Management Tools for RetD Project Portfolios in Complex Organizations – the case of an international pharmaceutical firm

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MANAGEMENT TOOLS FOR R&D PROJECT PORTFOLIOS IN COMPLEX ORGANIZATIONS: THE CASE OF AN INTERNATIONAL PHARMACEUTICAL FIRM*

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ABSTRACT

Project Portfolio Management (PPM) is a growing issue in both professional and academic circles. The typology of Cooper et al. (1998) has pictured the variety of PPM formalized approaches into four types (financial, strategic, scoring and "bubble diagram"). While the use of formalized methods by top performers is clearly attested, the choice of a specific approach and the precise benefits and limits of different instruments are still in debate.

The present paper formalizes more precise contingency hypotheses between PPM practices and organizational variables such as R&D strategy, the structure and history of a firm's development, partnership policy and learning track in the project domain. Where managerial implications are concerned, the paper puts forward an analytical framework for the adjustment of portfolio instruments to fit specific situations and develops the conclusions of that framework for an international pharmaceutical group, Merck Lipha.

The research underlying this paper adopts an interactive and experimental case-based methodology which has been on-going since 1997.

KEY WORDS: Project portfolios, pharmaceuticals, decision processes, interactive research.

INTRODUCTION

Project Portfolio Management (PPM) is a growing issue in both professional (especially pharmaceutical) [1] and academic circles [2, 3, 4, 5] due to two convergent trends. On the one hand, increased allocation of resources to high-capacity, rapid-development processes is leading to new needs for methods suited to such R&D decisions. On the other, innovation performance is becoming a major criterion in evaluating a firm's efficiency, and so creates new constraints in terms of communication on the domain of R&D projects. Formalized tools thus provide a way to make the PPM competency more visible from the outside.

The research done by Cooper *et al*. [5] has pictured the variety of PPM formalized approaches, defining four types (financial, strategic, scoring and "bubble diagram") and reached conclusions on efficient practices: top performers use explicit tools in a "hybrid" approach combining different types. A more precise comparison of the benefits and limits of the various approaches is still, however, a matter of debate.

The aim of the present paper is to provide an evaluation of these tools in the context of an analysis of organizational functions — what precisely are the functions of these management tools in complex organizations? Who is to deploy them? And why? Is there a more precise link between the tool, the specific features of R&D activity which it is its task is to represent and evaluate, and those of the structure in which the tools are deployed? What can we infer from a given representation in a given situation?

This paper sets out to provide the beginnings of an answer to these questions in the light of interactive research which has been conducted since late 1997 with the Lipha pharmaceuticals

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group (an associate of Merck KGaA, Darmstadt, Germany). At the time the research began, this corporation had already been experimenting for four years with a formalized project portfolio management approach. This has led to a general overview of the results of the trial and has also conducted a comparison with more recent approaches analyzed in the literature. To accomplish this, we have tested some thirty or so tools by applying them to the real corporate portfolio. These simulations were assessed through a working group whose members were the company's main managers for R&D, strategic marketing and business analysis, those in charge of heading up project portfolios and researchers. This phase of analysis and proposals was completed in March 1998 with the presentation to the corporation's R&D steering committee of a scenario for future development of the portfolio management system, a scenario which is currently in the course of implementation.

In the first part of this paper, we analyze the portfolio management experiment conducted by this company. This reveals two types of driving force behind the current modernization of PPM: first, the dynamic of R&D strategies and, second, the constraints linked to the control of world-class industrial groups formed by a process of external acquisition.

In the second part of the paper, we shall present the theoretical framework we deployed for the analysis of the role of management tools in complex organizations. This framework [6, 7] identifies as levels relevant to comprehension the organizational functions of a specific instrumentalization the organizational context and the decision process in which the instrument is involved, the tools' conceptual apparatus, the ergonomic properties of the visual representations provided by PPM tools and the data process which supports such PPM applications.

We present then, on three levels, the results of the application of this theoretical framework to the company studied. General lessons can be drawn from these results as to the implementation of such sets of instruments in the context of world-class pharmaceuticals groups:

- On the basis of a typology of situations for the use of project portfolio management tools, we demonstrate the variety of representations adjusted to suit the contexts of use.
- We link up a description of the characteristic features of the research strategy (an exploration targeting worldwide therapeutic goals, oriented towards research on "Block Busters", growing openness of R&D to the problematics of "swapping" on-going projects) and the nature of the representations relevant to their control.
- We also link up the type of internal control used in the corporate group and its maturity in terms of project management, on the one hand, with portfolio management techniques on the other.

