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Portfolio Management for New Product Development: Results of an Industry Practices Study

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Portfolio Management for New Product Development: Results of an Industry Practices Study

By Dr. Robert G. Cooper, Dr. Scott J. Edgett and Dr. Elko J. Kleinschmidt



This paper reports the results of a survey questionnaire sent to IRI member companies participating in an ongoing best practices study (results as of October 2001). Dr. Cooper, Dr. Edgett and Dr. Kleinschmidt examine the consequences of poor portfolio management practices. They outline the results of the study including the role of portfolio management at the participating companies and why industry considers it to be so important. The article then examines popular tools, methods and models employed by these companies to make go/kill decisions and to help prioritize projects.

Keywords: Industrial Research Institute (IRI), portfolio management, tools, models, and methods.



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Introduction

Portfolio management for product innovation has surfaced as one of the most important senior management functions [11,23,26] as we move into the next century. Faced with rapidly changing technologies, shorter product life cycles, and heightened global competition, more than ever, how your business spends its technology dollars and resources is paramount to your future prosperity and even your survival. Indeed portfolio management is the *manifestation of your business's strategy* – it dictates where and how you'll invest for the future. Portfolio management treats R&D investments much like a fund manager in the stock market treats financial investments. It deals with issues such as maximizing the value of the portfolio, hence return on R&D spending; an appropriately balanced portfolio; and a portfolio investment strategy that is aligned with the company's overall business strategy.

How do companies decide where and how to spend their R&D funds? And how are senior managements dealing with the issue of portfolio management? This article reports the results of a large sample best practices study into portfolio management (conducted in cooperation with the IRI¹) – see box, next page. The goals of the study are to...

- learn about the role of portfolio management – for example whether or not it is endorsed by senior management; and the reasons why or why not;
- determine what types of portfolio management techniques are used, their relative popularities, and which method appears to dominate the decision process;
- probe the details of some of the portfolio methods – descriptions of each and how they are used;
- identify the best performers – those businesses with enviable portfolios – and assess what distinguishes the best from the rest.

The study's overall goals are to study industry current and best practices in portfolio management, and to gain insights to guide all of us in designing and implementing superior portfolio management methods².

¹ The IRI (Industrial Research Institute) is a Washington-based institute of CTOs (chief technology officers), representing about 80% of R&D spending in the U.S.

² Some of the results of the study have also been reported in [7]. The results of an exploratory study of a handful of leading firms are in [4,5].

Portfolio Management Defined

Before charging into the topic of what portfolio techniques industry relies on, let's stand back and reflect on what portfolio management is. We *define portfolio management* formally as follows [6,7,15,16,25,26]:

Portfolio management is a dynamic decision process, whereby a business's list of active new product (and R&D) 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 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.

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 the entire set of projects, and comparing all projects against each other), making Go/Kill decisions on individual projects on an on-going basis (using gates or a *Stage-Gate*TM process [3]), and developing a new product strategy for the business, complete with strategic resource allocation decisions.

Details of the Study

An exploratory study of 30 leading firms was first undertaken – in-depth personal interviews. This study helped to identify the issues, goals, concerns, metrics, types of methods used, etc. – see [4,5,6].

Next, a detailed survey questionnaire was developed in concert with the IRI's Research on Research Committee. The questionnaire dealt with a number of topics including:

- importance of portfolio management and reasons why
- general nature of the portfolio management method used by the business
- details of the portfolio methods used
- dominant method used
- criteria used for selecting and ranking projects
- performance of the business's portfolio management method
- general demographics (industry, business size, etc.). (etc.). (See also [7,8].)

Most of the questions required the respondent to check a box or circle a number, although some open-ended questions were included to solicit verbal comment. The questionnaire itself was carefully structured, exhaustively reviewed by a committee of industry experts from the IRI, pre-tested on eight businesses via personal interviews, and finalized.

Data was collected via a mail survey of businesses known to be active in product development in North America. The population list included the IRI membership list (largely CTOs of larger firms in the US) as well as other private lists compiled by the authors. Although not the total population of all firms undertaking R&D and product development in the U.S., the list is a fairly representative one.

The eventual combined useable response rate was a respectable 205 completed questionnaires (a response rate of 25.8%). The breakdown of businesses by industry is given in Figure 1. The mean size of corporations in the study is \$6.74 billion annual sales, while the mean size of the specific business (unit) studied is \$1.89 billion.

But Why All the Hype?

Portfolio management has gained much attention among senior management this last decade. For example, it was voted the number one issue by CTOs in the IRI, while the book *Third Generation R&D* thrust the topic front and center on the CEO's desk [26]. So vital is that topic that one recent book claims that "... portfolio analysis and planning will grow in the 1990s to become the powerful tool that business portfolio planning became in the 1970s and 1980s." [26].

But why the sudden interest? Simple! If you get portfolio management wrong, expect serious negative consequences in your total new product efforts [10,11]. Indeed, many of the ailments that plague businesses' new product efforts can be directly or indirectly traced to ineffective portfolio management, according to the managers we interviewed in the exploratory phase of the investigation (see box):

Strategic: One negative side of poor portfolio management is that strategic criteria are missing in project selection. This translates into no strategic direction to projects selected; projects not strategically aligned with the business strategy; many strategically unimportant projects in the portfolio; and R&D spending that does not reflect strategic priorities of the business. The end result is a scattergun R&D and new product effort that does not support the company's strategy.

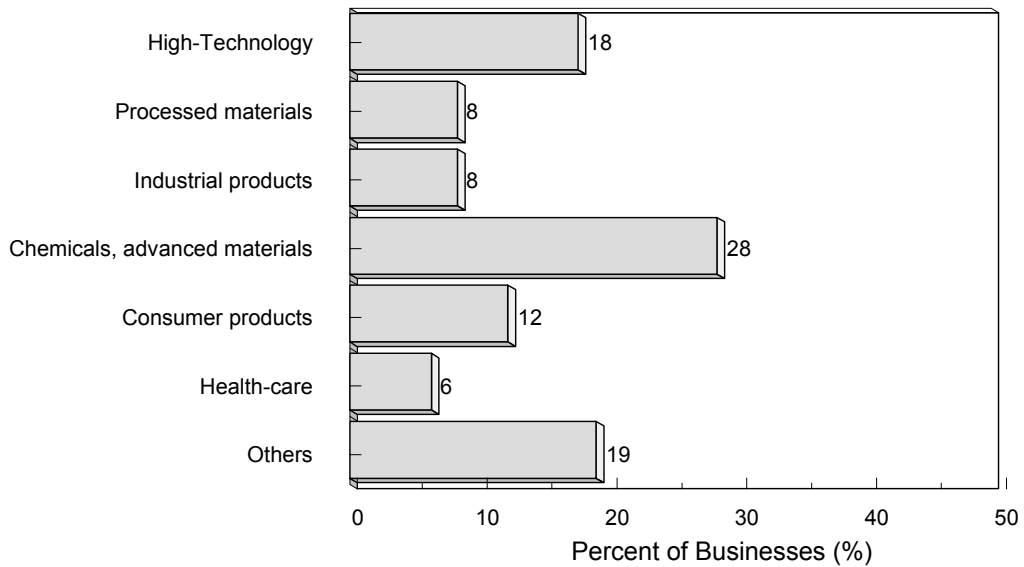
Low value projects: Poor portfolio management means deficient Go/Kill and project selection decisions, which in turn leads to many mediocre projects in the pipeline – too many extensions, modifications, enhancements and short-term projects. Many of these are marginal value projects to the business. This translates into a lack of stellar, high reward projects, while the few really good projects are starved for resources – they take too long, and may fail to achieve their full potential.

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

The wrong projects: Poor portfolio management means that often the wrong projects are selected. With no formal selection method, decisions are not based on facts and objective criteria, but rather on politics, opinion and emotion ... for example, "pet" projects of some senior executive. Many of these emotionally-selected projects fail.

