



Portfolio Management Tools

Portfolio management (PM) techniques are systematic ways of looking at a set of projects or activities or even business units, in order to reach an optimum balance between risks and returns, stability and growth, attractions and drawbacks in general, by making the best use of usually limited resources.

Why and When Are They Used?

The motivation for a company to have several projects at a time can be of very different nature. In many organizations, the uncertainty surrounding individual projects leads them to place considerable emphasis on the development of a portfolio of activities which is aimed at balancing risk and reward in such a way as to reduce the overall uncertainty. One useful approach to this task is to consider the innovation process from idea to implementation alongside certain variables, such as future cash flow projections and resource requirements.

The starting point for this analysis is the recognition that the innovative process within most organizations is likely to be a multistage one which can be slowed down, accelerated or discontinued as circumstances dictate. Some organizations consider their portfolio as being similar to a funnel which they need to keep topping up in order to ensure the flow through is strong enough and the outputs are sufficient to meet their needs. Diagrammatically it might be portrayed as in Figure 1.

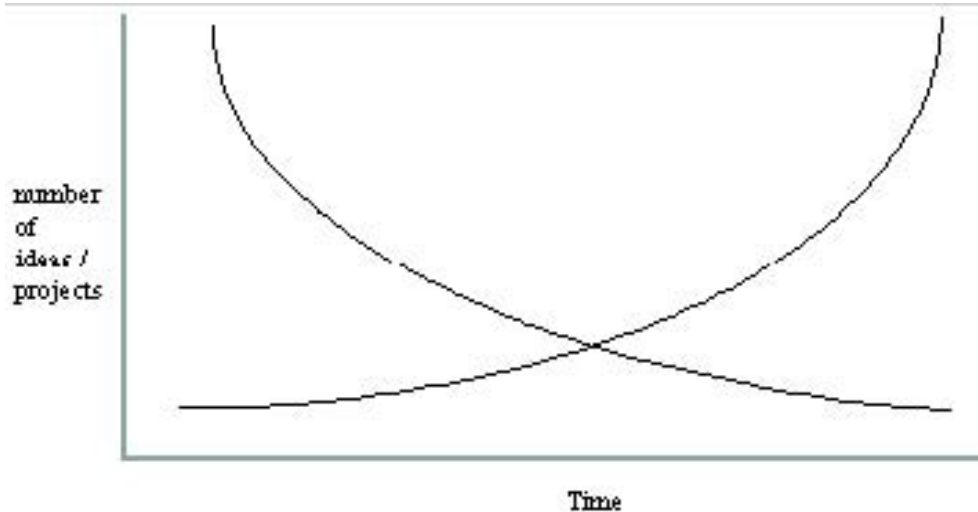


Figure 1 Flow of ideas/projects in comparison with resource requirements

In general, separate analysis of projects is unlikely to ensure the most productive use of limited resources at any time, something which PM provides. Of particular importance is also the need to ensure that RTD plans are consistent with business strategy. Comparable problems of fit with strategy and selection of appropriate investments within constraints are to be found in most aspects of business management, and are commonly dealt with using PM techniques.



Several techniques dealing with PM can be mentioned. In general, all of them have certain common aspects:

- A portfolio involves **balancing** the results of assessing the individual projects which comprise it. In this way PM could be combined with appropriate single project evaluation techniques. In fact, when used to assess and select projects, PM partially or totally uses the outcomes of the analysis undertaken for the evaluation of individual projects. One issue to be dealt with when applying PM is that projects do not normally occur over the same period of time, which implies some discontinuities. In fact, having the timely balance of projects in terms of costs and returns over time is one of the typical uses of PM.
- Every project should be examined in the same way, in order to ensure the **consistency and validity of the input data**. Otherwise, comparison, hence balancing, between projects is not sufficiently reliable. A common vocabulary has to be established.

The level of analysis might differ to suit how the company organizes the RTD activities. In that sense, although in the explanation of this tool it is often referred to a portfolio of projects, in the same way, depending on specific techniques, the tool can be applied to look at a set of programmes (which in themselves are made up of a set of projects), or technologies, or even at different business units. In any case, one important issue is that PM is in itself a strategic exercise used to look at the whole set of RTD activities

Specific Techniques

Many project evaluation techniques can in fact be used as portfolio evaluation techniques, just by directly comparing the results of the assessment of individual projects. On the other hand, there are other types of techniques specially suited for PM, at the strategic and operational level. A classification of distinct types of PM techniques is shown in Table 1.