PHARMACEUTICAL GROUP DYNAMICS AND THE FORMALIZATION OF PROJECT PORTFOLIO MANAGEMENT

Why are we witnessing today such a spectacular development in project portfolio management tools in the R&D field, especially in the pharmaceutical industry? The arguments repeatedly based on the growing importance of innovation in corporate competitive strategies, plus the assertion that such instruments are effective, seem to us to be worthy of closer examination.

Firstly, such tools cannot be truly described as "new", since virtually all of them stem from concepts based on the theory of decision-making in contexts of uncertainty [8, 9] and the financial analysis of investment, concepts which were developed in the 1960s and 1970s, although the most recent developments relating to inclusion of information value are more recent than this [10, 11].

Secondly, the assertion that it is more efficient to guide R&D decisions in a more instrumentalized manner has been the subject of frequent debate. Authors of classic work on this even maintain that it is the specific features of R&D management by the absence of formalized control instruments for this activity [12, 13]. Recent research on corporate management in high-technology industries [14, 15] revise this view, demonstrating the role played by "semi-structured" control mechanisms and relatively formalized management systems in scientific and technological contexts characterized by high levels of uncertainty and rapid development, such as microelectronics, information technology and biotechnology.

The experience of the company studied here can provide empirical data to enable us to understand the current effervescent state of the field.

After forty-nine years as a subsidiary of Air Liquide, which withdrew from this sector, in 1991 Lipha was absorbed into the German group Merck, whose sales volume in the pharmaceutical industry now stands at almost FRF 15 billion. In 1998, Lipha sales figure was FRF 5.2 billion, approximately 35% of which was generated in France, 46% being earned in the United States. With Glucophage Lipha is currently in first place worldwide for the treatment of diabetes type 2.

The current interest in project portfolio management tools can be seen as the result of two driving forces. The first is internal to R&D and relates to the dynamic of the research conducted by this firm. The second is an obligation to increase visibility, and is linked to the group's growth dynamic.

Research strategy dynamics: a philosophy based on internal portfolio management

The R&D conducted by this company is intended to discover new chemical compounds (NCE) or biological substances (NBE) or new formulas, the aim being final development of therapeutic drugs.

The origin of the present situation is to found in the 1990s. At that time, the R&D portfolio was growing in all directions and there was a mismatch between the scientific outlook of the researchers and the commercial outlook of marketing development, this being a fairly typical situation at that time. The new director of research began a strategic refocusing of the company's R&D portfolio. The strategic decision made was to channel research toward precise therapeutic goals for which Lipha already had substantial scientific, technological and commercial expertise and a strong reputation (diabetes). This new policy was reflected in a concentration of the portfolio, with projects diverging from the strategy being either abandoned or transferred. It also led to the implementation to new methodologies directed at greatly enhancing the processes of exploration and development of the newly focused portfolio:

- Acquisition of technologies enabling a widening and accelerating of the exploration of the products tested (combinatory chemistry, high throughput screening),
- High volume test methods,
- Implementation of a more professional project management system: creation of project manager posts from 1982, creation of an internal "school of project management" in order to systematize the acquisition of project management techniques. An internal consultant with the task of providing this training and methodological backup for the implementation of the methods as appointed in 1992. This section hired a second internal consultant in 1995.

The policy was backed up with a substantial research and development budget: approximately FRF 700 million in 1998. In 1999, the R&D budget amounted to FRF 760 million.

When in 1997 we were approached to undertake joint research on the management of project portfolios, Lipha had already been using such tools for four years. This request for research came at a time when the issue of portfolio management, which was a long-standing one as we have seen, was becoming critical once again due to the very success of the policy first implemented 5 years before. Initially, the refocusing of research led to a fall in the number of the company's projects, now that strategy is producing a flow of potentially valuable candidate drugs which is beginning to overtake the human and financial resources of R&D. The need for sophisticated instrumentation is all the greater since the “exotic” projects which can be easily eliminated have already been removed from the initial targeting configuration, and all the project which remain are, by definition “correctly oriented strategically”. Should the overall R&D budget be increased? How should projects be selected in order to spread scarce resources correctly? Among other questions.