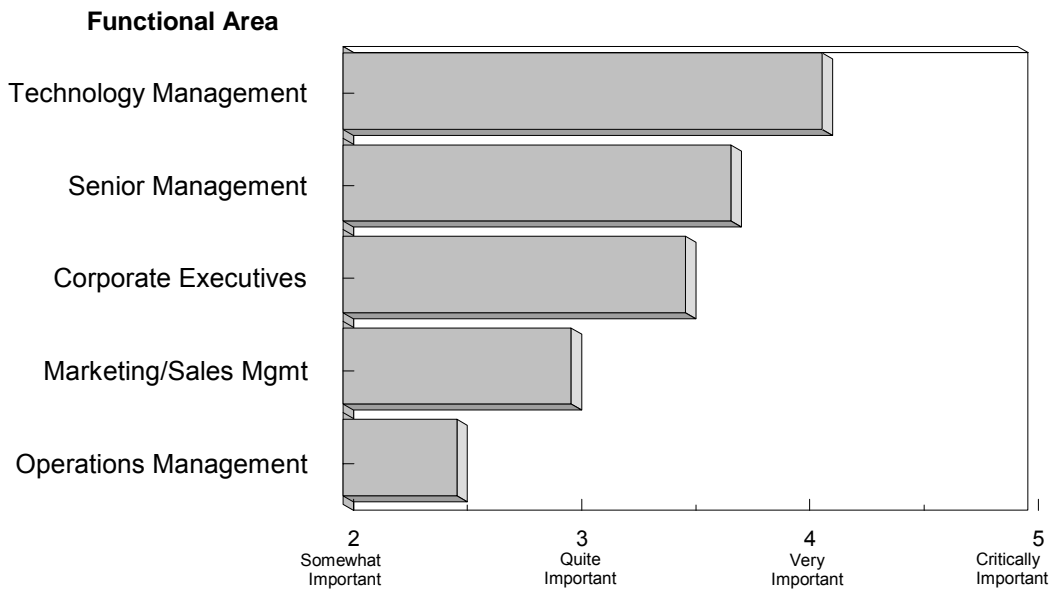
Portfolio management is typically very poorly handled, however. It was rated as the *weakest area in new product management* in a recent benchmarking study [10]. Management confessed to no serious Go/Kill decision points in their new product process; no criteria for making the Go/Kill decision; poor project prioritization; and too many projects for the limited resources available.

Figure 1: Breakdown of Businesses in the Study by Industry



Note: High-Technology includes aerospace, electronics, professional & scientific instruments, computer & related products, communications, R&D services and genetic engineering.
Health-care includes medical products and pharmaceuticals.

Figure 2: How Senior Management Sees the Importance of Portfolio Management



• Rank-ordered according to mean scores (highest scores at top of figure).

Effective portfolio management for new product and R&D spending is thus a major business challenge. So much that is right or wrong with your business's new product efforts hinges on the project selection and portfolio choices you make. The trouble is that there are many different approaches, much confusion about which is best, and no easy answers. Indeed it is a topic that most companies that we interviewed in the exploratory study were spending considerable time and energy addressing.

So read on and witness the results of this first and large sample survey of business practices and opinion on the vital topic of new product portfolio management.

How Industry Sees Portfolio Management

Portfolio management is viewed as a very important task in the business, according to at least some senior management in the survey. Figure 2 provides the mean importance ratings of portfolio management, broken down by executive function. Not surprisingly, senior managers in technology (CTOs, VPs of R&D, etc.) are evaluated as giving portfolio management the highest importance ratings of all functions (see 'technology management' with a score of 4.1 out of 5, where 5 = critically important). They are followed by senior management overall and then by corporate executives. Of the 20 percent top performing firms, senior managers are given the value of 4.2 on the 5-point scale, the technology managers in the top 20% are given a 4.6 out of 5. (These details are not shown here but are depicted in Figure 18).

Note, however, that Marketing/Sales managements are perceived as thinking that portfolio management is less important (the score is only at the mid-range, 3.0 out of 5 based on the assessment of the respondents of the 205 firms). This is problematic: the fact that Marketing/Sales senior management are not perceived to have vigorously bought into the concept and importance of portfolio management represents a serious deficiency in the widespread acceptance and implementation of portfolio management. Clearly the function that interfaces with the customer – namely Marketing/Sales – has a clear role to play in project selection and portfolio management. Additionally, and perhaps less of a surprise, Operations/Production managements are perceived as viewing portfolio management as the least important of all functional management groups (a 2.5 on the 1 to 5 point scale).

Why So Critical?

Why is portfolio management so important? Consider these *eight key reasons* cited by senior management who took part in the study:

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.
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.
8. to provide better objectivity in project selection – to weed out bad projects.

These eight reasons were uncovered in part by asking managers to rate possible reasons why portfolio management might be important in their businesses. Seven possible reasons were suggested, and ratings on each one were sought [7,8,9]. Figure 3 shows the ratings. Additionally, numerous verbal or “top of mind” comments were also provided by respondents, and are grouped and listed by frequency of mention (see Figure 4).

If your senior management has not yet adopted portfolio management, then you may wish to introduce them to the reasons why other companies place such importance on the topic. So, consider the reasons in a little more detail:

1. *Financial*: Not surprisingly, the most frequently mentioned reasons (see Figure 4) by far for why portfolio management is so vital are financial – making the most money, bang for buck, and so on. Many of these financial reasons obviously are closely related to maintaining the competitive position of the business and to effective resource allocation, but it is indeed interesting to note how much *the financial concerns dominate the discussion* on why the business undertakes portfolio management. Comments such as “... because it [portfolio management] improves and maximizes R&D productivity” and “... to get the best return on investment” are typical here.
2. *Maintaining (or improving) the competitive position of the business* – the number one rated item in Figure 3 – is echoed in the “top of mind” comments as a reason why portfolio management is important. The types of comments offered include “... because we must continue to meet our growth targets” and “... because we must depend on new products to grow”.

3. *Properly and efficiently allocating scarce resources* is a key issue for managements, and is rated an important reason why portfolio management is critical (see Figure 3). Today's business is called upon to develop and launch more new products, and faster than ever. But resources have not increased. Thus, allocating these scarce resources is more vital than ever, hence the increasing importance of portfolio management. A typical comment is that "portfolio management focuses resources on projects that matter most to the business". In the same vein, "portfolio management is important to ensure that the limited number of new product projects we can do and our limited development resources are aimed at parts of the business that need them most and can maximize their value".
4. *Strategic issues* is another major "top of mind" theme (see Figure 4), which coincidentally, is the number three rated reason for the importance of portfolio management in Figure 3. Increasingly, the realization is that *strategy begins when one starts spending money*, and so resource allocation to projects is how strategy is implemented. Comments such as "portfolio management is the *tangible expression of strategy*" and "portfolio management is critical because it provides the *basis for meeting defined business objectives*" are common.
5. *The desire to achieve better focus* – not doing too many projects for the resources available – is also a highly rated reason, and emerges in the "top of mind" comments as well (see Figures 3 and 4). "We have too many projects ... we wish to resource the great ones!" and "we want to make sure that the resources are focused on the right ones" characterize the desire for focus.
6. The goal of the *right balance* of projects (e.g., between long term and short term, between high risk and low risk) is yet another highly rated reason (see Figure 3). "Portfolio management makes sure that where resources are spent is consistent with short term and long term business goals" and "portfolio management helps to balance short term and long term goals" are typical comments.
7. *Improved communication within the organization* is a frequently-mentioned "top of mind" reason for viewing portfolio management as important (see Figure 4). Some communication is vertical and for visibility reasons: "portfolio management is a very effective communication tool between executive management and divisional management" and "portfolio management provides visibility for all projects so that people understand why we are working on a certain project" are comments heard here.

Horizontal communication – across functions – is also a frequently cited "top of mind" reason for adopting portfolio management: Comments are that "portfolio management promotes communication between R&D and Commercial" and "... to maintain uniform priorities [of projects] across functions".

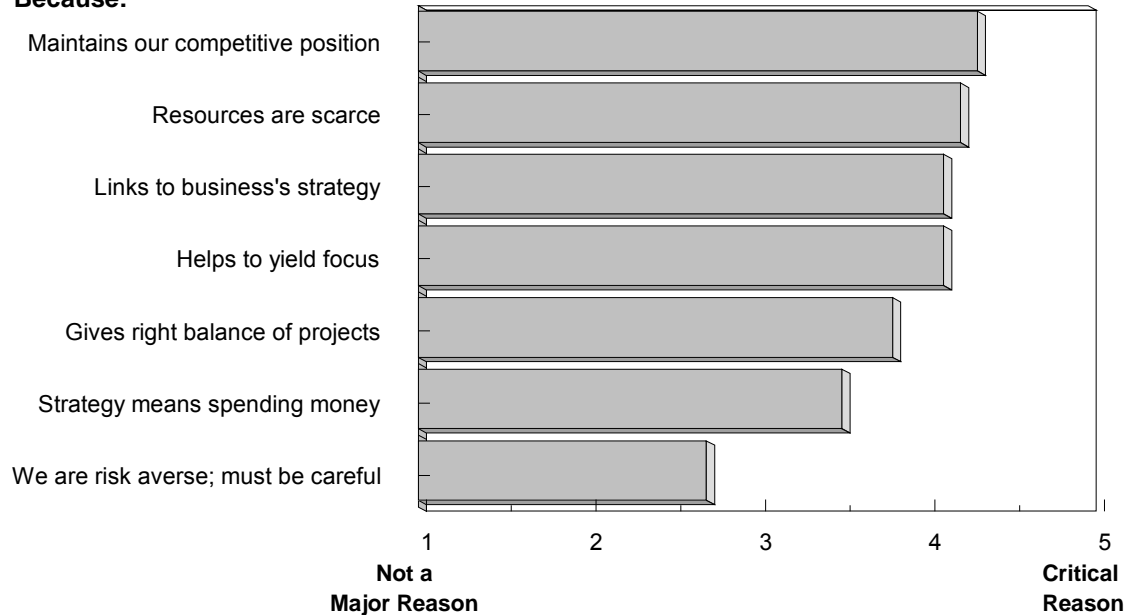
8. *Providing better objectivity in project selection* is the final reason for the importance accorded portfolio management (see Figure 4). The view is that portfolio

management “greatly reduces the tendency for ‘pet projects’ to enter the system – projects that cannot really be justified” and that effective portfolio management must be in place “... to ensure that projects do not take on a life of their own – that older projects which have outlived their usefulness can be killed and replaced by others.”

