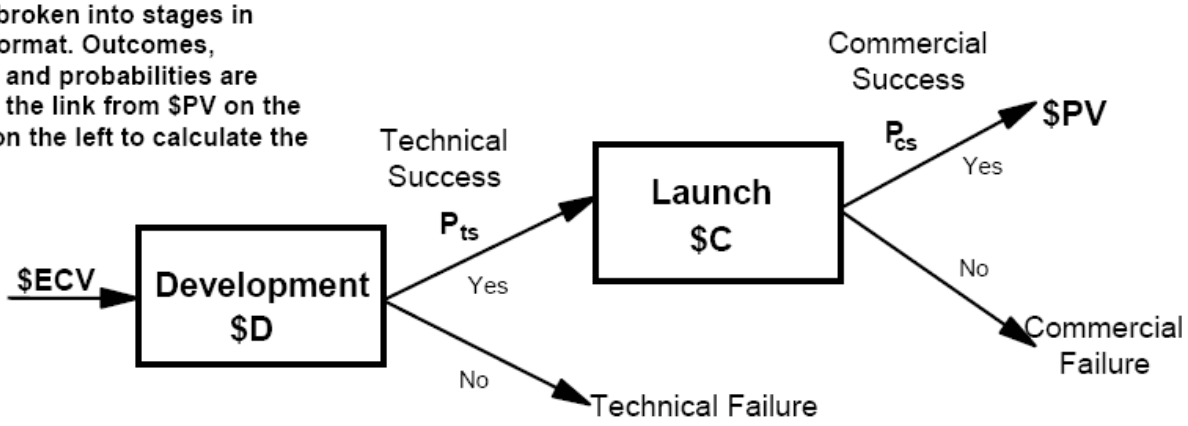
Why So Important?

Portfolio management is a critical and vital senior management challenge, according to a best practices – see Figure 1 [7,8]. Note how important the topic is rated by the senior executives in the business as well as the senior technology people. Additionally, higher performing businesses also tend to rate the importance of portfolio management much higher than poorer performers.

Specific reasons for the importance of portfolio management, derived from the best practices study, are [7,8]:
1. financial – to maximize return; to maximize R&D productivity; to achieve financial goals
2. to maintain the competitive position of the business – to increase sales and market share
3. to properly and efficiently allocate scarce resources

Figure 1. Determination of Expected Commercial Value of Project

The project is broken into stages in decision-tree format. Outcomes, consequences and probabilities are shown. Follow the link from $PV on the right to $ECV on the left to calculate the ECV.



$$ECV = [(PV * P_{cs} - C) * P_{ts} - D]$$

$ECV = Expected Commercial Value of the project

P_{ts} = Probability of Technical Success

P_{cs} = Probability of Commercial Success (given technical success)

$D = Development Costs remaining in the project

$C = Commercialization (Launch) Costs

$PV = Present Value of project's future earnings (discounted to today)

4. to forge the link between project selection and business strategy: the portfolio is the expression of strategy; it must support the strategy
5. to achieve focus – not doing too many projects for the limited resources available; and to resource the "great" projects
6. to achieve balance – the right balance between long and short term projects, and high risk and low risk ones, consistent with the business's goals
7. to better communicate priorities within the organization, both vertically and horizontally.
to provide better objectivity in project selection – to weed out bad projects.

Four Goals in Portfolio Management

There are four common denominators across businesses when it comes to portfolio management: four macro or *high level goals*. The goal you wish to emphasize most will in turn influence your choice of portfolio methods. These four broad or macro goals are:

Value Maximization: Here the goal is to allocate resources so as to maximize the value of your portfolio. That is, you select projects so as to maximize sum of the values or *commercial worths* of all active projects in your pipeline in terms of some business objective (such as long term profitability, EVA, return-on-investment, likelihood of success, or some other strategic objectives).

Balance: Here the principal concern is to develop a balanced portfolio – to achieve a desired balance of projects in terms of a number of parameters; for example, the right balance in terms of long term projects versus short ones; or high risk versus lower risk projects; and across various markets, technologies, product categories, and project types (e.g., new products, improvements, cost reductions, maintenance and fixes, and fundamental research)[2].

Strategic Direction: The main goal here is to ensure that, regardless of all other considerations, the final portfolio of projects truly reflects the business's strategy – that the breakdown of spending across projects, areas, markets, etc., is directly tied to the business strategy (e.g., to areas of strategic focus that management has previously delineated); and that all projects are "on strategy".

Right Number of Projects: Most companies have too many projects underway for the limited resources available [7,8,9,10]. The result is pipeline gridlock: projects end up in a queue; they take longer and longer to get to market; and key activities within projects – for example, doing the up-front homework – are omitted because of a lack of people and time. Thus an over-riding goal is to ensure a balance between resources required for the "Go" projects and resources available.

What becomes clear is the potential for conflict between these four high level goals. For example, the portfolio that yields the greatest NPV or IRR may not be a very balanced one (it may contain a majority of short-term, low risk projects; or is overly focused on one market); similarly a portfolio which is primarily strategic in nature may sacrifice other goals (such as expected short term profitability). Note that the nature of the portfolio management tool that one elects indicates a hierarchy of goals. This is because certain of the portfolio approaches are

[2] Although the focus here is on portfolio management for new products, to the extent that technology resources used in new products are also required for other types of projects, portfolio management must consider the fact that new product projects compete against process developments, product maintenance projects and even fundamental research projects.

much more applicable to some goals than others: for example, the visual models (such as portfolio bubble diagrams) are most suitable for achieving a balance of projects (visual charts being an excellent way of demonstrating balance); whereas scoring models may be poor for achieving or even showing balance, but most effective if the goal is maximization against several objectives. Thus the choice of the "right" portfolio approach depends on which goal your leadership team has explicitly or implicitly highlighted.

What methods do companies find most effective to achieve the three portfolio goals? The next sections outline the portfolio management methods, complete with strengths and weaknesses.

Goal # 1: Maximizing the Value of the Portfolio

A variety of methods can be used to achieve this goal, ranging from financial models through to scoring models. Each has its strengths and weaknesses. The end result of each method is a rank-ordered or prioritized list of "Go" and "Hold" projects, with the projects at the top of the list scoring highest in terms of achieving the desired objectives: the value in terms of that objective is thus maximized.

Net Present Value (NPV)

The simplest approach is merely to calculate the NPV of each project on a spreadsheet; and then rank all projects according to their NPV. The Go projects are at the top of the list ... continue adding projects down the list until you run out of resources. Logically this method should maximize the NPV of your portfolio. Additionally, each project team usually determines the NPV for their project as part of their business case or capital appropriations request – so you're using a number that's already available.

Fine in theory…. but: The NPV method ignores probabilities and risk; it assumes that financial projections are accurate (they usually are not!); it assumes that only financial goals are important – for example, that strategic considerations are irrelevant; and it fails to deal with constrained resources – the desire to maximize the value for a limited resource commitment, or getting the most bang for the limited buck. A final objection is more subtle: the fact that NPV assumes an all-or-nothing investment decision, whereas in new product projects, the decision process is an incremental one – more like buying a series of options on a project [13].

Expected Commercial Value (ECV)

This method seeks to maximize the value or *commercial worth* of your portfolio, subject to certain budget constraints, and introduces the notion of risks and probabilities. The ECV method determines the value or commercial worth of each project to the corporation, namely its *expected commercial value.* The calculation of the ECV is based on a decision tree analysis, and considers the future stream of earnings from the project, the probabilities of both commercial success and technical success, along with both commercialization costs and development costs (see Figure 2 for the calculation and definition of terms).

In order to arrive at a prioritized list of projects, the ECV of each project is determined. Next consider what resources are scarce or limiting. In the example in Table 1, R&D resources (people, but measured in terms of dollars) are thought to be the constraining or scarce resources – an R&D budget of $15 million. You may chose to use R&D people or work-months, or even capital funds, as the constraining resource.

Next, take the ratio of what you are trying to maximize – namely the ECV – *divided by the constraining resource*, namely the R&D costs per project (also in Table 1). Projects are rank ordered according to this ECV/R&D Cost ratio until the total R&D budget limit is reached: those projects at the top of the list are Go, while those at the bottom (beyond the total R&D budget limits) are placed on Hold. The method thus ensures the greatest "bang for buck": that is, the ECV is maximized, for a given R&D budget[3].

Table 1: Expected Commercial Value Used to Prioritize Projects

1 Project Name	2 PV	3 Prob Tech Success	4 Prob Comm Success	5 Dev Cost	6 Comm Cost	7 ECV	8 ECV/Dev	9 Rank & Status
Alpha	30	.80	.50	3	5	5.0	1.67	3 Go
Beta	63.75	.50	.80	5	2	19.5	3.90	1 Go
Gamma	8.62	.75	.75	2	1	2.1	1.05	6 On Hold
Delta	3	1.00	1.00	1	0.5	1.5	1.50	5 On Hold
Echo	50	.60	.75	5	3	15.7	3.14	2 Go
Foxtrot	66.25	.50	.80	10	2	15.5	1.55	4 On Hold

The ECV column shows the value of the ECV (column 7), determined from data in the table (columns 2-6), using the formula in Figure 2. This ECV is divided by the limiting resource, namely Development Costs (EVC/Development Cost in column 8). Projects are then rankled 1-6 according to this ECV/Dev metric, until one is out of resources (column 9). The Development Budget is $15 Mil. Projects Beta, Echo & Alpha, totaling $13 Mil., are Go's. Source: *Portfolio Management for New Products* [6].