Techniques	Short description
2D and 3D matrices	<ul style="list-style-type: none"> • Based on a graphical representation of several variables in 2 or 3 dimensional matrices • Preference is given to those variables most important to the decision-maker • Foster discussion in order to arrive at the decision
Mathematical programming	<ul style="list-style-type: none"> • Based on complex mathematical algorithms aimed at optimizing the portfolio • Need computer support • Mostly company specific, difficult to adapt to different companies and situations • They usually choose the solution (e.g. which are the projects to invest in) • They usually choose the solution (e.g. which projects to invest in)
Others (typical of project evaluation)	<ul style="list-style-type: none"> • Methods like decision trees and others



The techniques based on 2D and 3D matrices are considered the most interesting ones as they are suitable for any company and context, as well as being quite easily implementable and usable compared with other techniques. They are described in more detail below.

These matrices provide a framework for examination of several parameters, and some experimentation is needed by the company who wants to apply them in order to find the appropriate combinations. These matrices, in any case, do not avoid the need for judgement although these judgements will be well supported through the use of these techniques.

2D and 3D matrices

These are matrices used to analyse and represent the situation of RTD projects or activities, or even business units, according to two or three meaningful variables. All those matrices are grouped together in this section because they can be regarded as mostly complementary and require a similar process for analysing the data and for taking decisions.

To analyse the portfolio, business and RTD managers first examine each individual project, then place each project within portfolio structures (matrices) that accommodate the strategic elements most critical to the specific company and its industry.

In most cases, the qualitative nature of many of the human judgements necessary to assess all variables implies that the projects can only be assessed on a relative rather than an absolute basis (i.e. better or worse rather than correct or incorrect). In general, preference is given to those variables easily understandable and of critical meaning to the decision-maker.

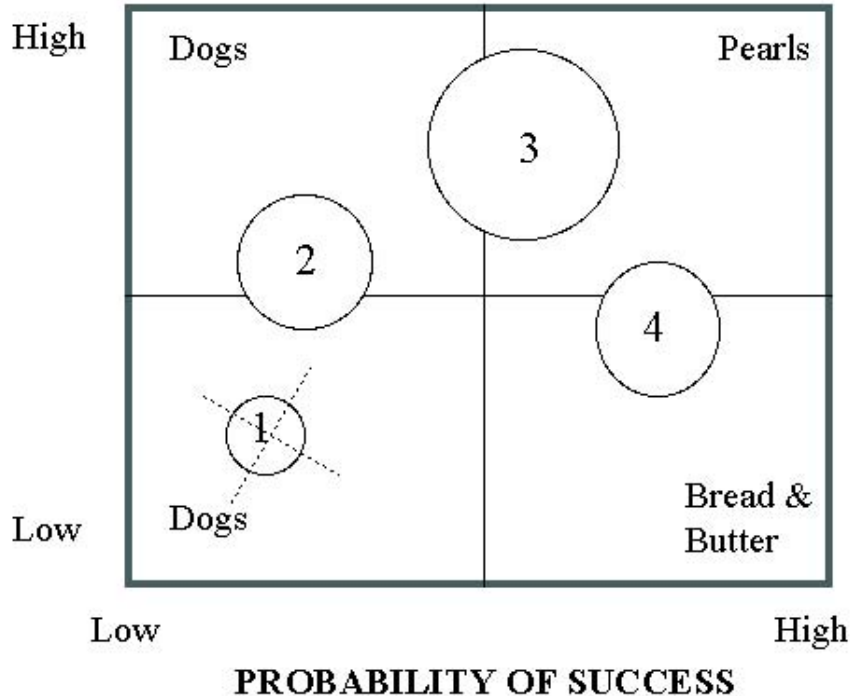
One common characteristic of the 3D matrices is that one of the variables usually represents the size of the project measured in financial terms (e.g. the amount of funding invested in a specific project or technology, or the revenues being generated by a business unit). This factor stresses the importance given to the resource issue.

In what follows, several matrices are explained in terms of specific objectives, what they represent and the discussion they should imply. In general terms these matrices are useful for projects, businesses, technologies and other kinds of application. The matrices shown are identified by the variables that are being assessed and discussed.