The only identified reason that is relatively low-rated is the last item in Figure 3: the fact that the business might be risk averse and conservative, so that it must be very careful in project selection so as to have no failures. This is not deemed to be a very important reason for adopting portfolio management.

Figure 3: Reasons Why Portfolio Management is Important

Because:



• Reasons are rank-ordered according to mean scores (most important at top of figure).

Figure 4: Reasons Why Portfolio Management is Important -- "Top of Mind" Comments

1.	Financial reasons: make money, maximize returns
2.	Strategy: expression of strategy, supports strategy
3.	To communicate vertically; to create visibility
4.	To communicate horizontally
5.	To increase objectivity
6.	To increase sales and market share
7.	To achieve focus

• Rank-ordered in terms of frequency of mention; unaided, top-of-mind comments.

Popularity of Portfolio Management Methods Used

The popularity of portfolio methods that industry uses provides insights and guides to others. But words of caution: just because a method is popular, don't assume it gives the best results. In fact, a provocative finding that we outline later in the article is that the most popular portfolio methods yield the poorest results. Here then are the methods uncovered, and their relative popularities (see Figure 5, light bars). (For a review of methods assessed in academic journals see [1], see also [2,4,14, 18, 19, 22, 27])

Note that many businesses use multiple methods, so that the percentages of methods used in Figure 5 add up to well over 100 percent. Thus we queried respondents about which method is the *dominant one* – the method that dominates the decision process. The black bars in Figure 5 show the breakdown of dominant methods used (add to 100 percent).

1. *Financial methods* dominate portfolio management and project selection approaches. Financial methods include various profitability and return metrics, such as NPV, RONA, ROI or payback period. See Figure 6 for an example of a typical financial method, the ECV approach. The popular Productivity Index method is yet another but similar approach here [13,20]. A total of 77.3 percent of businesses use a financial approach in portfolio management and project selection – see Figure 5 – while 40.4 percent of businesses rely on financial approaches as the dominant portfolio method. That is, project selection and the composition of the portfolio of projects boils down to a financial calculation, and the rating and ranking of projects is based on this financial number or index!
2. The *business's strategy* as the basis for allocating money across different types of projects is the second most popular portfolio approach. 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. See Figure 7 for a disguised example of one strategic method as used in a major materials company – we labelled it the Strategic Buckets approach [4,5,6,16,21,25,28]. A total of 64.8 percent of businesses use a strategic approach to select their portfolio of projects; for 26.6 percent of businesses, this is the dominant method.
3. *Bubble diagrams or portfolio maps* have received much hype and exposure in recent books, articles and software [6,13,20,22,26]. Here, projects are plotted on an X-Y plot or map, much like bubbles or balloons. Projects are categorized according to the zone or quadrant they are in (e.g., pearls, oysters, white elephants, and bread-and-butter projects) – see Figure 8 for an example. These bubble diagrams resemble the original portfolio models – Stars, Cash Cows, Dogs, etc. – except that the axes are quite different, and projects rather than business units are plotted [12]. A total of 40.6 percent of businesses use portfolio maps; only 5.3 percent of businesses use this as their dominant method, however.

Figure 5: Popularity of Portfolio Methods Employed

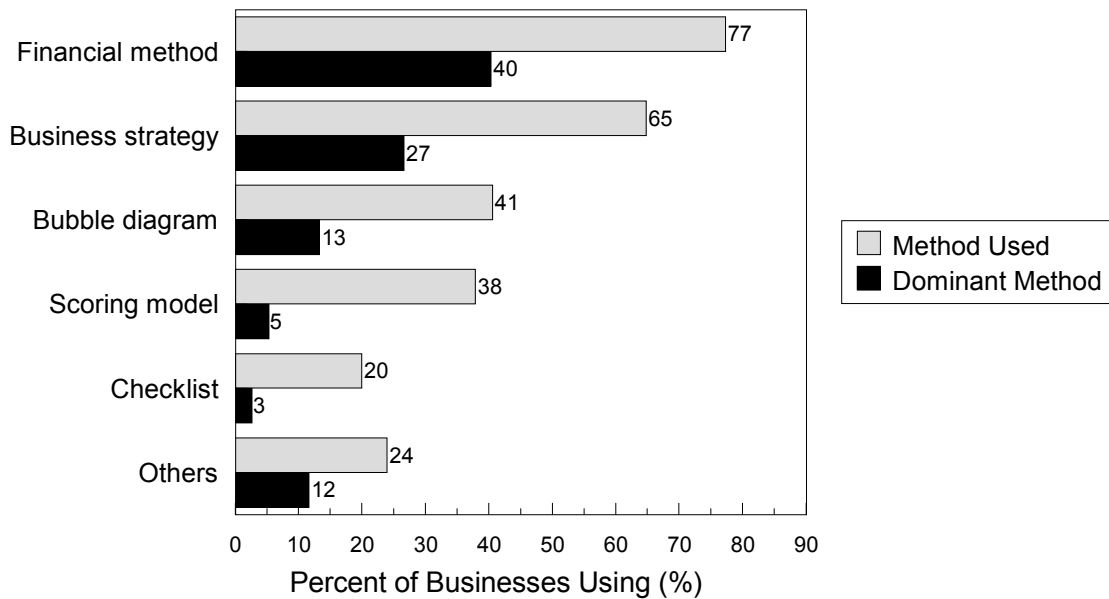
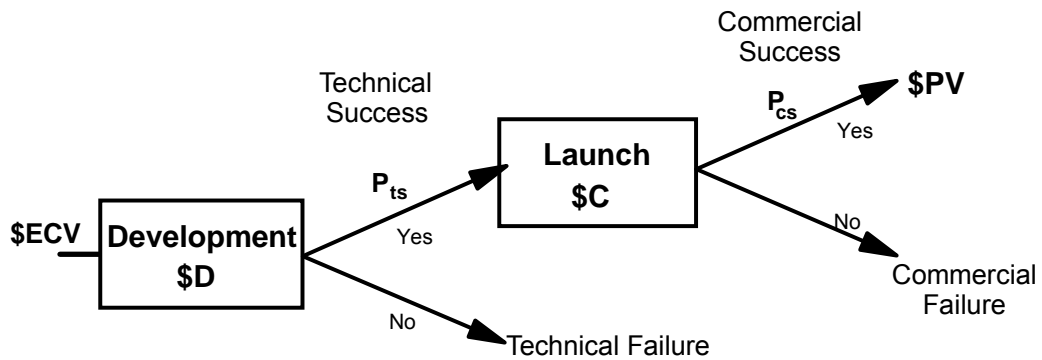


Figure 6: Rank Ordered Against Financial Criterion -- Determination of Expected Commercial Value of Project



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

- \$ECV = Expected Commercial Value of the project
- \$PV = Income stream from project (discounted to present)
- \$C = Commercialization costs (capital equipment & market launch)
- \$D = Development costs
- P_{ts} = Probability of technical success
- P_{cs} = Probability of commercial success (given technical success)

The ECV (Expected Commercial Value) is determined for each project, and divided by the constraining resource (e.g., by R&D cost per project). Projects are then rank-ordered according to this ECV/R&D index..