This ECV model has a number of attractive features: it recognizes that the Go/Kill decision process is an incremental one (the notion of purchasing options); all monetary amounts are discounted to today (not just to launch date), thereby appropriately penalizing projects that are years away from launch; and it deals with the issue of constrained resources, and attempts to maximize the value of the portfolio in light of this constraint.

The major weakness of the method is the *dependency on extensive financial and other quantitative data*. Accurate estimates must be available for *all* projects' future stream of earnings; for their commercialization (and capital) expenditures; for their development costs; and for probabilities of success – estimates that are often unreliable, or at best, simply not available early in the life of a project. A second weakness is that the method *does not look at the balance* of the portfolio – at whether the portfolio has the right balance between high and low risk projects, or across markets and technologies. A third weakness is that the method considers only *a single financial criterion* for maximization.

[3] This decision rule of rank order according to the ratio of what one is trying to maximize divided by the constraining resource seems to be an effective one. Simulations with a number of random sets of projects show that this decision rule works very well, truly giving "maximum bang for buck"!

Productivity Index (PI)

The *productivity index* is similar to the ECV method described above, and shares many of ECV's strengths and weaknesses. The PI tries to maximize the financial value of the portfolio for a given resource constraint [12,16].

The Productivity Index is the following ratio:

$$PI = ECV * P_{ts} / R\&D$$

Here, the definition of *expected commercial value* is different than that used above. In the Productivity Index, the *expected commercial value* (ECV) is a probability-adjusted NPV. More specifically, it is the probability-weighted stream of cash flows from the project, discounted to the present, and assuming technical success, less remaining R&D costs. There are various ways to adjust the NPV for risks or probabilities: via employing a risk adjusted discount rate used; or by applying probabilities to uncertain estimates in calculating the NPV; or via Monte Carlo simulation to determine NPV.

This risk-adjusted NPV is then multiplied by P_{ts}, the probability of technical success, and divided by *R&D*, the R&D expenditure *remaining* to be spent on the project (note that R&D funds already spent on the project are sunk costs and hence are not relevant to the prioritization decision). Projects are rank ordered according to this productivity index in order to arrive at the preferred portfolio, with projects at the bottom of the list placed on hold.

Scoring Models as Portfolio Tools

Scoring models have long been used for making Go/Kill decisions at gates. But they also have applicability for project prioritization and portfolio management. Projects are scored on each of a number of criteria by management. Typical main criteria include:

- ✓ Strategic alignment
- ✓ Product advantage
- ✓ Market attractiveness
- ✓ Ability to leverage core competencies
- ✓ Technical feasibility
- ✓ Reward vs. risk.

The Project Attractiveness Score is the weighted addition of the item ratings, and becomes the basis for developing a rank ordered list of projects (Table 2 provides an illustration, using the six criteria listed above; projects are ranked until there are no more resources, in this case measured by FTE people). A sample scoring model is also shown in Table 3, with a more detailed list of criteria.

Scoring models generally are praised in spite of their limited popularity. Research into project selection methods reveals that scoring models produce a strategically aligned portfolio and one that reflects the business's spending priorities; and they yield effective and efficient decisions, and result in a portfolio of high value projects [7,8].

Table 2: Prioritized Scored List of Projects - A Rank Ordered List

Project	Leader	Strat Fit	Prod Advtg	Market Attract	Core Comp	Tech Feasib	Re-ward	Project Attract Score	People FTE	Cum FTE	Status
Epsilon	Peters	9	9	10	10	9	9	93.3	20	20	Active
Gamma	Cooper	10	10	7	7	7	7	80.0	20	40	Active
Alpha	Smith	8	7	7	8	8	9	75.0	15	55	Active
Delta	Scott	7	7	9	9	8	5	74.0	12	67	Active
Beta	Jones	7	7	6	6	8	6	66.7	20	87	HOLD
Omicron	Baily	8	6	6	8	7	5	66.7	20	107	HOLD

(resource limit: 70 FTE)

1. Set up a spreadsheet - list your Active, On Hold & proposed projects
2. Rank these projects according to some criterion (e.g., Project Attractiveness Score or NPV)
   - ✓in this example, 6 screening criteria are used (see text) - Strategic Fit, Product Advantage, etc.
   - ✓the Project Attractiveness Score - the average of these 6 crtieria, but taken out of 100 - is used as the ranking criterion
   - ✓all 6 projects are good ones, with scores over 65 points out of 100
3. Include projects until you are out of resources (here measured by FTEs - full time equivalent people)
   - ✓here the first 4 projects are Active (note the resource limit of 70 FTEs); and the last 2 are put on Hold

Source: *Winning at New Products* [4].

Goal # 2: A Balanced Portfolio

The second major goal is a balanced portfolio – a balanced set of development projects in terms of a number of key parameters. The analogy is that of an investment fund, where the fund manager seeks balance in terms of high risk versus blue chip stocks; and balance across industries, in order to arrive at an optimum investment portfolio.

Table 3: A Typical Scoring Model for Project Selection [2,6]

Factor 1 – Reward:

<Absolute contribution to profitability (5 year cash flow: cumulative cash flows less all cash costs, before interest & taxes)
<Technological payback: the number of years for the cumulative cash flow to equal all cash costs expended prior to the start-up date
<Time to commercial start-up

Factor 2 – Business Strategy Fit:

<Congruence: how well the program fits with the strategy (stated or implied) for the product line, Business and/or Company
<Impact: the financial and strategic impact of the program on the product line, Business and/or Company (scored from minimal "to "critical").

Factor 3 – Strategic Leverage:

<Proprietary position
<Platform for growth (from "one of a kind" to "opens up new technical & commercial fields")
<Durability: the life of the product in the marketplace (years)
<Synergy with other operations/businesses within the corporation

Factor 4 – Probability of Commercial Success:

<Existence of a market need
<Market maturity (from "declining" to "rapid growth")
<Competitive intensity: how tough or intense the competition is
<Existence of commercial applications development skills (from "new" to "already in place")
<Commercial assumptions (from "low probability" to "highly predicable")
<Regulatory/social/political impact (from "negative" to "positive")

Factor 5 – Probability of Technical Success:

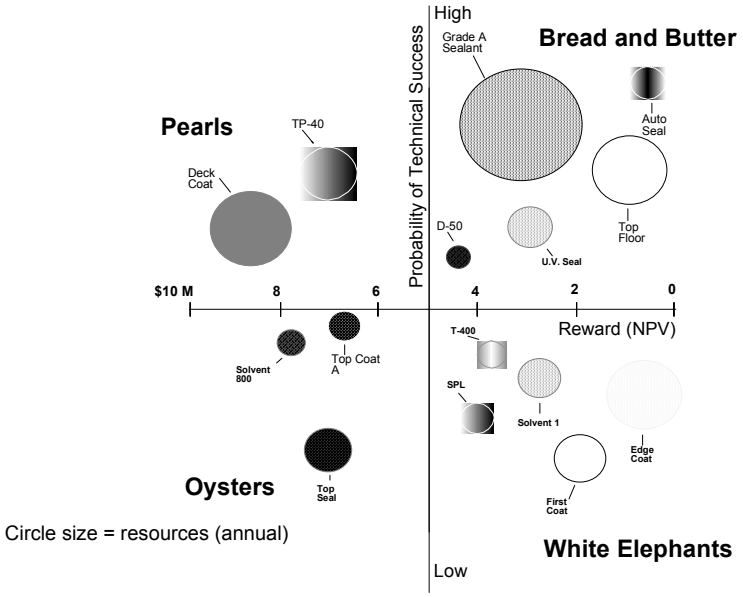
<Technical gap (from "large gap" to "incremental improvement")
<Program complexity (from "very high, many hurdles" to "straightforward")
<Existence of technological skill base (from "new to us" to "widely practiced in company")
<Availability of people & facilities (from "must hire/build" to "immediately available")

Each criterion above (question) is scored by management on 1-10 scales; scale-points 1, 4, 7 & 10 are "anchored". The five Factors are calculated via weightings x ratings. These Factors are then added in a weighted fashion to yield a Project Attractiveness Score. This Score is compared to a cut-off (to make Go/Kill decisions) and is also used to rank order projects – from best to worst (Table 6).