Note that the scope of PPM is limited to the development phases of the projects. The initial fuzzy discovery R&D was not concerned because of the poor reliability of the data to be computed.

The dynamics of the integration of a world-class pharmaceuticals group: a philosophy based on external control of R&D

The other reason for the institution of this research relates to the dynamics of the structure of the Merck group. This does not stem from a philosophy of internal project management within a portfolio but from a requirement of visibility and external control of the R&D activity with respect to the shareholders of the Merck group. Indeed, 1997 was a milestone for the control of R&D in the group.

Since the early 1990s, the group has been organized in a matrix-type structure by therapeutic domains (Business Area Teams, or BATs) and by geographical zones. In that structure, Lipha had a dual responsibility: geographical responsibility for France (for the marketing of the Merck and Lipha range) and worldwide responsibility for the diabetes BAT, which is its core therapeutic speciality. Within that context, since its absorption into the Merck group in 1991, research decisions have been devolved to the Lipha, the R&D budget being 14.5% of the sales volume for the Lipha subsidiary. The commercial success of the subsidiary over this period had enabled the financial autonomy of R&D to be preserved up until the present time.

In 1997, the group began a new phase in its worldwide integration by initiating study of the management of R&D project portfolios. The aim was to compare existing approaches applied in the various companies in order to arrive in due course at common tools for the standardized assessment of projects in the various BATs.

On the one hand such standardization seems on the face of it to be desirable: some parts of the group are at a very advanced stage on this issue, others are less so. This can be a way forward for the swift capitalization of acquired expertise. Similarly, as in all world-class corporate groups whose growth has been based external acquisition, co-ordination and reporting become, due to the inconsistent nature of the various systems, extremely cumbersome and tedious. Project managers are asked on numerous occasions to provide input for databases at various levels; inconsistencies are frequent since assumptions as to figures and quantities are not the same in the various companies, and so on. Simplification and improvement of the system at an overall level would therefore seem to entail the implementation of uniform approaches.

On the other hand, such standardization can be seen to bring a risk of undermining the decentralization rule which has worked well until now. Might the current study be the first step toward the construction of a vast, centralized portfolio of disparate projects, which would contradict, on the face of it, the logic of strategic focusing which has been implemented since the early 1990s, and which, when all is said and done, has proved profitable[4]? It seemed to senior management at Lipha that the building of internal trust within the group required mutual exchange and comprehension of the techniques used to manage project portfolios. All that remained was to agree on a common approach: should the existing method be applied

[4] With respect to 1997’s results, Lipha was assessed as the most commercially and financially efficient French pharmaceutical company by the business journal “Les Echos” and as the most innovative of all French pharmaceutical companies by the magazine *La tribune de l’Expansion*.

universally? Should improvements be suggested? Should other tools be chosen? How did this approach compare with that of other BATs in the group? What distortions might arise from the general application of unsuitable instrumentation? The stakes were high for the company given past investment in the definition and implementation of its system.

AN ANALYTICAL PATTERN FOR THE EVALUATION OF PROJECT PORTFOLIO INSTRUMENTS IN COMPLEX ORGANIZATIONS

The above analysis shows how diverse are the issues involved in the choice of project portfolio management tools if one considered them not in the context of an individual rational decision model but as one component in a complex regulatory system for an entire organization. In order to examine project portfolio management tools from this point of view, we used the analytical grid shown below, which is based on the work of the Management science centre at the École des Mines in Paris and the Management research centre of the École Polytechnique [16, 6, 7]. This grid uses five explicit variables to account for the effects of a set of management instruments within an organization:

- The management situation (or the organizational context) in which the instrument is implemented. Management instruments are tools handled by groups. The task is to provide instruments for cooperation on a given topic and in a given context. A precise description of that context and the goal of the cooperation is therefore an essential starting point for an analysis of the management tool. Who uses it? To what end? In conjunction with what implementation processes (who generates the information, who applies it? At what intervals? With what degree of accuracy? And so on). At this level, the notion of the "management of project portfolios" relates to a wide variety of situations and participants [1, 5]: budget options, project monitoring, shareholder information, etc. According to the precise situation, the players will not always have the same perception or raise the same issues with respect to the phenomenon under study. It can be easily imagined that a given instrument suited to a given player in a given situation will not be suited to others in different situations. This angle led us to define the various situations and their impact on the suitability of the mode of representation.
- The "management philosophy" underlying the tool. What reasoning does the tool make it possible to model? Are the concepts it implements relevant to the utilization expected by the player concerned? The focus here is on the way in which notions such as risk, or the value of a project to the company can be formalized, for example. The level involved here is that of the economic concept and decision theory.
- The "technical substrate" of the tool. The focus here is on the internal operation of the "management machine". What software and computer architecture does it use? Is it data-intensive and are the date easy to acquire? Are they easy to update? Is the tool easy to handle or is it cumbersome? And so on.
- The ergonomics of the representation provided. At the opposite end of the spectrum, as it were, from the high level of abstraction of concepts and theories, the characteristics of the mode of representation also have a part to play: Does the tool provide a representation which is "expressive"? Is it a good vector for communication and exchange of views on the topic under discussion? For example, a matrix with four boxes in which projects are "divided up" has qualities which a table of figures does not. Again, a logarithmic axis scale will reduce the visual impact of differences and lead to debate centred on orders of magnitude, it is difficult for a "bubble diagram" to depict a portfolio with more than thirty projects without becoming unreadable, and so on.

UTILIZATION SITUATIONS FOR PROJECT PORTFOLIO MANAGEMENT TOOLS AND THE MODE OF REPRESENTATION OF THE PORTFOLIO

We begin by describing the situation for utilization of the instruments for portfolio management by those involved. The situations requiring the use of project portfolio management tools mobilize a very diverse range of players: project managers, those responsible for shared R&D resources, central management departments allocating resources, shareholders and financial experts seeking to ensure the visibility of parameters of determining importance for the future performance of the company, external scientific or administrative authorities. We summarize in the diagram below this entire set of players implementing representations of the portfolio of projects. This model, which is certainly highly simplified, is nevertheless sufficient to give an account of the two philosophies described above (control internal to R&D, external visibility).

We describe below in greater detail the relationships between these players on the basis of the goals underlying the respective situations. Four contexts have been identified as important:

- Planning goals, in which the need is to define overall objectives and to plan resources for commitment in a strategic [17] or budgetary context.
- A decision goal, relating to individual projects (in project reviews or R&D committees) and product acquisitions under license, taking into account the overall logic of the portfolio.
- An information or control goal, in which the need is to communicate an image of the current status of the R&D activity.
- A learning goal (typically training sessions with project managers, or periodic status updates on R&D activity).

Figure 1: Players and practical contexts involved in the management of project portfolios

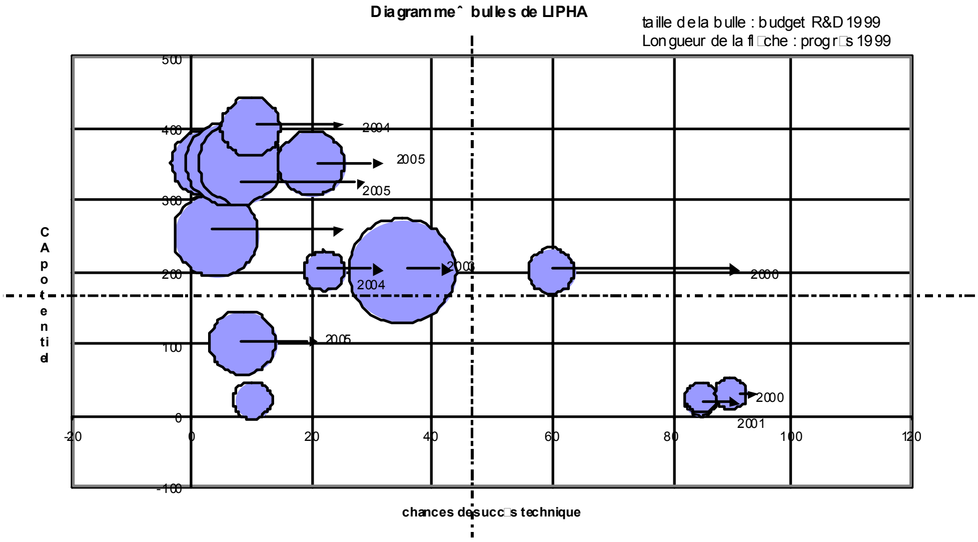
The performance provided by instruments in a given situation must initially be analyzed in terms of the fit with the cognitive bias of the participants: a representation which will seem simplistic to some will seem complex and obscure to others. For instance, an internal management tool which involves bringing together researchers and their managers to exchange information on a weekly basis on scientific and strategic issues is certainly not well suited to the briefing of shareholders.