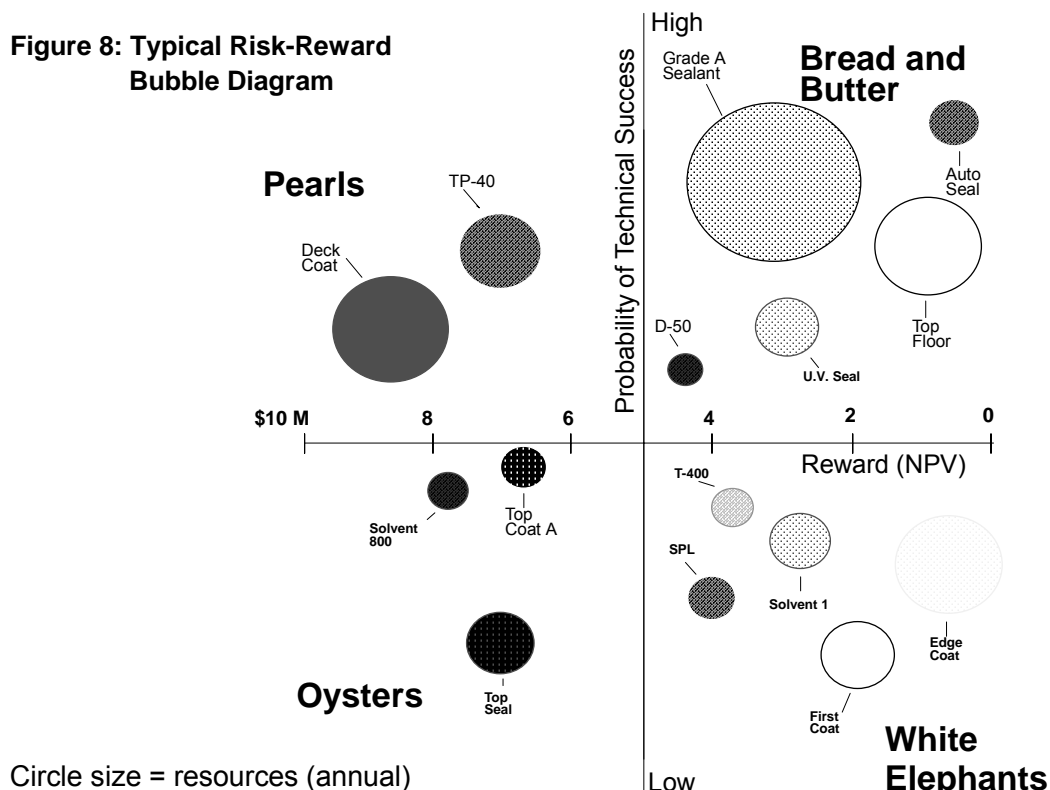
4. *Scoring models*: Here, projects are rated or scored on a number of questions or criteria (for example, low-medium-high; or 1-5 or 0-10 scales). The ratings on each scale are then added to yield a Total or Project Score, which becomes the criterion used to make project selection and/or ranking decisions. This addition is done in a simple or a weighted fashion (certain questions are weighted more heavily, reflecting greater importance). Figure 9 provides a sample of the scoring model used in a major chemical company [6]. A total of 37.9 percent of businesses use scoring models; in 13.3 percent, this is the dominant decision method. (For further details on scoring models and check lists see [17, 24, 26,29])
5. *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 20.9 percent of businesses use check lists; and in only 2.7 percent is this the dominant method.
6. *Others*: Twenty-four percent of businesses indicate that they use some "other method"— other than the ones described above. A closer scrutiny of these "other" methods reveals that most are variants or hybrids of the above models and methods, for example:
 - Many businesses that responded "other method" describe a strategically driven process, much like the strategic method above. That is, they let their business's strategy drive the spending splits (e.g., across buckets such as markets, product types, project types) and even let their strategy drive the choice of individual projects.
 - A number of businesses use multiple criteria – profitability, strategic, customer appeal – but not necessarily in a formal scoring model format (as in method 4 above).
 - Some businesses use probabilities of commercial and technical success, either multiplied together, or multiplied by various financial numbers (EBIT, NPV) – a variant of the financial methods (#1 above).
 - One business simply confessed to relying on "intuition and experience".

Figure 7: Strategic Buckets Method

New Products: Product Line A Target Spend: \$8.7M	New Products: Product Line B Target Spend: \$18.5M	Maintenance of Business: Product Lines A & B Target Spend: \$10.8M	Cost Reductions: All Products 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	

Strategic Buckets method: Based on the business's goals, vision and strategy, senior management makes forced splits of money across various dimensions (for example, by product line; by market; by project type, and so on). From these splits are created 6-10 buckets (only four are shown above). Projects are then sorted into buckets, and then rank-ordered within buckets until the spending limit is reached for each bucket. Ranking can be via a financial index, the ECV, or a scoring model. Using the Strategic Buckets approach, R&D spending is forced to mirror the business's strategy. See also [4,5].

Figure 8: Typical Risk-Reward Bubble Diagram



Details of the Methods: How the Various Portfolio Methods are Used

Use of Financial Methods

Financial methods are the most popular of the various project selection and prioritization methods with 77 percent of businesses using this method overall, and 40 percent reporting it as the dominant method they rely on (see Figure 5). Financial methods are used in several ways:

- Most often, a financial method is used to rank projects against each other. That is, the project's expected financial results or *economic value* is determined, and that value is used to rank order projects against each other in order to decide the portfolio of projects (38.1 percent of all businesses employ this ranking approach – see Figure 10).
- A slightly less popular method, but still evident, is the use of a financial measure compared against a hurdle rate (or acceptable level) in order to make Go/Kill decisions on individual projects (which, in turn, determines the list of active projects, hence the portfolio). A total of 28.4 percent of businesses that operate this way.

Some businesses do both: the project's financial value is used to rank projects against each other, and also is compared to a hurdle to make Go/Kill decisions (10.2 percent of businesses). Those ten percent of businesses doing both – against a hurdle and as a ranking tool – achieve slightly higher portfolio performance than the other three groups in Figure 10.

Use of Strategic Approaches

Strategic approaches, namely allocating resources to different buckets or envelopes based on the businesses strategy, is employed by 65 percent of businesses and is the dominant method for 27 percent of businesses (see Figure 5). Most important, these strategic approaches boast many strengths and very few weaknesses, according to the verbal comments and ratings from respondents.

The approach requires that the business allocate resources into different buckets based on strategy and strategic priorities (see for example Figure 7). The dimensions of these buckets vary greatly by business, but the most popular splits, dimensions or buckets are shown in Figure 11.

The next question is: now that different buckets are defined, each with its allocated resources, how are projects prioritized within a bucket? Figure 12 shows the prioritization approaches here. Note that the majority of businesses use *no formal ranking method*, with financial value and a scoring model being the most frequently cited formal ranking techniques. The fact that no formal method is used by the majority suggests that strategic issues drive the portfolio selection (i.e., strategy determines allocations by bucket, and also heavily influences the choice or ranking of projects within buckets).

Figure 9: Scoring Model (a major chemical company)

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 (years).

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").

3. Strategic Leverage:

- Proprietary position (scored from "easily copied" to "well protected via patents, trade secrets, etc.).
- Platform for growth (scored 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.

4. Probability of Commercial Success:

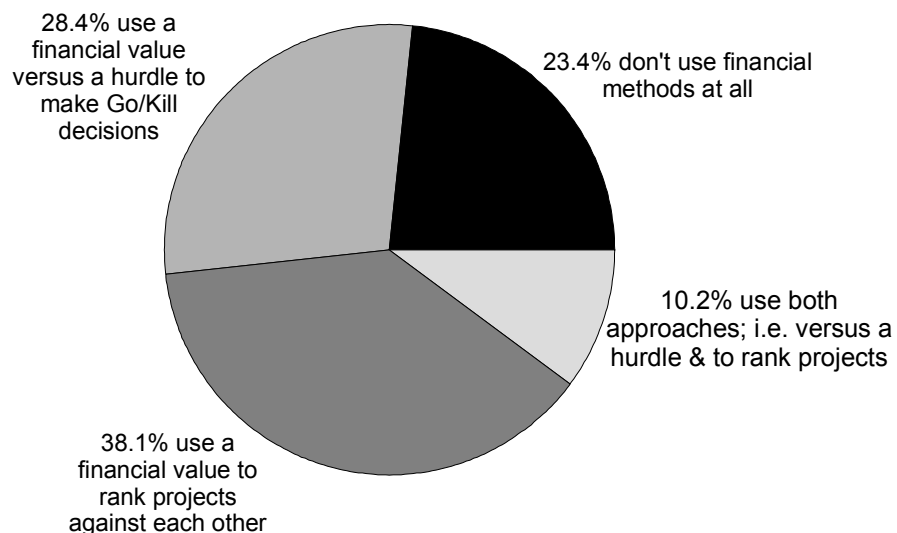
- Existence of a market need.
- Market maturity (scored from "declining" to "rapid growth").
- Competitive intensity: how tough or intense the competition is.
- Existence of commercial applications development skills (scored from "new" to "already in place").
- Commercial assumptions (from "low probability"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

5. Probability of Technical Success:

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

These 19 rating questions are each scored 1-10. Each question is anchored (what a 10 is, what a 1 is). Questions are added in a weighted fashion to yield the five Factors. The five Factors are added, also in a weighted fashion, to yield the Program Attractiveness Score, which is used to make Go/Kill and prioritization decisions. See also [2,4].

Figure 10: Use of Financial Methods (Percent Breakdown of Businesses)



Use of Scoring Models

Scoring models are the dominant method in only 18 percent of businesses, but nonetheless are a fairly popular approach, with 38 percent of businesses using these. Further, scoring models rate exceptionally well with many strengths and few weaknesses, according to managers' comments: those managers that use scoring models like them, and rate them as both effective and efficient decision tools³.

Scoring models, when used, tend to be employed overwhelmingly as a ranking or prioritization tool: that is, the *project score* is used to rank order projects against each other. Relatively few businesses, by contrast, use scoring models to make Go/Kill decisions per se (that is, where the score is compared to some cut-off criterion or hurdle). Figure 13 shows the breakdown of how scoring models are used.