Visual charts are favored in order to display balance in new product project portfolios. These visual representations include portfolio maps or bubble diagrams (Figure 3) – an adaptation of the four quadrant BCG (star; cash cow; dog; wildcat) diagrams which have seen service since the 1970s as strategy models – as well as more traditional pie charts and histograms.

A casual review of portfolio bubble diagrams will lead some to observe that "these new models are nothing more than the old strategy bubble diagrams of the 70s!". *Not so.* Recall that the BCG strategy model, and others like it (such as the McKinsey/GE model), plot *business units* on a market attractiveness versus business position grid [11,15]. Note that the unit of analysis is the SBU – an existing business, whose performance, strengths and weaknesses are all known. By contrast, today's new product portfolio bubble diagrams, while they may appear similar, plot individual new product projects – future businesses or *what might be.* As for the dimensions of the grid, here too the "market attractiveness" versus "business position" dimensions used for existing SBUs may not be as appropriate for new product possibilities; so other dimensions or axes are extensively used.

Figure 3: Risk-Reward Bubble Diagram



Source: *Winning at New Products* [4].

Which Dimensions to Consider

What are some of the parameters that your business should plot on these bubble diagrams in order to seek balance? Different pundits recommend various parameters and lists, and even suggest the "best plots" to use. Table 4 provides a list of the most popular bubble diagram plots [7,8].

Table 4: Popular Bubble Diagram Plots (rank ordered by popularity)

Rank	Type of Chart	First dimension plotted		Second dimension plotted	Percent of businesses using bubble diagrams*
1	Risk Vs. Reward	Reward: NPV, IRR, benefits after years of launch, market value	by	Probability of success (technical, commercial, overall)	44.4%*
2	Newness	Technical newness	by	Market newness	11.1%
3	Ease Vs. Attractiveness	Technical feasibility	by	Market attractiveness (growth, potential, consumer appeal, life cycle)	11.1%
4	Strength Vs. Attractiveness	Competitive position (strengths)	by	Attractiveness (market growth, technical maturity, years to implementation)	11.1%
5	Cost Vs. Timing	Cost to implement	by	Time to implement	9.7%
6	Strategic Vs. Benefit	Strategic focus or fit	by	Business intent, NPV, financial fit, attractiveness	8.9%
7	Cost Vs. Benefit	Cumulative reward	by	Cumulative development costs	5.5%

* Reads: Of all the businesses using bubble diagrams, 44.4% use the Risk vs. Reward version (in Figure 3). Source: IRI and *R-T Mgmt* [7,8].

Risk-Reward Bubble Diagrams

The most popular bubble diagram is a variant of the *risk/return chart* (see Figure 3 and Table 4). Here one axis is some measure of the *reward* to the company, the other is a *success probability*:

- One approach is to use a *qualitative estimate* of reward, ranging from "modest" to "excellent" [17]. The argument here is that too heavy an emphasis on financial analysis can do serious damage, notably in the early stages of a project. The other axis is the probability of overall success (probability of *commercial* success times probability of *technical* success)

- In contrast, other firms rely on very quantitative and financial gauges of reward, namely the probability-adjusted NPV of the project [12,16]. Here the probability of *technical* success is the vertical axis, as probability of commercial success has already been built into the NPV calculation.

A sample bubble diagram is shown in Figure 3 for an SBU of a major chemical company. Here the size of each bubble shows the annual resources spent on each project (dollars per year; it could also be people or work-months allocated to the project).

The four quadrants of the portfolio model in Figure 3 are:

- *Pearls* (upper left quadrant): These are the potential star products – projects with a high likelihood of success, and which are also expected to yield a very high reward. Most businesses desire more of these. There are two such Pearl projects, and one of them has been allocated considerable resources (denoted by the sizes of the circles).

- *Oysters* (lower left): These are the *long-shot* projects – projects with a high expected payoff, but with low likelihoods of technical success. They are the projects where technical breakthroughs will pave the way for solid payoffs. There are three of these; none is receiving many resources.

- *Bread and Butter* (upper right): These are small, simple projects – high likelihood of success, but low reward. They include the many fixes, extensions, modifications, and up-dating projects of which most companies have too many. More than 50% of spending is going to these Bread and Butter projects in Figure 3.

- *White Elephants* (lower right). These are the low probability and low reward projects. Every business has a few white elephants – they inevitably are difficult to kill; but this company has far too many. One third of the projects and about 25% of spending falls in the lower right White Elephant quadrant.

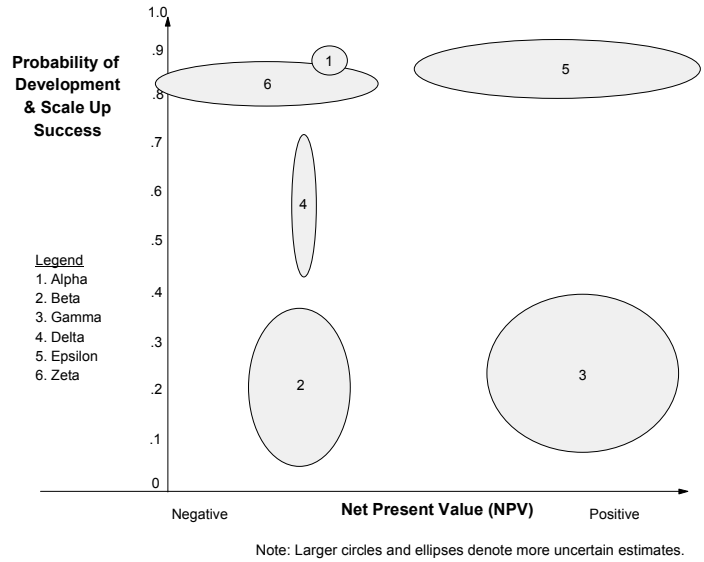
Given that this chemical SBU is a star business seeking rapid growth, a quick review of the portfolio map in Figure 3 reveals many problems. There are too many White Elephant projects (it's time to do some serious pruning!); too much money spent on Bread and Butter, low value projects; not enough Pearls; and heavily under-resourced Oysters.

One feature of this bubble diagram model is that it forces senior management to deal with the resource issue. Given finite resources (e.g., a limited number of people or money), *the sum of the areas of the circles must be a constant*. That is, if you add one project to the diagram, you must subtract another; alternatively you can shrink the size of several circles. The elegance here is that the model forces management to consider the resource implications of adding one more project to the list – that some other projects must pay the price!

Also shown in this bubble diagram is the product line that each project is associated with (via the shading or cross-hatching). A final breakdown is via color is timing (not shown in our black-and-white map). Here hot red means "imminent launch" while blue is cold and means "an early stage project". Thus, this apparently simple risk/reward diagram shows a lot more than simply risk and profitability data: it also conveys resource allocation, timing, and spending breakdowns across product lines.

Variants of Risk-Reward Bubble Diagrams: Dealing With Uncertainties

Figure 4: 3M's Risk-Reward Bubble Diagram Showing Uncertainties



Note: Larger circles and ellipses denote more uncertain estimates.

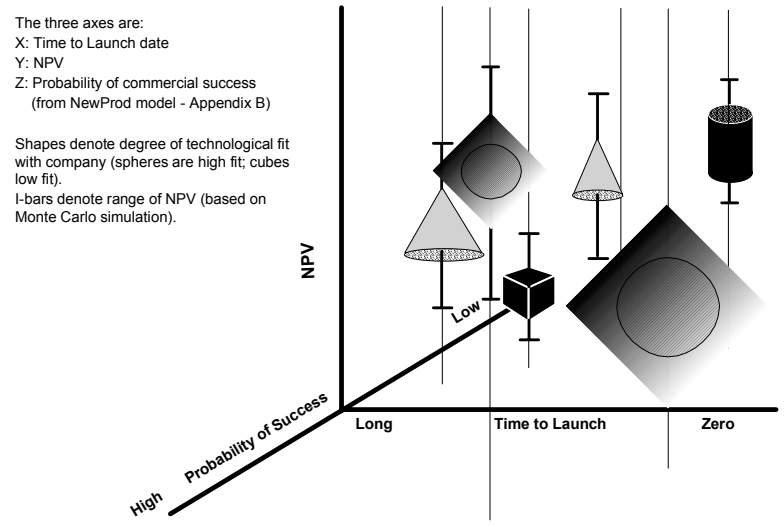
Source: *R-T Management* & *Portfolio Management for New Products* [5,6].

3M's ellipses: One problem with the bubble diagram in Figure 3 is that it requires a point estimate of both the reward, namely the likely NPV, as well as the probability of success. Some businesses at 3M use a variant of the bubble diagram to effectively portray uncertain estimates [20]. In calculating the NPV, optimistic and pessimistic estimates are made for uncertain variables, leading to a range of NPV values for each project. Similarly low, high and likely estimates are made for the probability of technical success. The result is Figure 4, where the sizes and shapes of the bubbles reveal the uncertainty of projects: here, very small bubbles mean highly certain estimates on each dimension, whereas large ellipses mean considerable uncertainty (a high spread between worst case and best case) for that project.