It must also be seen in terms of " creation of contrasts" in relation to the problem raised by the participants. This concept means that the tool must both illuminate usefully the issue to be dealt with but also at the same time create areas of opacity s to the other ways of comprehending the reality considered. Otherwise the image will be complex, blurred and the tool will lose its credibility even if it is offering a more "realistic" vision (because it is less simplified) of the phenomena at issue. Let us take a few examples.

Negotiation of R&D strategy with the group

At this level, the focus is on the overall characteristics of the portfolio: can its level of risk be assessed? How can it contribute to the overall financial balance of the group? Can investment needs linked to it be funded? Representations which involve the concept of the expectation and probability of gain are relevant here. For example, the " bubble diagram " shown in figure 2 below is well suited to this situation : it reveals the portfolio trade-off between valuable and unrisky projects (" pearls " in the classical typology), valuable but risky (" oysters "), incremental changes (" bread and butter ") and the most problematic " white elephants ".

Note that Lipha's instrument innovates by representing the portfolio's dynamics : arrows reveal the expected situation of each project after the R&D budget allocation of the year and each project is characterised by its expected commercial launching date.



Bubble size: R&D budget 1999
Arrow length: progress made in 1999
X-axis: chances of success in technical terms
Y-axis: sales potential

Figure 2: Lipha bubble diagram

Note that this classical four-boxes representation is obtained through the elimination of some characteristics of the projects. For example, projects in the bubble diagram are considered as independant, an hypothesis that is certainly not realistic. Some bubbles correspond to " back-up " strategies which explore the same marketing target following various scientific tracks, in order to minimize global risk. Then, the success of one project inside the family will result in stopping the others.

At the level of ergonomics, we see also that this instrument is successful in representing five characteristics of projects (risk, expected value, remaining investment, expected progression, commercial launch). This probably reaches a limit in complexity. The graphic codes were largely discussed in the research task-force : for example, people criticized the representation under the charge that the size of the bubble is spontaneously taken as a positive criteria (a large bubble looks like a good project), when it is in fact a negative attribute (a large bubble means heavy R&D costs).

Budget options within the project portfolio

This instrument is positioned within a type 2 relational structure. The relevant variables at this level are not exactly the same as in the previous situation. The focus for example will not be on the total required investment to bring a product to market but only R&D expenditure incurred in the budget year considered. Similarly the notion of "expectation of gain" which is relevant to the representation of the performance of a project population, becomes abstract in the context of debate between a project manager and his managers: for the former, the project can either fail or succeed. The result he will see will never be a linear combination of both these outcomes. The group has, given this, given priority to the representation of the project not in terms of expectation of gain but in those of gain in the event of success. Lastly, the layout of the "bubble diagram" is ill suited to quick simulations of different allocations of scarce resources to projects. On the contrary, the representation given in figure 4, which orders projects by decreasing NPV/I, showing a cumulative total of expenditure on the X-axis and profits on the Y-axis, is very well matched to this exercise.

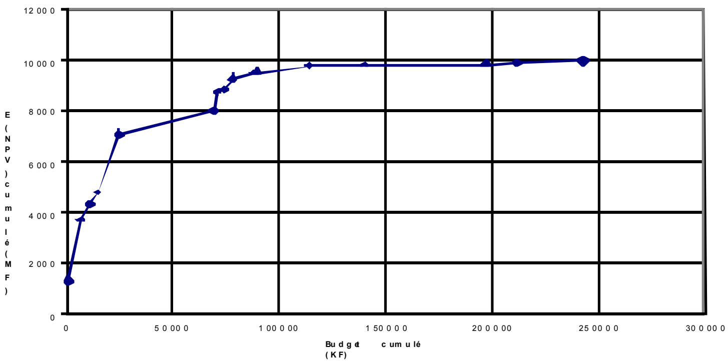


Figure 3: SKB project prioritization tool
Source: Sharpe, P., Keeling, T. (1998)

Note that the assumptions as to the independence of variables on which the above representation is based are also to be found here. Differences in risk associated with projects are no longer pictured, and the notion of overall portfolio balance has been lost.