The specific selection criteria used to select or rank projects were also investigated. These criteria are often operationalized in the form of a scoring model or check list method, although "informal use" of these criteria is also reported. Not surprisingly, at the top of the list of selection criteria are *strategic fit* and *financial reward* – see Figure 14. Other important selection criteria include risk and probability of success, and the business's technological and commercial capabilities to undertake the project. We offer this list of criteria in Figure 14, and their frequency of mention, as a guide to you in the development of your own scoring model or check list scheme.

Use of Bubble Diagrams

Bubble diagrams are also a fairly popular portfolio tool, with 41 percent of businesses using them. But bubble diagrams appear more to be a *supporting tool*, with relatively few businesses relying on them as their dominant portfolio method (only 8 percent). Nonetheless, management is a strong supporter of bubble diagrams, rating them as very effective decision tools and strongly recommending their use to others.

Myriad bubble diagram plots are possible. Figure 15 lists the more popular plots identified in the current study, with the common risk/reward plot at the top of the list, and by a considerable margin. You might wish to consider some of the common diagrams in Figure 15 as you design your own portfolio management method.

Use of Check List Models

Check lists are among the least popular portfolio tools, with only 3 percent of businesses using these as their dominant method and only 18 percent using check lists at all. Like bubble diagrams above, when used, check lists tend to be viewed more as a supporting tool, with some other method dominating.

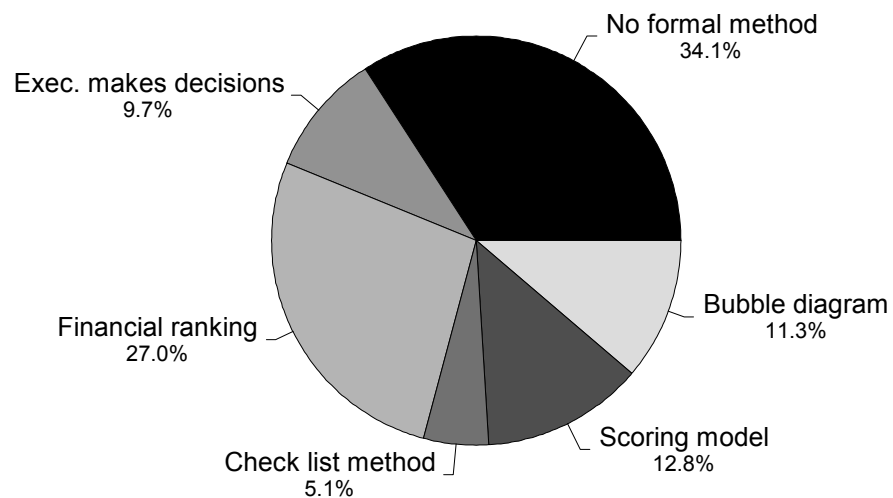
³ In another article, we report the strengths and weaknesses of the various methods, as rated by managers [7]. While significant differences between methods are few, managers rate scoring models well: both effective decisions and efficient decisions. Similarly, managers rate bubble diagrams very highly: they would recommend them to others and these models yield very effective decisions.

Figure 11: Dimensions Used to Split R&D Spending Into Buckets

Rank Order	Dimension
1	Type of Market
2	Type of Development: maintenance, exploratory, frontier research, systems, line extensions
3	Product Line
4	Project Magnitude: minor/major project
5	Technology Area
6	Platform Types
7	Strategic Thrust (against strategies in the plan)
8	Competitive Needs

• Rank-ordered according to frequency of mention.

Figure 12: Strategic Buckets Approach -- How Projects are Ranked Within Buckets



Check lists, unlike scoring models, when used, tend to be employed as Go/Kill decision tools – for making Go/No Go decisions on individual projects – and hardly at all for ranking of projects (see Figure 16). Thus, although much like scoring models – a list of qualitative questions – the roles of these two similar models are quite different: check lists see most duty as a Go/Kill decision tool, with a focus on individual projects; whereas scoring models are most popular as a ranking tool, and for comparing a number of projects against each other.

Figure 13: Use of Scoring Models (Percentage Breakdown of Businesses)

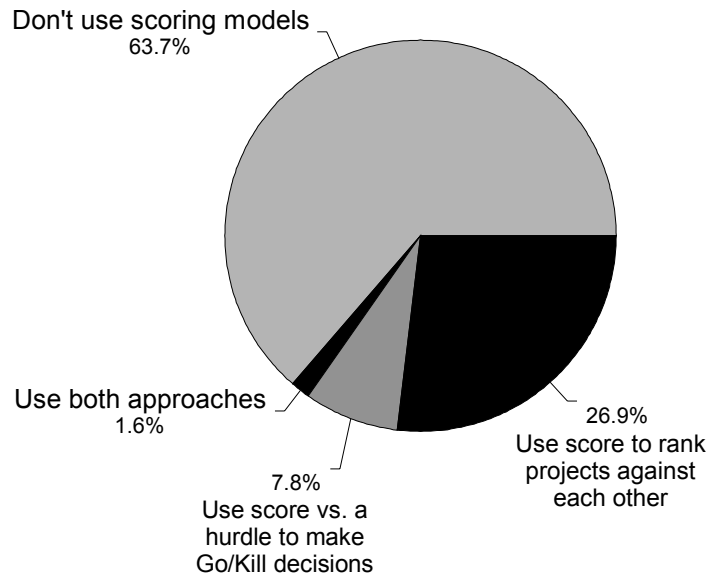
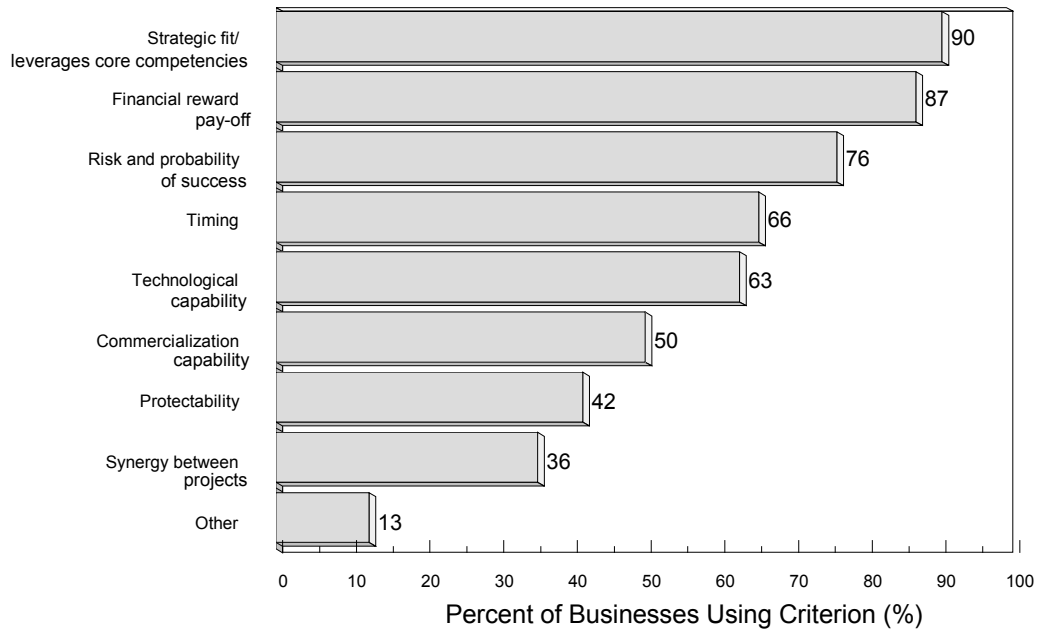


Figure 14: Criteria Used to Rank Projects



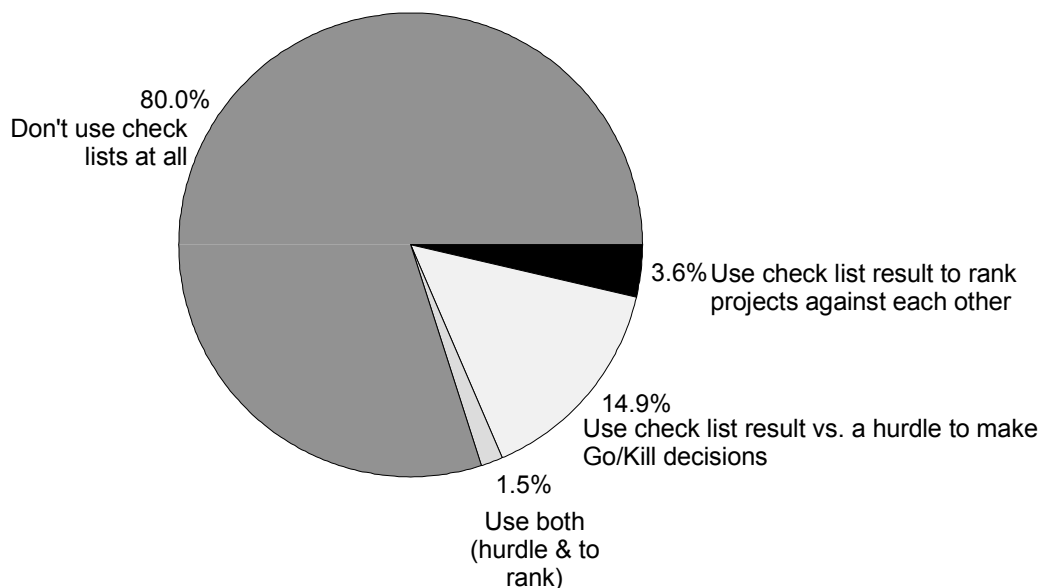
Percentages add to more than 100% due to multiple mentions.