Monte Carlo simulation: Procter & Gamble uses Monte Carlo simulation to handle probabilities. P&G's portfolio model is a three dimensional portfolio model, created by 3-dimensional CAD software (Figure 5); the three axes are:

- ✓ NPV – a measure of the project's expected reward (probability adjusted)
- ✓ time to launch (the longer the time, the higher the risk, and the more distant the reward)
- ✓ the probability of commercial success (as calculated from P&G's customized version of the NewProd model [1][4]).

Figure 5: Procter & Gamble's 3-Dimensional Risk-Reward Bubble Diagram

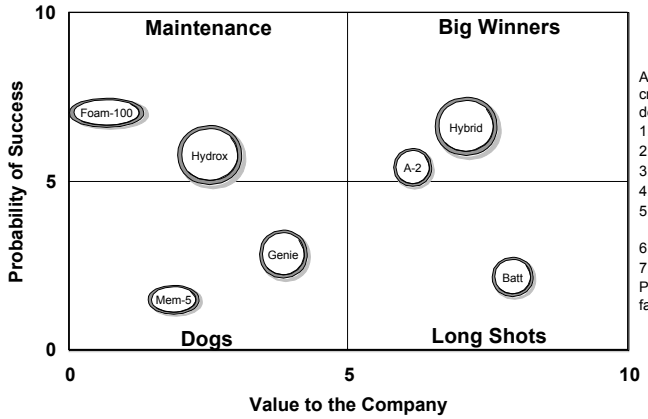


Source: P&G Corporate New Ventures [5,6].

In both firms, in order to account for commercial uncertainty, every variable – revenues, costs, launch timing, and so on – requires three estimates: a high, low and likely estimate. From these three estimates, a *probability distribution curve* is calculated for each variable. Next random scenarios are generated for the project using these probability curves as variable inputs. Thousands of scenarios are computer-generated (hence the name Monte Carlo: thousands of spins of the wheel), and the result is a distribution of financial outcomes. From this, the expected NPV and its range is determined – an NPV figure which has had all commercial outcomes, and their probabilities, figured in. P&G shows this range of NPVs simply as an I-beam drawn vertically through the spheres.

Portfolio Maps With Axes Derived From Scoring Models

Figure 6: Risk-Reward Bubble Diagram Using Scored Axes



A Scoring Model with 7 scoring criteria is used to make Go/Kill decisions at Gates:
1. Competitive Advantage
2. Level of Customer Interest
3. Level of Business Unit interest
4. Fit with Company Strengths
5. Probability of Technical Feasibility
6. Credibility of Business Case
7. Profitability (NPV and Payback)

Projects are scored on these 7 factors (0-10 scales).

The two axes - Value and Probability - are computed from Scoring Model results (0-10 scores)
The computation is:
Value = .66 (Profitability) + .34 (Comp Adv)
Prob. of Success = .25 (Cust Int.) + .5 (Tech Feasibility) + .25 (Fit)

Source: Specialty Minerals Inc. as reported in: *Portfolio Management for New Products* [6].

A combination scoring model and bubble diagram approach is employed by Speciality Minerals, a spin-off company from Pfizer. A scoring model is used to make Go/Kill decisions on projects and also to rank order projects on a prioritization list. Here, seven factors are considered in the firm's scoring model (see Figure 6 for list). These *same factors* then provide the input data to construct the bubble diagram. For example:

- ✓ The horizontal axis, labelled "value to the company", is comprised of the financial attractiveness and competitive advantage factors, added together in a weighed fashion
- ✓ The vertical axis is "probability of success" and is made up of three factors: customer interest, technical feasibility, and fit with technical/manufacturing capabilities (again, a weighted addition).

The unique feature here is that this company's seven factor scoring model does double duty: it is the basis for Go/Kill decisions at project or "gate reviews". It also provides five of the factors (and data) to construct the two axes of the portfolio bubble diagram.

Traditional Charts for Portfolio Management

There are numerous parameters, dimensions or variables across which one might wish to seek a balance of projects. As a result, there are an endless variety of histograms and pie charts which help to portray portfolio balance. Some examples:

Timing is a key issue in the quest for balance. One does not wish to invest strictly in short term projects, nor totally in long term ones. Another timing goal is for a steady stream of new product launches spread out over the years – constant "new news", and no sudden log-jam of product launches all in one year. A histogram captures the issue of timing and portrays the distribution of resources to specific projects according to years of launch (not shown).

Another timing issue is *cash flow*. Here the desire is to balance one's projects in such a way that cash inflows are reasonably balanced with cash outflows in the business. Some companies produce a timing histogram which portrays the total cash flow per year from all projects in the portfolio over the next few years (not shown).

Project types is yet another vital concern. What is your spending on genuine new products versus product renewals (improvements and replacements), or product extensions, or product maintenance, or cost reductions and process improvements? And what should it be? Pie charts effectively capture the spending split across project types – actual versus desired splits.

Markets, products and technologies provide another set of dimensions across which managers seek balance. The question faced is: do you have the appropriate split in R&D spending across your various product lines? Or across the markets or market segments in which you operate? Or across the technologies you posses? Pie charts are again appropriate for capturing and displaying this type of data.

Goal # 3: Building Strategy Into the Portfolio

Strategy and new product resource allocation must be intimately connected. *Strategy becomes real when you start spending money!* Until one begins allocating resources to specific activities – for example, to specific development projects – strategy is just words in a strategy document.

The mission, vision and strategy of the business is made operational through the decisions it makes on where to spend money. For example, if a business's strategic mission is to "grow via leading edge product development", then this must be reflected in the mix of new product projects underway – projects that will lead to growth (rather than simply to defend) and products that really are innovative. Similarly, if the strategy is to focus on certain markets, products or technology types, then the majority of projects and spending should be focused on such markets, products or technologies.

Linking Strategy to the Portfolio: Approaches

Two broad issues arise in the desire to achieve *strategic alignment* in the portfolio of projects:

- ✓ *Strategic fit:* The first is: are all your projects consistent with your business's strategy? For example, if you have defined certain technologies or markets as key areas to focus on, do your projects fit into these areas – are they in bounds or out of bounds?
- ✓ *Spending breakdown:* The second is: does the breakdown of your spending reflect your strategic priorities? In short, when you add up the areas where you are spending money, are these totally consistent with your stated strategy?

There are two ways to incorporate the goal of strategic alignment:

1. *Bottom up – building strategic criteria into project selection tools*: here strategic fit is achieved simply by including numerous strategic criteria into the Go/Kill and prioritization tools; and
2. *Top-down – Strategic Buckets method:* this begins with the business's strategy and then moves to setting aside funds – envelopes or *buckets of money* – destined for different types of projects.

Bottom Up – Strategic Criteria Built into Project Selection Tools

Not only are scoring models effective ways to maximize the value of the portfolio, they can also be used to ensure strategic fit. One of the multiple objectives considered in a scoring model, along with profitability or likelihood of success, can be to *maximize strategic fit*, simply by building into the scoring model a number of strategic questions.

In the scoring model displayed earlier in this chapter (Table 3), two major factors out of five are strategic; and of the 19 criteria used to prioritize projects, six, or almost one-third, deal with strategic issues. Thus, projects which fit the business's strategy and boast strategic leverage are likely to rise to the top of the list. Indeed, it is inconceivable how any "off strategy" projects could make the active project list at all: this scoring model naturally weeds them out.

Top Down Strategic Approach – Strategic Buckets Model

While strategic fit can be achieved via a scoring model, a top down approach is the only method designed to ensure that the eventual portfolio of projects *truly reflects* the stated strategy for the business: that where the money is spent mirrors the business's strategy.

The Strategic Buckets model operates from the simple principle that *implementing strategy equates to spending money on specific projects*. Thus, setting portfolio requirements really means "setting spending targets".

The method begins with the business's strategy, and requires the senior management of the business to make forced choices along each of several dimensions – choices about how they wish to allocate their scarce money resources. This enables the creation of "envelopes of money" or "buckets". Existing projects are categorized into buckets; then one determines whether actual spending is consistent with desired spending for each bucket. Finally projects are prioritized within buckets to arrive at the ultimate portfolio of projects – one that mirrors management's strategy for the business.

Sounds simple, but the details are a little more complex: Senior management first develops the vision and strategy for the business. This includes defining strategic goals and the general plan of attack to achieve these goals – a fairly standard business strategy exercise. Next, they make forced choices across key strategic dimensions. That is, based on this strategy, the management of the business allocates R&D and new product marketing resources across categories on each dimension. Some common dimensions are:

- ✓ *Strategic goals:* Management is required to split resources across the specified strategic goals. For example, what percent should be spent on Defending the Base? On Diversifying? On Extending the Base? and so on.
- ✓ *Product lines:* Resources are split across product lines: e.g., how much to spend on Product Line A? On Product Line B? On C? A plot of product line locations on the product life cycle curve is used to help determine this split.
- ✓ *Project type:* What percent of resources should go to new product developments? To maintenance-type projects? To process improvements? To fundamental research? etc.
- ✓ *Familiarity Matrix:* What should be the split of resources to different types of markets and to different technology types in terms of their *familiarity to the business*? You can use the "familiarity matrix" proposed by Roberts – technology newness versus market newness – to help split resources [18].
- ✓ *Geography:* What proportion of resources should be spent on projects aimed largely at North America? At Latin America? At Europe? At the Pacific? Or at global?