The preceding analyses therefore confirm and flesh out the observations made on the advantages of using more than one instrument, choosing them to suit the situations covered by project portfolio management. The evaluation of simulations of the various tools has also made it possible to highlight whether given approaches are a good fit, or irrelevant, for the specific features of the research strategy in the company's research and organization. The "management philosophies" underlying some tools are too far out of step with the realities and the strategies they are supposed to picture and to support. The "contrast" effect they create can in this case become a vector for major distortion. Hence the strong tensions frequently to be observed in industrial groups implementing this kind of management instrumentation. We analyze in the section which follows the fit between tools and the specific features of the research strategy of the firm considered here, and in the final section, the match with the specific features of its structure and its past project-related history.

R&D STRATEGY AND THE LOGIC UNDERLYING PROJECT PORTFOLIO MANAGEMENT TOOLS

Lipha's research strategy is characterized by three major features. As we saw in the first section of this paper, Lipha has chosen to focus its research on therapeutic targets. In addition, as in most large pharmaceutical groups, research strategy has been locked on to the discovery of "block busters" on the basis of economics which are totally different from those found in other sectors such as manufacturing. Finally, one of the fundamental trends in pharmaceutical R&D is the development of on-going project trades between firms: for example, the co-development of compounds or the sale and purchase of candidate drugs. How can portfolio management tools integrate such sector-specific parameters?

Exploration driven by therapeutic goals or targeted on defined technologies

The focusing of Lipha R&D on defined targets is reflected in an initial screening of projects immediately on their entry into the development phase. The projects which survive are, by definition, “correctly targeted”. In this context, the multicriteria strategic evaluation tools (scoring) used to ensure such correct targeting subsequently cease to be of use for portfolio comparison and control.

The situation changes when the exploration strategy is targeted on a defined technology (for example, exploration of the properties of a range of substances or a genome). In this context, periodic comparison of the strategic positioning of projects becomes important. Scoring, a method of multicriteria analysis enabling qualitative and quantitative criteria to be aggregated, is particularly well suited to this problem.

R&D targeted on “block busters”

The economics of the pharmaceutical industry is shaped fundamentally by patent-based protection of new drugs (NCE = New Chemical Entity), which guarantees income from a monopoly over a defined period. Once the patent has expired, generic drugs make inroads into the original product and margins collapse. This situation leads to phenomena related to concentration of profits on a few flagship products (the “block busters”) which fund numerous failures. As an example, in 1998, Lipha’s own flagship product, Glucophage, generated worldwide sales of about USD one billion. In this context, commitment to a given R&D thrust is expressed as a minimum frequency of discovery of “block busters” – one every nine years for example.

Which instruments are consistent with the management of a policy embodying this form of commitment? What we find here is a discrete phenomenon (projects are scarce), made up of non-linear events (two molecules chemically and biologically analogous at the outset may end up totally differently) and evidencing a learning track dynamic (projects are not independent).

Non-probabilistic reasoning is obviously ill-suited to managing this type of phenomenon. Conventional approaches based on taking uncertainty into account by appeals to expectation (hoped-for gain and probability of occurrence) are also highly unsatisfactory when a company is faced with very major gains associated with low levels of probability and low numbers of occurrences [18]. Thus the representation described above as well suited to dealing with overall budget constraints, based on a logic of incremental, additive investment, pictures this phenomenon poorly. By seeking to concentrate on investments whose hoped-for marginal gains are highest, there is a risk of ending up with dramatically low long-term probabilities of project outcomes.

The preference will therefore be for representations based on counting of probable flows of products at different stages, setting targets of the type “throughput of at least two active compounds to the development phase every year”, as can be seen in the figure below.