Figure 15: Axes Used in Popular Bubble Diagram Plots

Rank	Type of Chart	Axis #1	by	Axis #2	%
1	Risk Vs. Reward	Reward: NPV, IRR, benefits after years of launch; market value	by	Probability of Success (technical, commercial)	44.4
2	Newness	Technical Newness	by	Market Newness	11.1
3	Ease Vs. Attractiveness	Technical Feasibility	by	Market Attractiveness (growth potential, consumer appeal, overall attractiveness, life cycle potential)	11.1
4	Our Strengths Vs. Project Attractiveness	Competitive Position (our relative strengths)	by	Project Attractiveness (market growth, technical maturity, years to implementation)	11.1
5	Cost Vs. Timing	Cost to Implement	by	Time to Impact	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 (\$)	5.6

* Rank ordered, in descending order of popularity; last column shows percentage breakdown of bubble diagram usage (as a percent of businesses using bubble diagrams).

Figure 16: Use of Check Lists (Percentage Breakdown of Businesses)



How Sound Are Their Portfolios?

The next question: So what are the results? And which method yields the best portfolios? The problem is that portfolio performance is a multi-faceted concept, and cannot be measured by a single metric. Thus, we constructed *six important metrics* to capture how well the business's portfolio is performing [7,8,9⁴], and by inference, how well its portfolio management method is working. These metrics were derived during our exploratory study that helped to identify what a "good portfolio" is. Performance metrics focus on having high value projects, the right balance of projects, a strategically aligned portfolio, the right number of projects, and so on – see Figure 17 for a complete listing.

Portfolio management appears to be working in a *moderately satisfactory fashion* on average in our sample of businesses. Mean scores across the six performance metrics are typically in the mid-range area – not stellar, but not disastrous either – although there are some major differences across performance metrics (see Figure 17; the black bars show mean values). But averages don't tell the whole story here: there are *broad distributions of responses* on these six performance metrics, suggesting major differences between the best and worst performers.

The Best Versus the Rest

This large performance spread begs the question: Who are these better performers? And what is it that they are doing differently than the poor performers? To answer the questions, we developed a single performance gauge, based on the six individual metrics in Figure 17⁵. To gain insights into best practices, we separated the top 20 percent of businesses – the Best – measured by their portfolio performance on this gauge, and compare their results and practices to the bottom 20 percent of businesses – the Worst.

As might be expected, the top performers – the Best – achieve dramatically better portfolio performance results across all six performance metrics (Figure 17, the pairs of shaded bars). For example, their portfolios are aligned with the business's objectives and R&D spending mirrors the business's strategy; and their portfolios contain very high value projects. However, the two areas where the Best really excel are:

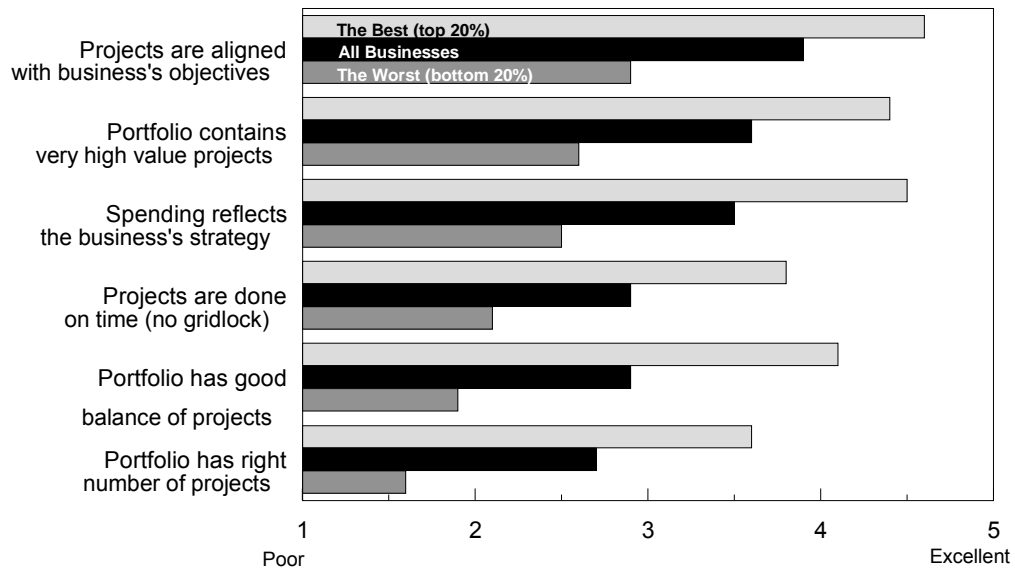
- portfolio balance – achieving the right balance of projects; and
- having the right number of projects for the resources available.

Both are areas where the average business performs fairly weakly.

⁴ These 'performance' measures are perceptual measures but not actual business performance measures [7,8,9]. Actual business performance in financial terms was not available and financial performance is, of course, influenced by many other aspects besides 'good' portfolio management. See discussion on performance measures for new product development success (a much more defined area of performance) and the encountered problems with attempting to use financial measures [15,24].

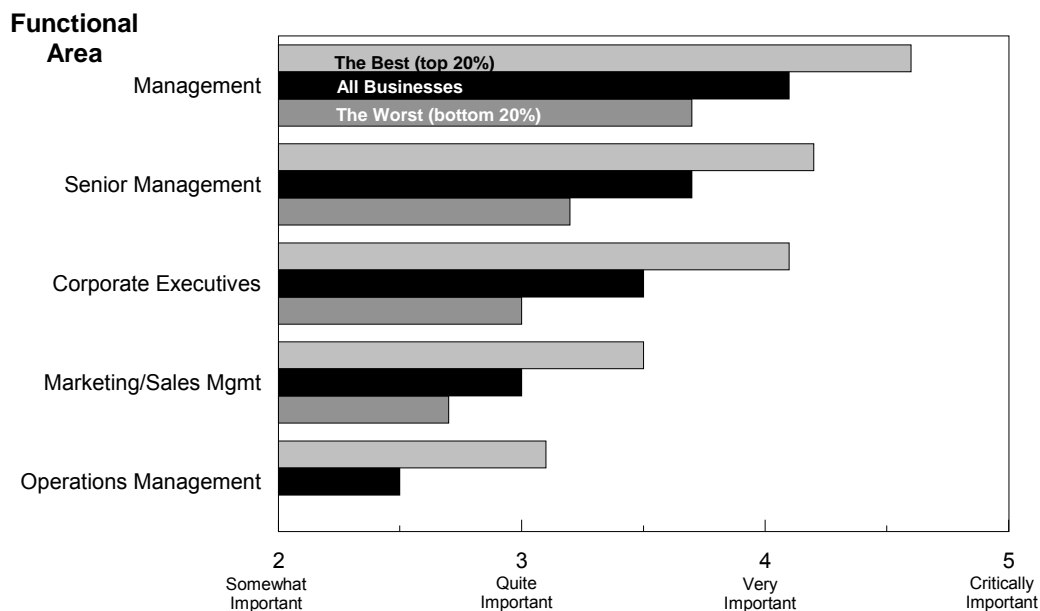
⁵ Factor analysis was undertaken on the six performance metrics in Figure 17 (SPSS-X routine, Varimax rotation, principle components analysis). The results: only a single factor was uncovered, suggesting that the six performance metrics could be combined into a single scale (simple unweighted addition of the six metrics). This single performance scale or gauge is a very robust one, with a high internal consistency (Cronbach coefficient alpha = 0.812).

Figure 17: Portfolio Performance Results On Six Key Metrics -- The Best Vs. Worst



- All differences between Best and Worst are significant at the 0.001 level.
- Performance metrics are rank-ordered according to mean scores (highest mean scores at top of figure).

Figure 18: How Management Sees the Importance of Portfolio Management -- The Best Vs. Worst



- All differences between Best and Worst are significant at the 0.001 level.
- Rank-ordered according to mean scores (highest mean scores at top of figure).

What Distinguishes the Best

Importance of Portfolio Management

Senior managements in the Best companies consistently and significantly view portfolio management as much more important than do managements in the Worst (see Figure 18, the pairs of shaded bars). This is true regardless of functional area. Thus, there appears to be a direct link between whether senior management in a business recognizes portfolio management to be important, and the portfolio results it achieves. Once again, however, technology managers score by far the highest here, with senior technology management in the Best businesses rating portfolio management a very high 4.6 out of 5 in importance. Marketing/Sales and Operations/Production managements continue to be perceived as seeing portfolio management as less vital, even among the Best businesses.