Table 5: Projects Prioritized Within Buckets

Four of 12 Buckets with Spending Targets in Each Bucket

Bucket #1: New Products for Product Line A Target Spend: $8.7M	Bucket #2: New Products for Product Line B Target Spend: $18.5M	Bucket # 3: Maintenance of Business for Product Lines A & B Target Spend: $10.8M	Bucket # 4: Cost Reductions for All Product Lines Target Spend: $7.8M
Project A 4.1	Project B 2.2	Project E 1.2	Project I 1.9
Project C 2.1	Project D 4.5	Project G 0.8	Project M 2.4
Project F 1.7	Project K 2.3	Project H 0.7	Project N 0.7
Project L 0.5	Project T 3.7	Project J 1.5	Project P 1.4
Project X 1.7	**Gap = 5.8**	Project Q 4.8	Project S 1.6
Project Y 2.9		Project R 1.5	Project U 1.0
Project Z 4.5		Project V 2.5	Project AA 1.2
Project BB 2.6		Project W 2.1	

12 "buckets" or categories of project types are defined in this example; only 4 buckets are shown here. Projects are sorted according to bucket, and then are rank ordered within columns according to a Maximization Method: ECV; a financial criterion such as NPV * Probability of Success; or better yet, a Scoring Model. Numbers within columns show resources required to do each project ($Mil.). Note that Bucket 1 runs out of resources after Project L; whereas in Bucket 2, there is a shortage of good projects. Source: *Portfolio Management for New Products* [6].

Now, management develops *strategic buckets*. Here the various strategic dimensions (above) are collapsed into a convenient handful of buckets. For example, buckets might be ....

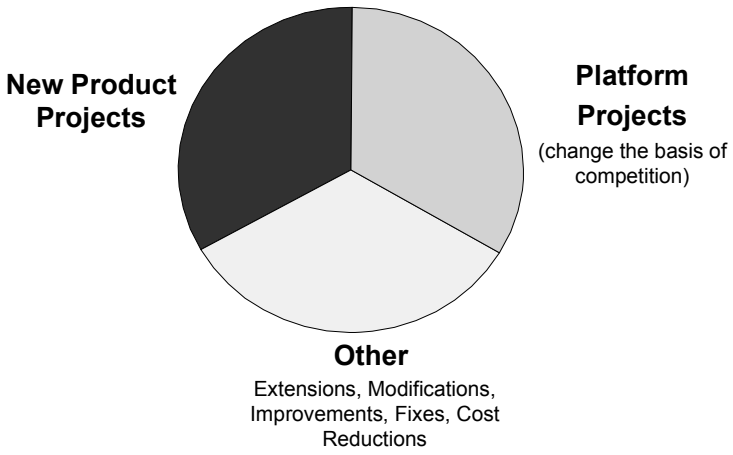
- ✓ Product Development Projects for Product Lines A and B
- ✓ Cost Reduction Projects for all Products Lines
- ✓ Product Renewal Projects for Product Lines C and D

and so on (see Table 5). Next, the desired spending by bucket is determined: the "*what should be*". This involves a consolidation of desired spending splits from the strategic allocation exercise above.

Next comes a gap analysis. Existing projects are categorized by bucket and the total current spending by bucket is added up (the "*what is*"). Spending gaps are then identified between the "*what should be*" and "*what is*" for each bucket.

Finally, projects within each bucket are rank ordered. You can use either a scoring model or financial criteria to do this ranking within buckets (Table 5). Portfolio adjustments are then made, either via immediate pruning of projects, or by adjusting the approval process for future projects.

Figure 7: Strategic Buckets Method of Portfolio Management



The business's strategy dictates the split of resources into buckets; projects are rank ordered within buckets, but using different criteria in each bucket (method used by AlliedSignal-Honeywell)

Source: *Portfolio Management for New Products* [6].

You may find that the number of dimensions and splits outlined above becomes too complex and onerous. A somewhat simpler breakdown is used at Honeywell-AlliedSignal: their "Mercedes Benz star" method of allocating resources (Figure 7). The leadership team of the business begins with the business's strategy, and uses the Mercedes emblem (the three-point star) to help divide up the resources. There are three buckets: fundamental research and platform development projects which promise to yield major breakthroughs and new technology platforms; new product developments; and maintenance – technical support, product improvements and enhancements, etc.. Management divides the R&D funds into these three buckets, and then rates and ranks projects against each other within each bucket. In effect, three separate portfolios of projects are created and managed. And the spending breakdowns across projects mirrors strategic priorities.

The major strength of the Strategic Buckets Model is that it firmly links spending to the business's strategy. Over time, the portfolio of projects, and the spending across strategic buckets, will equal management's desired spending targets across buckets. Another positive facet of the strategic buckets model is the recognition that all development projects that compete for the same resources should be considered in the portfolio approach. Finally, different criteria can be used for different types of projects. That is, one is not faced with comparing and ranking very different types of projects against each other – for example, comparing major new product projects to minor modifications. Because this is a two step approach – first allocate money to buckets, then prioritize like projects within a bucket – it is not necessary to arrive at a universal list of scoring or ranking criteria that fits all projects.

Goal # 4: The Right Number of Projects

Superimposed across all three goals above, of course, is resource constraints. That is, management must try to achieve these three goals, but always wary of the fact that if too many projects are approved for the limited resources, then pipeline gridlock is the result.

The problem of too many projects and too few resources can be partly resolved by undertaking a *resource capacity analysis*. This analysis attempts to quantify your projects' demand for resources (usually people, expressed as person-days of work) versus the availability of these resources – see Figure 8 [3,10]:

1. *Do you have enough of the right resources to handle projects currently in your pipeline?* Begin with your current list of active projects. Determine the person-days each month required to complete them according to their timelines. Then look at the availability of resources. You usually find major gaps and hence potential bottlenecks.

2. *Do you have enough resources to achieve your new product goals?* Begin with your new-product goals. What percent of your business's sales will come from new products?

Figure 8: Two Ways to Undertake Resource Capacity-Versus-Demand Analysis [3,4]

Method 1. Resource Demand Created by Your Active Projects:

Determine resource demand:

- Begin with your current list of active development projects, prioritized from best to worst (use a scoring model to prioritize projects, or a financial approaches, such as NPV or ECV). Develop a prioritized project list table, as below (here, Alpha is the best project; Foxtrot is the least attractive).
- Then consider the detailed plan of action for each project (use a timeline software package, such as Microsoft Project).
- For each activity on the timeline, note the number of person-days of work (or work-months), and what group (or what department) will do the work. These are shown in the "Person-days" column.
- Record these person-day requirements in the prioritized project list table – one column per department. In other columns, note the cumulative person-days by department.
- Develop such a table for each month.

▪

Resource Demand Vs. Capacity Chart - Example

Project	Product Mgmt		Marketing		Research Group A		Research Group B	
	Persondays	Cumulative	Persondays	Cumulative	Persondays	Cumulative	Persondays	Cumulative
Alpha	3	3	2	2	10	10	5	5
Beta	4	7	2	4	10	20	5	10
Gamma	3	10	2	6	15	35	5	15
Delta	5	15	3	9	15	50	8	23
Epsilon	6	21	3	***12***	5	55	8	31
Foxtrot	6	***27***	2	***14***	5	60	5	36
Demand		27		14		60		36
Available Persondays		20		10		60		40
% Utilization		***135.00%***		***140.00%***		100.00%		90.00%

What is your resource capacity?

- Next, look at the capacity available – how many person-days each department (or group) has available in total. (These person-days look at all people in that group or department, and what proportion of their time they have available for new products. Be sure to consider their "other jobs" in this determination – for example, the fact that a Marketing group likely has 90% of their time consumed by day-to-day assignments).
- Then mark the point in your prioritized-list-of-projects table where you run out of resources – where demand exceeds capacity. (Numbers in bold and italics show where we run out of resources in the sample table above).
- Determine the Percent Utilization – cumulative resources demanded divided by resources available – last row.

In the sample table above, note that two departments have over-committed resources, and two projects – Epsilon and Foxtrot – are the reasons why.

Results:

You will likely learn three things from this exercise:

- You really do have too many projects, often by a factor of two or three
- You can see which department or group is the constraining one, and
- You also begin to question where some departments spend their time (and why such a small proportion is available to work on new products!).