Matrix: expected value x probability of success

EXPECTED VALUE (\$)



Variables

Expected value	The expected return that the projects can provide over a period of time, usually in financial terms
Probability of success	The probability of achieving the objectives. It is a combination of the probability of both technical and commercial success
Resources	The amount of resources allocated for a specific project/product. It is represented by the area of the circle

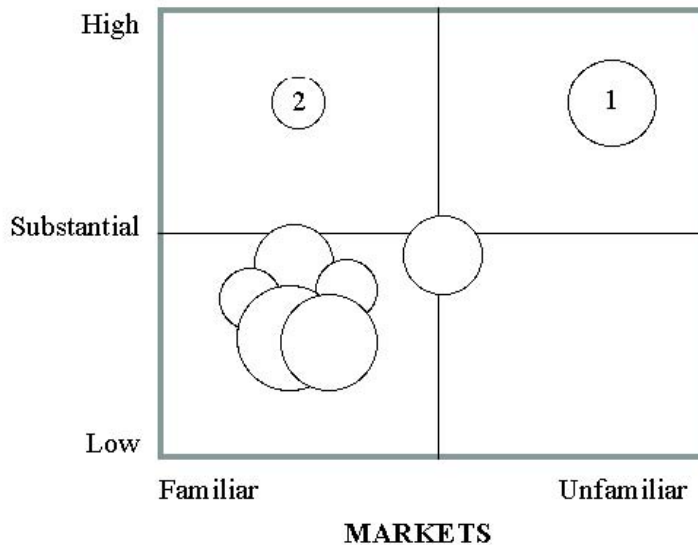
Use of the matrix

The matrix shows that it would be better to concentrate efforts on those activities with a high probability of success and high expected value, although this is not always possible. For those activities with a low probability of success, an analysis should be made on whether the expected return is worth the risk involved. In the example, project 1 would be better terminated and project 2 should be carefully analysed. At the same time, it is always interesting to have a pool of projects like project 4, which in total ensure a steady stream of returns.



Matrix: impact of R&D on competitive position x familiarity of market

IMPACT OF R&D ON COMPETITIVE POSITION



Variables

Impact of R&D on competitive position	How the specific projects could impact on the company's competitive position. High means that if the project succeeds the company's competitiveness will dramatically increase
Markets (familiarity)	The company's knowledge of both the market and the factors affecting the market
Resources	The amount of resources allocated to a specific business/project. It is represented by the area of the circle

Use of the matrix

This matrix gives a clear understanding of risk by examining the portfolio with respect to market familiarity and impact on competitive position. The example shows the portfolio of a company chiefly concerned with protecting its position in existing markets but, at the same time, having two R&D projects (1 and 2) intended to gain advantage, for instance through exploiting new technologies, one of which compounds the risk by aiming at a new market. By drawing attention to this, the evaluation will prompt discussion of the risks involved.

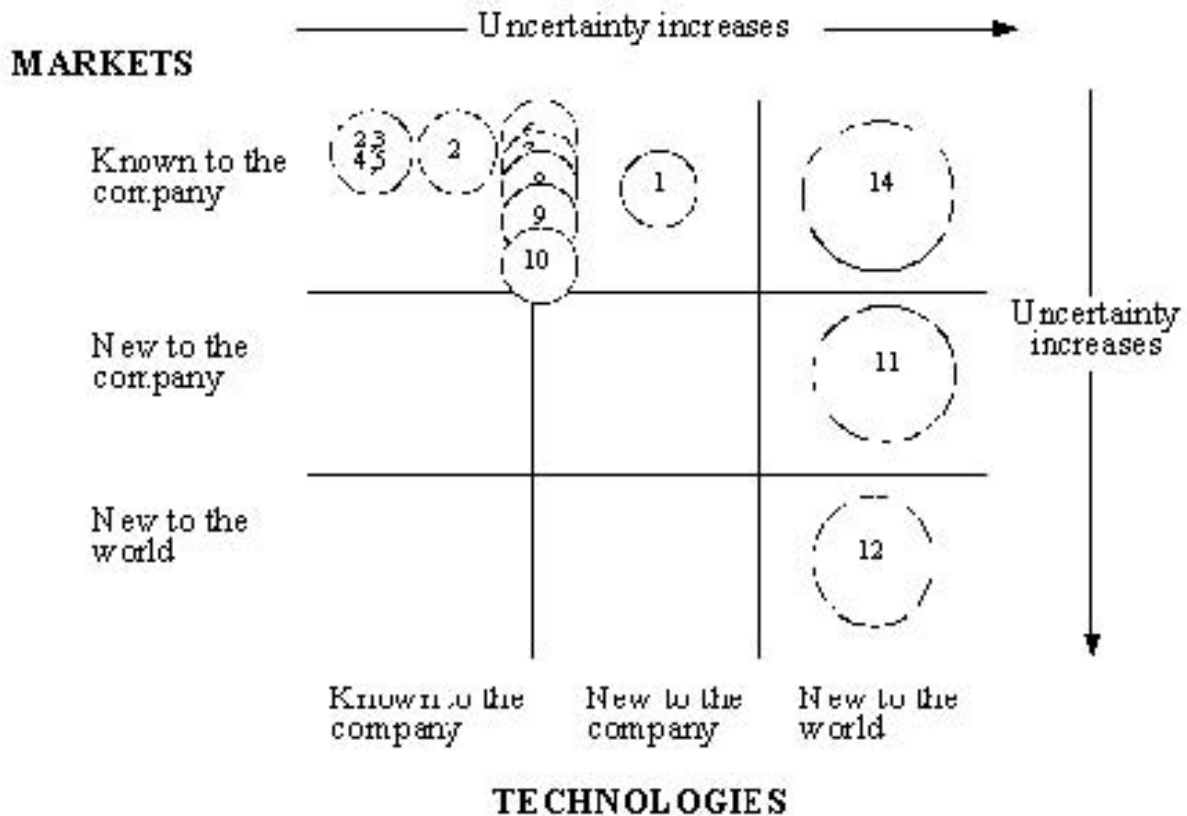
In summary, the company, while securing the position on current markets with several projects, is also aiming at new growth opportunities, either coming from new markets or from strengthening the current position in new markets.