Explicit Portfolio Method

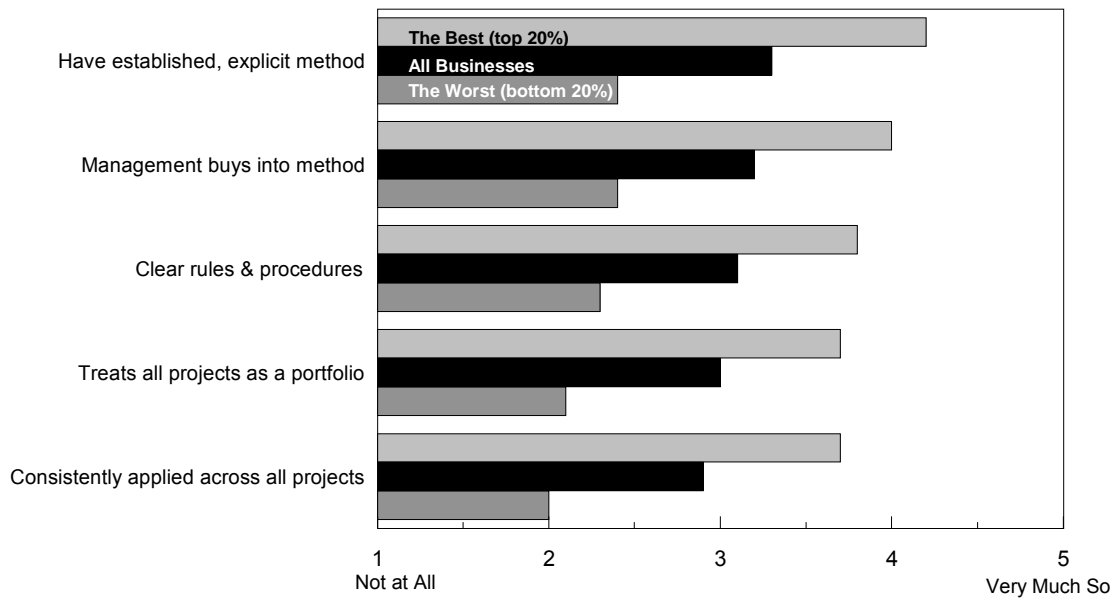
Does having a consistently applied, explicit portfolio management process have any impact on performance? Definitely yes, according to the results of the survey. Consider the major and significant differences between the Best and the Worst in Figure 19:

The Best, when compared to the Worst ...

- have an explicit, established method for portfolio management,
- where management buys into the method, and supports it through their actions;
- the method has clear rules and procedures,
- it treats projects as a portfolio (considers all projects together and treats them as a portfolio), and
- it is consistency applied across all appropriate projects.

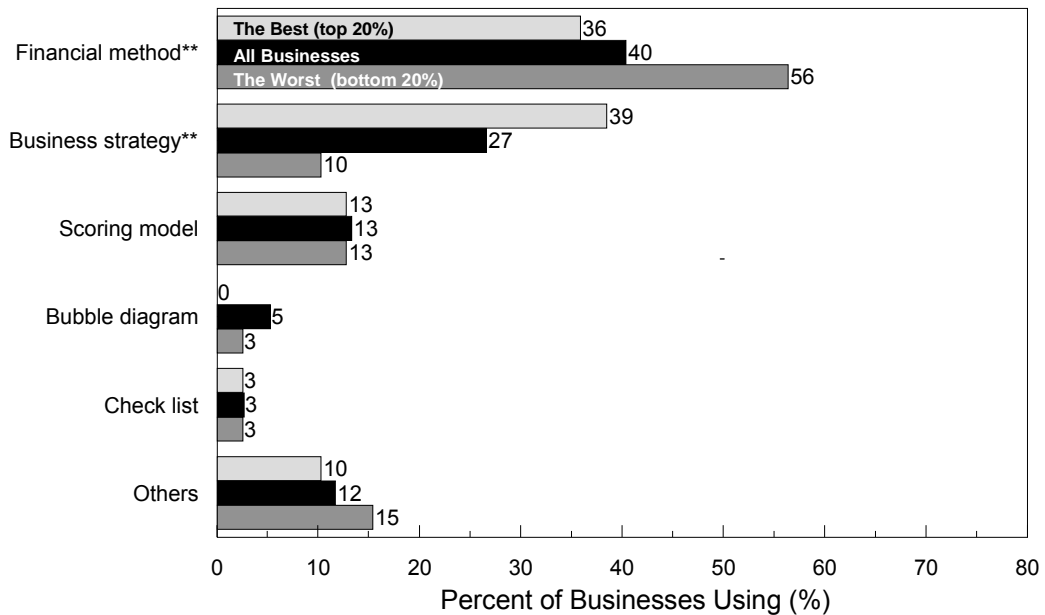
These differences between Best and Worst are consistent and major. The clear message is this: Businesses that achieve positive portfolio results – a balanced, strategically aligned, high value portfolio, with the right numbers of projects and good times-to-market (no gridlock) – boast a clearly defined, explicit, all-project, consistently applied portfolio management process which management endorses. Poor performers lack this!

Figure 19: How Explicit & Formal Portfolio Management Is -- The Best Vs. Worst



- All differences between Best and Worst are significant at the 0.001 level.
- Rank-ordered by mean scores.

Figure 20: The Dominant Portfolio Method Employed -- The Best Vs. Worst



Note: Dominant methods employed adds to 100%.
 **Significant differences between Best and Worst at the 0.001 level.

Portfolio Methods Used

The Best have decided preferences for which portfolio model or method dominates their decision process (see Figure 20):

- The Best tend to *rely much less on financial models* and methods as the dominant portfolio tool than does the average business. By contrast, the Worst place much more emphasis on financial tools. For example, only 35.9 percent of the Best rely on financial models as their dominant method, whereas 56.4 percent of the Worst use this as their dominant portfolio method.
- The Best let the business strategy allocate resources and decide the portfolio much more so than do the Worst. Only 10.3 percent of the Worst use the business's strategy as the dominant method, compared to 38.5 percent of the Best. Indeed, business strategy methods are *the number one method for the Best*, used even more so than the popular financial approaches as the dominant decision tool here – see Figure 20.

The use of other methods – scoring models, check lists, bubble diagrams – as the dominant approach is too infrequent to allow meaningful comparison of Best versus Worst (Figure 20).

Multiple Methods Used

The Best tend to rely on multiple methods for portfolio management – that is, they appear to acknowledge that *no one method gives the correct results*. For example, the Best on average use 2.43 different portfolio management techniques per business to select projects and manage their portfolio, while almost half of the Best (47.5%) use three or more methods! Even the average business uses multiple methods (2.34 per business). The Worst tend to rely on far fewer or even one portfolio method more so (1.83 methods per business, on average), with almost half of the Worst focusing on a single method only (46.3% of the Worst use only one portfolio approach).

Challenges Remaining

Although most businesses in the study recognize the need for and importance of portfolio management, there are still many issues that need to be addressed. Thus, we asked managers to identify what are the most significant challenges ahead (responses in Figure 21).

The most common challenge identified is the need to create a positive climate, culture and buy-in for their portfolio method. As might be expected, a key issue in any new process is the need to obtain organizational buy-in. Without total senior executive support, the portfolio management process becomes a difficult sell.

Other challenges and issues pertain to achieving the primary goals of portfolio management – achieving business objectives, obtaining linkages to strategy and achieving balance – and to the tools needed to obtain the needed information to be able to make disciplined decisions.

The most common complaint cited by managers is the abundance of short term, low risk projects in the pipeline. People are too busy working on these types of projects to be able to devote the time and energy needed to develop the next generation of “big winners” for the company. Executives are concerned that the need for quick hits in the market is placing longer term projects at risk.

The Benefits Are Worth the Effort!

A number of benefits have been derived from implementing portfolio management aside from the obvious goals of obtaining better financial returns. Figure 22 lists the “top of the mind” near-term benefits that managers expect to reap from their efforts in portfolio management.

The most frequently cited benefit is the expectation of achieving a common basis for discussion. By putting discipline into the process and providing a consistent basis of comparison, people are able to compare projects and to assess them from the same base of information and using the same criteria. Consistency in evaluations across projects is the result.

Managers also expect to obtain better focus, balance and strategic alignment – to target projects that are better and are more closely aligned to strategy, and to obtain the right mix between short and long term projects. By being better able to focus their resources, they expect to be in a position to reduce time to market and have the resources to seek the projects that will make a significant difference to the organization.

Figure 21: Significant Challenges Faced in Portfolio Management

Rank	Challenges
1	Creating a positive climate, culture and buy-in for our Portfolio Method
2	Better allocation of resources, selection of projects & balancing of projects
3	Finding the right balance between short term & long term projects
4	Obtaining better input data & forecasting estimates: markets, volumes, costs, etc.
5	Better linkages of our strategy to the portfolio of projects
6	Better balance & resource allocation) across SBUs, divisions & technologies
7	Better balancing across functions and level of involvement
8	Having more credible financial metrics & tools

• Rank-ordered in terms of frequency of mention; unaided, top-of-mind comments.