Method 2. Resource Demand Generated by Your Business's New Product Goals:

Determine resource demand:

- Begin with your new product goals – what sales or percentage of sales you desire from new products.
- Translate these goals into numbers of major and minor new product launches annually.
- Then, using your attrition curve – how many Stage 1, Stage 2, Stage 3, etc. projects does it take to yield one successful launch? – determine the number of projects per year you need moving through each stage.
- Next, consider the person-days requirements in each stage, broken down by function or department. The numbers of projects per stage combined with the person-days requirements yield the resource demand – namely, the person-days and personnel requirements to achieve your business's new product goals, again by department.

What is your resource capacity?

- Now turn to availability – how many person-days are available per department (same as the second part of Method 1 above).

Results:

- Again you'll likely find a major gap between demand versus capacity.
- At this point, you either modify your goals, making them a little more realistic; or make tough choices about adding resources or reassigning people in order to achieve your goals.

These two exercises can be done either with person-days (people x days) or dollars as the measure of resources.

Now, determine the person-days required to achieve this goal. Again, you will likely find a major gap between demand based on your goals, and capacity available. It's time to make some tough choices about the realism of your goals or whether more resources are required.

This capacity analysis is a beginning and usually highlights key problems:

- ✓ it detects far too many projects in the pipeline, resulting in an immediate prioritization and pruning effort
- ✓ it causes senior management to rethink its fairly arbitrary new product revenue and profit goals for the business
- ✓ it identifies the functional areas that are major bottlenecks in the innovation process, leading to decisions to increase or shift personnel.

The capacity analysis chart shown in Figure 8 can also be used at portfolio and gate review meetings to show the impact of adding a new product project to the active list – what the addition means to resource commitments and constraints.

Popularity & Effectiveness of Portfolio Methods

In practice, *financial methods* dominate portfolio management, according to the best practices study cited above [8]. Financial methods include various profitability and return metrics, such as NPV, ECV, ROI, EVA or payback period – metrics that are used to rate, rank order and ultimately select projects. A total of 77.3 percent of businesses use such an approach in portfolio management – see Figure 9. For 40.4% of businesses, this is the dominant method.

Other methods are also quite popular:

- *Strategic approaches:* for instance, having decided the business's strategy, money is allocated across different types of projects and into different envelopes or buckets. Projects are then ranked or rated within buckets. A total of 64.8 percent of businesses use this approach; for 26.6 percent of businesses, this is the dominant method.

- *Bubble diagrams or portfolio maps:* 40.6 percent of businesses use portfolio maps; only 8.3 percent use this as their dominant method. The most popular map is the risk versus reward map in Figure 9, but many variants of bubble diagrams are used.

Figure 9: Popularity of Portfolio Methods Employed

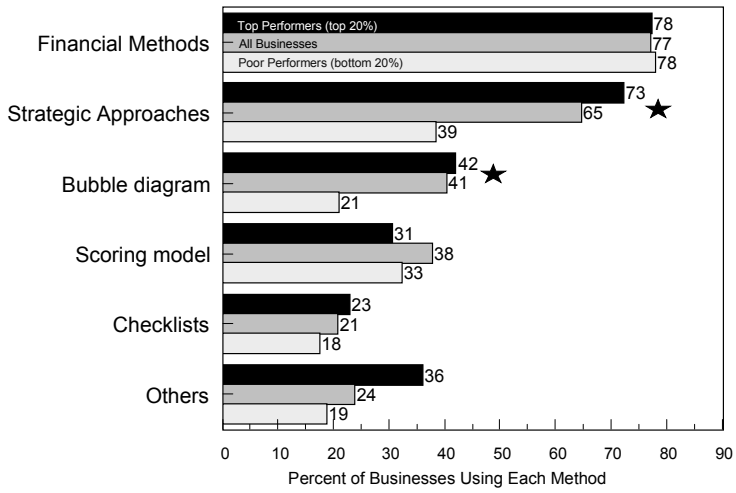


Chart shows percent of businesses using each portfolio method. Numbers are percentages, and add to more than 100% due to firms using multiple methods. Note that Top Performers tend to use Strategic approaches, while Poor Performers do not use bubble diagrams (denoted by stars). Source: IRI and *Research-Technology Management* [7,8].

- *Scoring models:* scaled ratings are added to yield a Project Attractiveness Score, which becomes the criterion used to make project selection and/or ranking decisions. These models are used by 37.9 percent of businesses; in 18.3 percent, this is the dominant decision method.

- *Check lists:* projects are evaluated on a set of Yes/No questions. Each project must achieve either all Yes answers, or a certain number of Yes answers to proceed. The number of Yes's is used to make Go/Kill and/or prioritization (ranking) decisions. Only 17.5 percent of businesses use check lists; and in only 2.7 percent is this the dominant method.

Popularity does not necessarily equate to effectiveness, however. When the performance of firms' portfolios were rated on six metrics in this study, companies that relied heavily on financial tools as the dominant portfolio selection model fared the worst (Table 6). Financial tools yield an unbalanced portfolio of lower value projects; and projects that lack strategic alignment. By contrast, strategic methods produce a strategically aligned and balanced portfolio. And scoring models appear best for selecting high value projects, and also yield a balanced portfolio. Finally, firms using bubble diagrams obtain a balanced and strategic aligned portfolio.

Table 6: Strengths/Weaknesses for Each Portfolio Method

Performance Ratings for Each Portfolio Method (1-5 Scores)

Performance Metric	Financial Methods	Strategic Methods	Scoring Model	Bubble Diagrams
Projects are aligned with business's objectives	3.76 ✗	4.08	3.95	4.11 ★
Portfolio contains very high value projects	3.37 ✗	3.77	3.82 ★	3.70
Spending reflects the business's strategy	3.50	3.72 ★	3.59	3.00 ✗
Projects are done on time -- no gridlock	2.79 ✗	3.22 ★	3.13	2.90
Portfolio has good balance of projects	2.80 ✗	3.08	3.20 ★	3.20 ★
Portfolio has right number of projects	2.50	2.93 ★	2.70	2.25

★ = Best method on each performance criterion

✗ = Worst method on each criterion

Ratings are 1-5 mean scores for each method, when used as dominant portfolio method.
Here 1=Poor and 5=Excellent

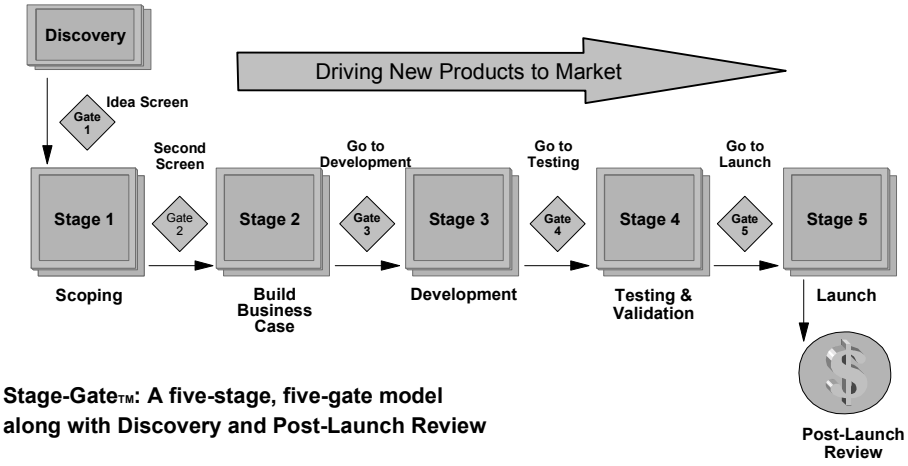
Source: *R-T Mgmt* [8].

It is ironic that the most rigorous techniques – the various financial tools – yield the worst results, not so much because the methods are flawed, but simply because reliable financial data are often missing at the very point in a project where the key project selection decisions are made.

Putting the Portfolio Tools to Work

How should one use these various portfolio tools? Here we make the assumption that you already have a new product process in place – a gating or *Stage-Gate™* process as in Figure 10. (Note: a PDMA best practices study reveals that the great majority of PDMA members have such processes in place [14]; if not, implementation of such a process is your first step).

Figure 10: The Typical Stage-Gate™ Model - From Discovery to Launch



Stage-Gate™: A five-stage, five-gate model along with Discovery and Post-Launch Review

Source: *Winning at New Products* [4]

There are two fundamentally different approaches to integrating portfolio management tools into your new product process[5]:

1. The "Gates Dominate": approach is best for larger firms in mature businesses where the portfolio of projects is fairly static.. A solid gating process, where resource allocation methods are integrated into the gates, is likely best here: there is simply no great need to reprioritize the entire set of projects every few months; rather the focus is more on in-depth reviews on individual projects and making sound Go/Kill decisions on each.. Portfolio management is simply added to the process by modifying the gates somewhat, (e.g. displaying portfolio lists and charts at gates) and holding several portfolio reviews annually, but more a course corrections.