MANAGING INNOVATION



Tools

Matrix: market (knowledge) x technology (knowledge)



Variables

Market knowledge	The company's knowledge of both the market and the factors affecting it. It also involves assessing whether the market is known by the competitors
Technology knowledge	The company's knowledge of both the technology and the factors affecting it. It also involves assessing whether the technology is known by the competitors
Resources	The amount of resources allocated to a specific business/project. It is represented by the area of the circle

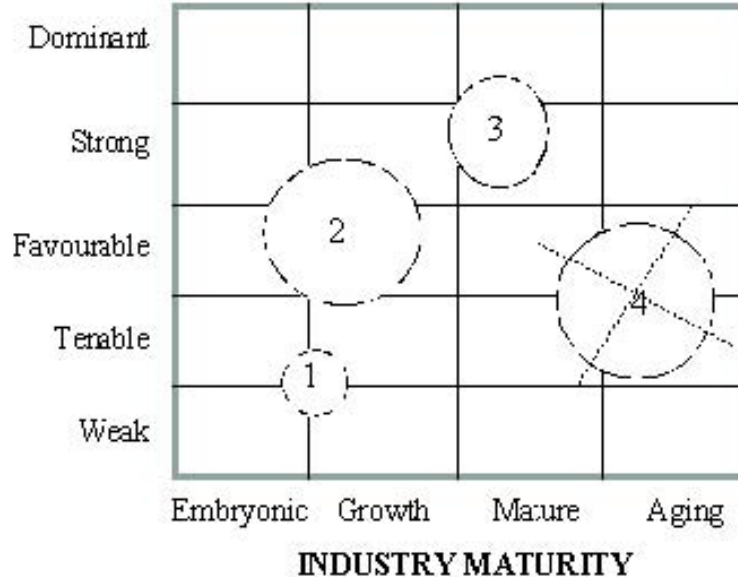
Use of the matrix

This matrix gives an understanding of the situation of a company's portfolio with respect to technology and market. It is remarkable that both technology and market are divided according to company's knowledge in three groups, and uncertainty increases on those technologies and markets that are new. This matrix also gives information about the risks involved (higher uncertainty, higher risks). Experience says that those projects using unknown technologies and directed towards unknown markets (projects 11 and 12) are likely to run into problems. On the other hand, if successful, rewards might be huge.



Matrix: technological competitive position x industry maturity

TECHNOLOGICAL COMPETITIVE POSITION



Variables

Technological competitive position	The technological position of a company's products regarding its market competitors. A dominant position would mean the company is the technological leader
Industry maturity	The situation of the company's products according to the life cycle: <ul style="list-style-type: none"> • Embryonic: is not clear the direction of technological advance. Regular efforts would produce some advances but these might still be useless • Growth: major technological advance can be expected with regular efforts • Mature: minor technological advance would require very high efforts • Ageing: no technological advance can be expected
Resources	The amount of resources allocated for a business/project. It is represented by the area of the circle

Use of the matrix

The matrix describes the context for innovation activities. The circles might well represent the size of business divisions and show that, while most divisions have favourable strong technical positions, the new venture (project 1) is poorly placed in a rapidly developing industry. It becomes clear that the position of this division will be soon untenable, hence the strategy should be either to find an exit or to move it upwards by receiving much stronger support. Projects 2 and 3 are reasonably well-placed while project 4 is close to an untenable low-profit situation and should probably be terminated.