Figure 22: Benefits Expected from Portfolio Management

Rank	Benefits Expected
1	Creates a common basis for discussion, discipline & consistency
2	Helps us to focus on major projects, breakthrough projects
3	Leads to better strategic fit (of the portfolio)
4	Provides balance between short and long term projects
5	Helps us to concentrate on fewer but more worthwhile projects
6	Achieves improved times to market
7	Unified support & creates better buy in
8	Improves strategic planning

• Rank-ordered in terms of frequency of mention; unaided, top-of-mind comments.

Implications for Management Action

Here then are our conclusions and suggestions – a call to action:

1. Portfolio management works! Those businesses that have gone to the trouble of installing a systematic, explicit portfolio management system – one with clear rules and procedures, that is consistently applied across all appropriate projects and treats all projects as a portfolio, and which management buys into – are the clear winners [8,10]. Their portfolios outperform the rest on all six performance metrics: higher value projects; better balance; the right number of projects; a strategically aligned portfolio; and so on. The message is clear: Step #1 is to make a commitment to installing a systematic, formal and rigorous *portfolio management system* or process in your business. See [6] for guidance.

2. Sell all senior management on the importance of portfolio management. Management buy-in is one of the key challenges identified in the study. Further, while many senior managements are well aware of the importance of portfolio management, many others are not – perhaps out of ignorance, or perhaps because they think that project selection and portfolio management is “an R&D thing”, best handled by technology management people. Finally, those businesses where portfolio management is accorded great importance are also doing the best – their portfolios are in great shape! So there is a strong link here between perceived importance, management buy-in, and doing well.

Perhaps the *toughest sell* will be to the senior Marketing/Sales and Operations Management people. They seem to be the least in tune with the importance of portfolio management. As ammunition, we offer you our list of *eight key reasons* why other businesses and their senior managements see portfolio management as so important (see section headed “How Industry Sees Portfolio Management”).

3. There is no one right portfolio management method – so try a hybrid approach. Certainly financial models and methods are the most popular, with 77 percent of businesses using them, and 40 percent relying on them as the dominant portfolio decision tool. But there is great diversity of approaches as well: strategic approaches, scoring models and bubble diagrams are also popular, and can easily be used in conjunction with financial models, and in concert with each other. Indeed, the Best businesses tend to use a combination or hybrid approach – an average of 2.43 portfolio methods per business. Finally, no one method has a monopoly on strengths and positive performance. Rather, strengths and weaknesses were offered in verbal comments for all methods, and while certain portfolio methods do yield superior portfolio results, when used in conjunction with other methods, the results are even better [9].

4. Beware an over-reliance on financial methods and models. Those businesses that use financial methods as the dominant portfolio selection method end up with the worst and poorest performing portfolios! This is ironic: these businesses adopted what appeared to be a rigorous approach to project evaluation, namely a financial tool, in

order to maximize returns and performance, yet achieved exactly the opposite outcomes. Why? One reason is that the sophistication of financial tools often *far exceed the quality of the data inputs* (These sophisticated tools can be quite elegant, and include ECV, Productivity Index and even probabilistic models such as *At Risk* and *Crystal Ball*⁶; but the data inputs are often based on flimsy market and costs analyses). A second reason is that the key Go/Kill and prioritization decisions must be made fairly early in the life of a project, precisely when the financial data are the least accurate! A final reason is that financial projections are fairly easy to “rig”, consciously or unconsciously, especially by an over-zealous project team.

5. Look more to strategic approaches as the way to manage your portfolio. Businesses that rely principally on strategic methods for portfolio management outperform the rest. Recall that 39 percent of the Best businesses use strategic approaches as the dominant portfolio method, while only 10 percent of the Worst do.

Strategic approaches, such as Strategic Buckets, can be used to allocate resources or funds into different buckets. Look to Figure 11 for a list of the popular bucket categories: by market; by project type; by product line; by project size; and by technology type. So first consider electing one or more of these dimensions, and splitting resources into buckets. Begin with your business’s new product goals, vision and strategy, and then move to resource splits (as in Figure 7). Remember: strategy begins when you start spending money!

Next, categorize your projects according to buckets, and then rank order your projects by bucket, as in Figure 7. You can consider financial methods or perhaps scoring models to do the ranking within buckets. This strategic method will ensure that your R&D spending reflects your business’s strategy [6].

6. Consider a scoring model as an effective prioritization tool. The users of scoring models have great praise for them, and see them as effective and efficient decision tools for portfolio management. Scoring models have the advantage that they combine the popular financial criteria with the desirable strategic criteria (Note that in the sample scoring model in Figure 9, the first two criteria are financial ones, and Factors 2 and 3 are both strategic factors). Use the sample in Figure 9, but also consider the often-used project evaluation criteria in Figure 14, and build these into a scoring model for your own use [9].

Employ scoring models at gate meetings to make Go/Kill and prioritization decisions; and utilize the project scores to help make prioritization decisions at periodic portfolio review meetings. A word of caution: don’t use the project score mechanically. The real value is the process of decision-makers walking through the criteria, discussing each and gaining closure on each criterion, rather than dwelling on the score itself!

⁶ *At Risk* and *Crystal Ball* are probabilistic financial models. These use Monte Carlo simulation techniques to generate many possible scenarios of financial outcomes of a project, and thereby are able to provide expected financial returns or NPVs as well as a probability distribution of returns or NPVs.

7. Bubble diagrams must also be part of your repertoire of portfolio models. They receive very high praise from management, who very strongly recommend their use to others. Moreover they are thought to be an effective decision tool, yielding correct portfolio decisions. Bubble diagrams have the advantage that they portray the entire portfolio in visual format, and are also able to display portfolio balance. Do look at the list of possible bubble diagrams: the majority of users plot the traditional risk-reward diagram (as in Figure 8), but Figure 15 shows some other axes that you should consider for your bubble diagrams.

In Conclusion

Meeting the challenge of developing an effective portfolio approach for your company is no small task. In today's business environment, there is no question that portfolio management is a vital issue. Our investigation points to several fundamental truths, however. There are no magic solutions. A number of companies, however, are developing, implementing and achieving better results from their portfolio management approach. As this study has indicated the top performers are indeed doing many things differently from the poorer performing organizations.

Portfolio management processes can be successfully developed to help executives in their attempts to obtain better results from scarce R&D dollars, achieve the balance needed between short term pressures and the future, longer term, needs of the organization and to ensure that R&D efforts are being directed towards helping the organization achieve its strategic objectives.

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Dr. Robert G. Cooper is a world expert in the field of new product management and has been labeled “the quintessential scholar” in the field of new products in the U.S. publication, *Journal of Product Innovation Management*. He is President of Product Development Institute Inc., Professor of Marketing at Michael G. DeGroot School of Business, McMaster University, Ontario, Canada and on the faculty of the ISBM at Penn State University’s College of Business Administration. He is also Crawford Fellow of the Product Development & Management Association (PDMA), and a Fellow of the Canadian Academy of Engineering.

Bob is considered the father of the Stage-Gate process, now widely used by leading firms around the world to drive new products to market. His NewProd series of research – an extensive investigation over the past 20 years into the practices and pitfalls of product innovation in hundreds of companies and over 1,000 new product projects – has been widely cited. He has published more than 75 articles and six books on new products, including the popular *Winning at New Products: Accelerating the Process from Idea to Launch*, 3rd edition.

Bob’s dynamic talks have captivated thousands of businesspeople in North America, Europe, and the Pacific. He has consulted in the field of new product management for leading companies worldwide, including Air Products, American Express, Bell-Canada, BF Goodrich, BP (U.K.), Carlsberg Breweries, Corning, Courtalds (U.K.), DuPont, Emerson Electric, Exxon Chemicals, Goodyear, Guinness Breweries, Hallmark, Hoechst (U.S.), IBM, Inco, Kodak, Lego, Northern Telecom, Pfizer, Polaroid, Proctor & Gamble, Reckitt-Benckiser (U.K. and U.S.), Rohm and Haas, SC Johnsons Wax, Shell, the Royal Bank of Canada, US West, and WR Grace. Many of these companies have implemented his Stage-Gate approach to accelerating new products to market.

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Elko has international working experience in Europe, North America, Australia and Africa. He has given numerous seminars to companies in North America, Europe, Asia (China) and Australia\NZ primarily in the area of new product development, portfolio management and marketing.

His consulting activities have included market forecasts, new product aspects, benchmarking analyses, portfolio management for new products and developing new product processes for companies.

Elko holds an mechanical engineering degree, as well as an MBA and Ph.D. in Business Administration. His practical work experience includes engineering tasks, investment analysis for technical projects and technical marketing.

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countries and
cultures

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via front line
experience with
5000+ clients

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comprehensive,
peer reviewed and
longest running
benchmark studies

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Dr. Robert G. Cooper and
Dr. Scott J. Edgett



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 - Motivational presentations by Robert Cooper and Scott Edgett
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