2. The "Portfolio Reviews Dominate" is best suited to fast-paced companies in fluid markets, whose portfolios are likely to be more dynamic: here a constant reprioritization of the portfolio of projects is essential, simply because things change so fast in the marketplace. What was a great project several months ago suddenly is not so good anymore – the whole market has changed! In this method, all projects are up for auction about 4 times per year. Portfolio Reviews are the key decision meetings and amount to an all-project., mass gate meeting, where all projects and all resources are on the table.

[5] This last part of the chapter is taken from an article in Research-Technology Management [10].

Approach 1: The Gates Dominate

Here, the philosophy is that if your gating or new product process is working well, the portfolio will take care of itself. Therefore, make good decisions at the gates! The emphasis of this approach is on *sharpening gate decision-making* on individual projects.

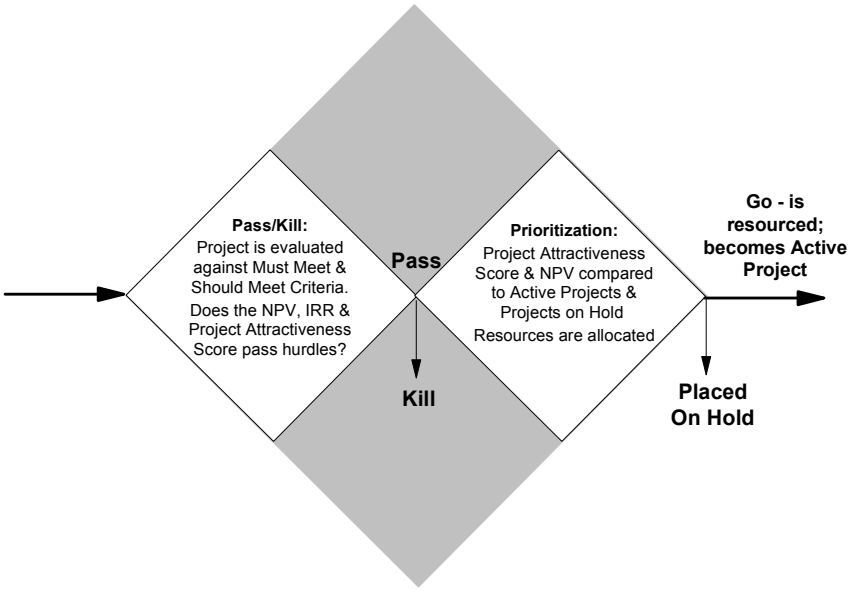
In Approach 1, senior management or gatekeepers make Go/Kill decisions at gates on individual projects. Also at gates, the project is prioritized and resources are allocated. Gates thus provide an in-depth review of projects, one project at a time, and project teams leave the gate meeting with committed resources – with a check in hand! This is a *real-time decision process,* with gates activated many times throughout the year. By contrast, the periodic Portfolio Review, held perhaps once or twice a year, serves largely as a check to ensure that real-time gate decisions are good ones.

This "gates dominate" approach is often used by companies that already have a *Stage-Gate™* process in place, and one that is working well. They then add portfolio management to their gating process, almost as a complementary decision process. This approach used most often in larger companies, in science-based industries, and where projects are lengthy.

Here's how it works: Projects proceed through a gating process as portrayed in Figure 10. Projects are rated and scored at gates, usually by senior management, especially at more critical gates (Gate 3 and beyond).

To introduce portfolio management, gates become two-part decisions (Figure 11). The first part or half of the gate is a Pass-versus-Kill decision, where individual projects are evaluated using the financial, checklist and scoring model valuation tools described above.

Figure 11: The Two-Part Decision Process at Gates



Source: *Research-Technology Management* [10].

The second half of the gate meeting involves *prioritization* of the project under discussion versus all other projects (Figure 11). In practice, this means making a Go-versus-Hold decision, and if Go, allocating resources to the project. A rank-ordered list of projects is displayed to compare the relative attractiveness of the project under discussion to the other Active and On Hold projects (Table 2). Here, projects can be ranked on a financial criterion (for example, NPV or, better yet, the ECV) or on the Project Attractiveness Score derived from the scoring model.

Additionally, the impact of the proposed project on the total portfolio of projects is assessed. The question is: Does the new project under discussion improve the balance of projects (or detract from balance), and does the project improve the portfolio's strategic alignment? Bubble diagrams and pie charts are the tools used for visualizing balance and alignment, as outlined above.

Note how the gates dominate the decision process in this approach: Go/Kill, prioritization decisions and resource allocation decisions are made in real time, right at the gate meeting. But other projects are *not* discussed and reprioritized at the gate; only the project in question is given a relative priority level versus the rest.

Portfolio Reviews in Approach 1

What about looking at all projects together? That's the role of Portfolio Reviews. In this approach, the Portfolio Reviews serve largely as *a check that the gates are working well.* Senior management meets perhaps twice a year to review the portfolio of all projects using the various pie charts, bubble diagrams and lists described (Figures 3-7 and Table 2):

- ✓ is there the right balance of projects?
- ✓ the right mix?
- ✓ are all projects strategically aligned (fit the business's strategy)?
- ✓ are there the right priorities among projects?

If the gates are working, not too many decisions or major corrective actions should be required at the Portfolio Review. Some companies indicate that they don't even look at individual projects at the Portfolio Review, but only consider projects in aggregate!

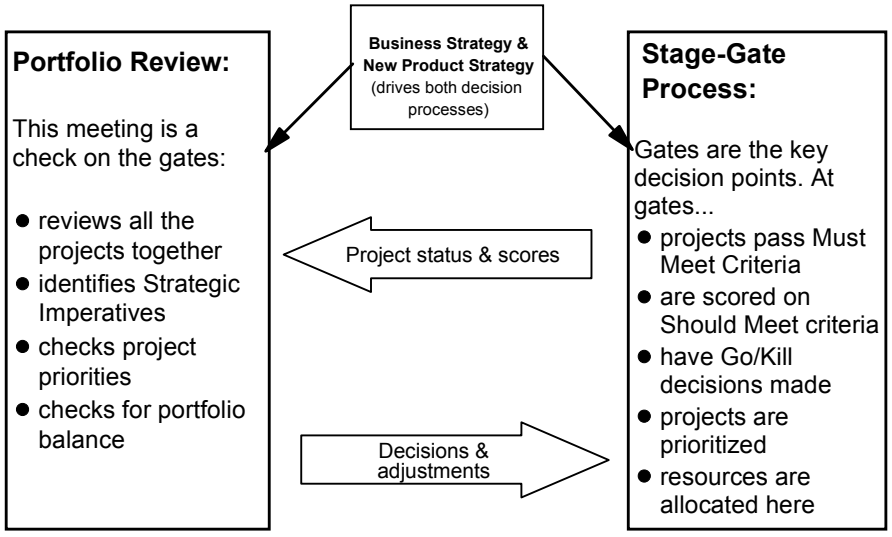
Recap: Approach 1

To recap, the gates are where the day-to-day Go/Kill decisions are made on projects in Approach 1. Gates focus on individual projects – one at a time – and are in-depth reviews. At gates, each project is evaluated and scored before moving on to the next stage – a real-time decision process. At gates, poor projects are spotted and weeded out, and good ones are identified and prioritized accordingly. Note that resource decisions – committing people and money to specific projects – are made right at these gate meetings. Thus, the gates become a two-part decision process, with projects evaluated on absolute criteria in the first part (Pass/Kill decisions in Figure 11), followed by a comparison with other Active and On-Hold projects in the second part (Go-versus-Hold decisions).

Portfolio Reviews, by contrast, are periodic meetings, held perhaps twice per year. They serve as a check on the portfolio, and oversee the gate decisions being made. If the gates are working well, the Portfolio Reviews are largely a rubber stamp.

Note that the portfolio reviewers and the senior gatekeepers are most often the same people within the business. The result of the gating process working in tandem with the Portfolio Reviews is an effective, harmonized Portfolio Management Process (Figure 12).

Figure 12: Method 1 - An Integrated Portfolio Management Process (Stage-Gate with Portfolio Reviews - Method 1)



Source: *Research-Technology Management* [10].

Approach 2: Portfolio Review Dominates

The philosophy of the second approach is that every project must compete against all the others. A single decision on all projects replaces one of the gates in the gating process.

Here, senior management makes Go/Kill and prioritization decisions at the Portfolio Reviews, where *all projects* are *up for auction* and are considered on the table together. This Portfolio Review typically occurs four times a year. The gates in the *Stage-Gate* process serve merely as checks on projects – ensuring that projects remain financially sound and are proceeding on schedule.

The result of this "portfolio review dominates" approach is a more dynamic, constantly changing portfolio of projects. The method may suit faster-paced companies, such as software, IT and electronics firms, but it requires a much stronger commitment by senior management to the decision process, spending the time to look at all projects together and in depth several times a year.

Approach 2 uses many of the same portfolio tools and models described above, but in a different way. The result is a more dynamic portfolio of projects. In this approach, the project enters the portfolio process typically after the first stage (at Gate 2 in Figure 10) when data are available.