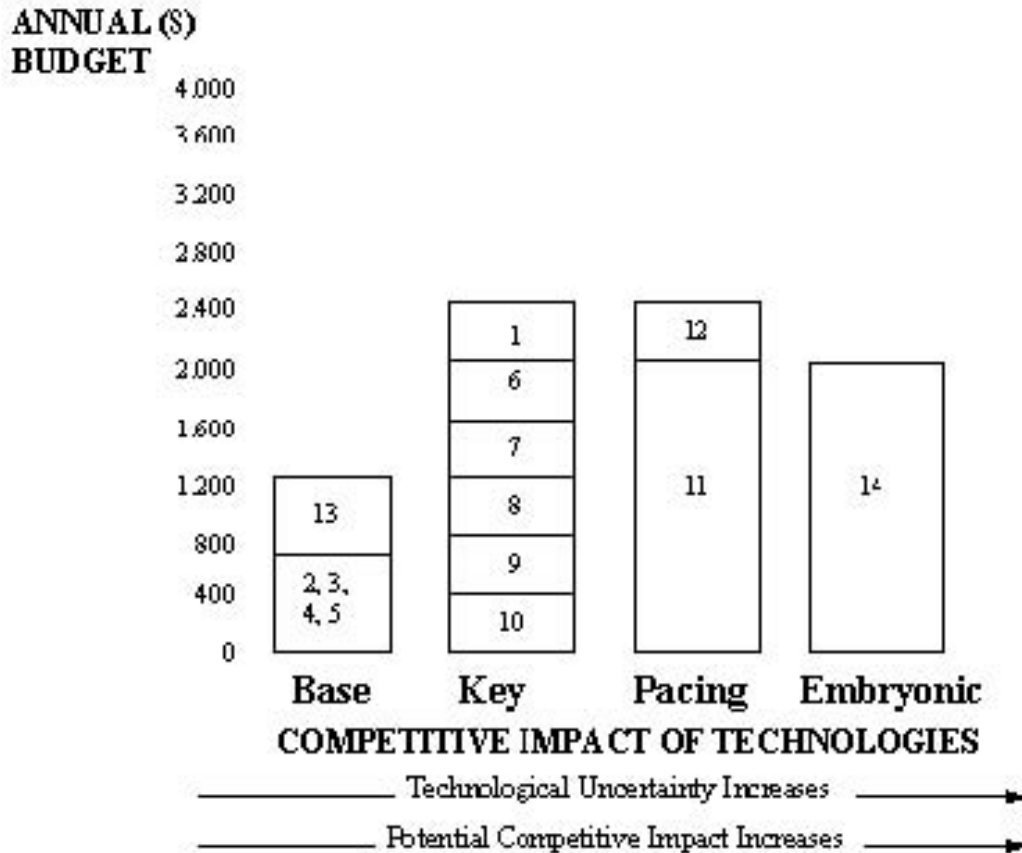
If the company only bets on projects aiming at mature technologies, the growth opportunities could be low.

MANAGING INNOVATION



Tools

Matrix: annual budget x competitive impact of technologies



Variables

Competitive impact of technologies	<p>The technological position of the company's technologies regarding its market competitors</p> <ul style="list-style-type: none"> • Embryonic: very new technology, in its infancy • Pacing: potential to change the basis of technological competition • Key: embodied in products and processes, differentiated in leading companies • Base: essential, but known to and practised by all competitors
Budget	The amount of resources allocated for each type of technology, normally on an annual basis

Use of the matrix

The matrix gives a view of the situation of a company's portfolio (products 1 to 14) according to its annual budget. It is remarkable that as the technologies are more unknown the budget involved for a product or project increases by a great amount.

With the current portfolio the company is probably not securing its current position as the budget devoted to key technologies is very distributed among a set of small projects, while betting too much on new technologies. A redistribution of resources among technologies is probably the most logical approach.



Further Information

Book

Philip A. Roussel, Kamal N. Saad and Tamara J. Erikson, *Third Generation R&D: Managing the Link to Corporate Strategy* (Harvard Business School Press, 1991).

This book describes in detail several portfolio management approaches and how they are integrated in the overall R&D management of a company. The book can be used to learn how to apply some specific techniques in a certain context

Website

<http://www.npd-solutions.com/portfolio.html>