The main difference from Approach 1 is that early in the life of projects, a combined Gate 2 and Portfolio decision meeting takes place. All new Gate 2 projects, together with all projects past

Gate 2, are reviewed and prioritized against one another. Every project at Gate 2 and beyond is thus in the auction, and all these projects are ranked against each other. Active projects, well along in their development, can be killed or reprioritized here, and resources are allocated here rather than at gates.

The role of gates in Approach 2 is very different from Approach 1. Successive gates (after Gate 2) are merely check points or review points. They:

- ✓ check that the project is on time, on course and on budget
- ✓ check quality of work done – the quality of deliverables
- ✓ check that the business case and project are still in good shape.

If No, the project could be killed at the gate, recycled to the previous stage, or flagged for the next Portfolio Review/Gate 2 meeting.

An "All Projects" Gate 2 Meeting

The major decisions, however, occur at the combined Gate 2/Portfolio decision point, which is a more extended, proactive meeting than Portfolio Reviews in Approach 1. And although this is a periodic process, it is almost real-time because this Portfolio/Gate 2 meeting is usually held every three months.

The format of this vital, quarterly Gate 2/Portfolio decision point is typically this: All Gate 2 and beyond projects are "on the table." The portfolio managers (senior management) first identify the "Must Do" projects – the untouchables. These are projects that are either well along and still good projects, or are strategic imperatives. Then, management votes on and identifies "Won't Do's," which are killed outright.

Next, the projects in the middle are evaluated. There are different methods here:

- ❑ Some firms use the same criteria they use at gate meetings, and in some cases, the most recent gate 0-10 scores; that is, the Project Attractiveness Score from each project's most recent gate meeting is used to rank-order the projects.
- ❑ Other managements re-score the projects right at the Portfolio/Gate 2 meeting (using a shorter list of criteria than the list found in the typical scoring model).
- ❑ Forced ranking on criteria is also used. Here management ranks the projects *against one another* – 1 to *N* – on each criterion. Again, a handful of major criteria are used, such as those used by Kodak at its Portfolio Review [17]:
  - ✓ Strategic fit
  - ✓ Product leadership (product advantage)
  - ✓ Probability of technical success
  - ✓ Market attractiveness (growth, margins)
  - ✓ Value to the company (profitability based on NPV).

We recommend the forced ranking method because it yields better discrimination than a traditional scoring model, forcing some projects to the top of the list and others to the bottom. One of the weaknesses of a scoring model is that projects tend to score middle-of-the-road – every project scores 60 out of 100. But any of these three methods yields a list of projects, rank-ordered according to objective scores. Projects are ranked until one runs out of resources. This ranked list is the first cut or *tentative portfolio.*

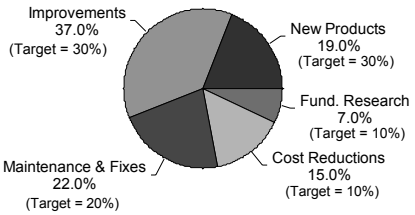
Following this, it is necessary to check for portfolio balance and strategic alignment: The proposed portfolio is displayed using some of the bubble diagrams, prioritized lists, and pie charts described above (summarized in Figure 13). The purpose here is to visualize the balance of the proposed portfolio and also to check for strategic alignment. If the tentative portfolio is poorly balanced or not strategically aligned, projects are removed from the list and other projects are bumped up. The process is repeated until balance and alignment are achieved.

Figure 13: The Portfolio Display After Completing the Ranking

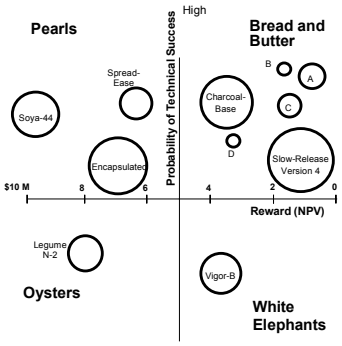
Prioritized Scored List of Active and On Hold Projects

Project	Rank (Priority Level)	Total Project Score	Portfolio Balance Factor	Adjusted Total Project Score
Soya-44	1	80	1.10	88
Encapsulated	2	82	1.00	82
Legume N-2	3	70	1.10	77
Spread-Ease	4	75	1.00	75
Charcoal-Base	5	80	0.90	72
Projects on Hold				
N2-Fix	1	80	1.00	80**
Slow-Release	2	70	1.10	77*
Multi-Purpose	3	75	.90	68
etc..	etc..			

By Project Type



Risk-Reward Bubble Diagram



Check for balance & alignment after completing the project ranking

Source: *Research-Technology Management* [10].

A Recap: Approach 2

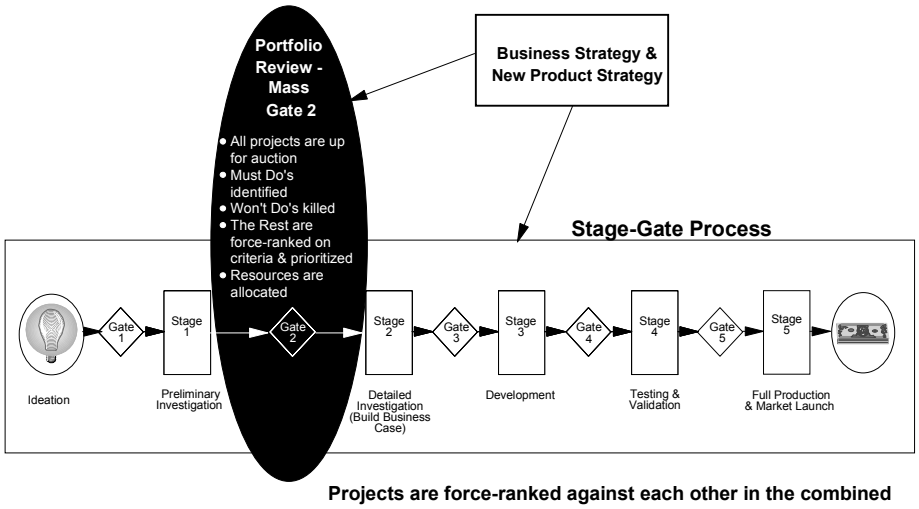
To recap, the Portfolio/Gate 2 decision meeting is where the key decisions are made in Approach 2. The Portfolio Review is really a Gate 2 and Portfolio Review all-in-one, and held about four times a year. It is here that the key Go/Kill decisions are made, and, consequently, is a senior management meeting. With all projects at or beyond Gate 2 on the table, the meeting:

- ✓ spots Must Do and Won't Do projects
- ✓ scores (forced ranking) the ones in the middle
- ✓ checks for balance and strategic alignment (using various portfolio charts and bubble diagrams)
- ✓ decides the portfolio: which projects, what priorities, how much resources.

The gates serve mainly as a check. Projects are checked as they progress from stage to stage to ensure that they are on time, on budget and remain good projects. Go/Kill decisions are still made at gates to weed out poor projects. Gates rely on criteria, and the scores at these gates are often used as inputs to the Portfolio Review meeting.

Approach 2 thus lashes together the two decision processes: the gating process and the Portfolio Review. Gate 2 is really the integrative decision point in the scheme, and the point where the two decision processes intersect (Figure 14).

Figure 14: Method 2 - Portfolio Management Intersecting with the New Product Process



Projects are force-ranked against each other in the combined Gate 2/Portfolio Review. Prioritization is established, and resource are allocated here. Subsequent gates serve as checks.

Source: *Research-Technology Management* [10].

Pros and Cons: Approach 2 vs. 1

Approach 2 has some advantages (and disadvantages) versus Approach 1. Management indicates that it is easier to prioritize projects when looking at all projects on the table together (rather than one at a time at real-time gates). Additionally, some people have difficulty with the two-part gate approach in Approach 1 and Figure 11; for example, how does one find resources for a good project when that is the only project being considered at the meeting? Finally, some managers like the notion that prioritization of all projects is redone regularly – no project is sacred!

There are also disadvantages to Approach 2, and areas in which Approach 1 is superior. Many managements believe that if projects are to be killed, then the project team should be there to defend the project (or at least to provide updated information), such as happens at an in-depth gate meeting. Another criticism is that Approach 2 requires a major time commitment from senior management; often taking several days every quarter to conduct this Portfolio/Gate 2 decision meeting!

A final advantage of Approach 1 is that gate reviews provide a much more in-depth assessment than is ever possible when all the projects are considered at a single meeting.

Just Do It!

New product portfolio management has become a vital concern, particularly among leading firms. Although a number of tools have been described that help to select projects and visualize a portfolio, the choice of tool may not be that critical; indeed, the best performers use an average of 2.4 tools each – no one tool can do it all!

Two different approaches to portfolio management – where the gates dominate, and where the Portfolio Review dominates – have also been outlined. Both have their merits, and both are recommended. Regardless of which portfolio method or which specific tools you favor, do move ahead: choose a method and implement it! Our research shows clearly that those businesses that feature a systematic portfolio management process – regardless of the specific approach – outperform the rest.

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