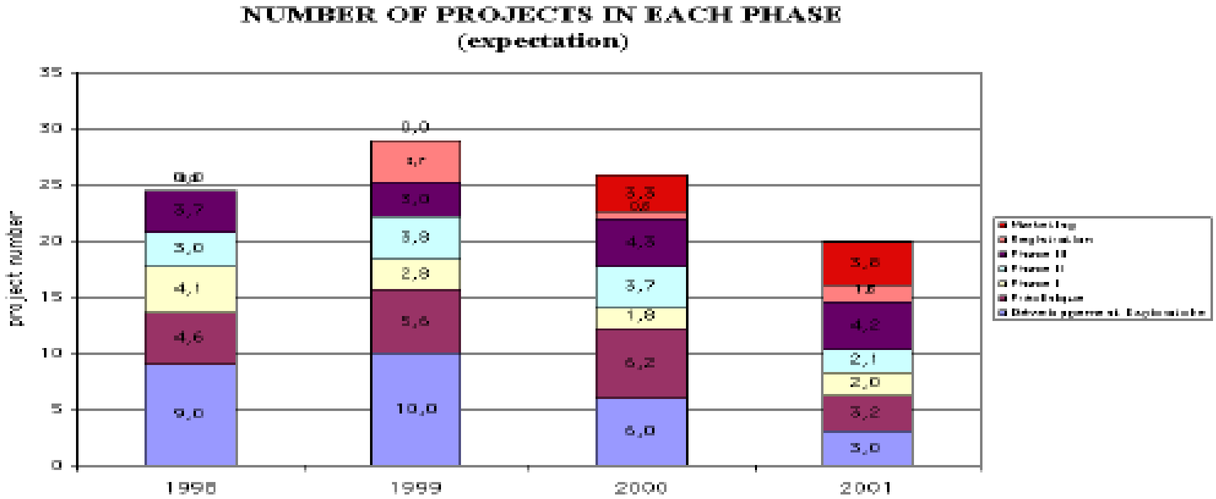


Figure 4: Diagram for changing probable numbers of projects in each phase

On the other side, one drawback of this representation is that it gives a rather unstable image of the portfolio: although it reflects reality of R&D situations, exhibiting erratic performances may damage trust among other professionals who are used to more stable environments.

Taking account of project trade strategies and the notion of the "porous funnel" in R&D

In the conventional literature, the project development space, often called the "R&D funnel" has just one possible business outcome: marketing of a new product when approved by the health authorities. Projects enter the initial development phases and progress gradually through the funnel until they are brought to market or fall by the wayside for various reasons. By introducing the possibility of "trading", buying or selling projects (wholly or partly) at different stages in their development, the relevant business model is modified to take into account the management of the R&D portfolio. This takes us from the conventional R&D "funnel" to one which we might describe as a "porous funnel", leaving room for trading with other firms as shown in the diagram below.

The project funnel: the track is followed through to marketing or the project is killed.

The "porous" funnel: value can be gained from projects other than by bringing them to market. At each stage a project can be halted, pursued or implemented.

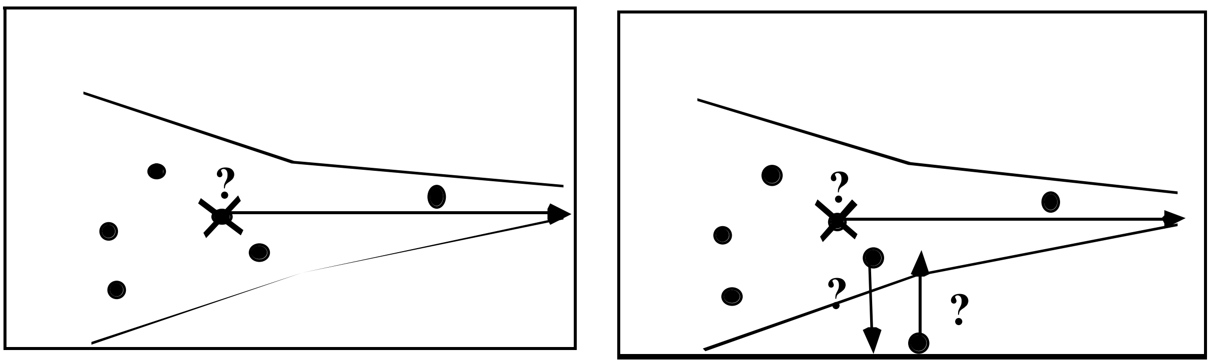


Figure 5: The R&D process: from the conventional funnel metaphor to the "porous" funnel

The decisional framework for R&D management in porous funnel mode is significantly different from that associated with the conventional funnel, as table 1 below shows:

Table 1: comparison of the decisional frameworks of "conventional funnel" R&D and "porous funnel" R&D

Conventional funnel situation		Porous funnel situation
Resource allocation is based on sharing out a fixed overall budget (zero-sum game between projects)	=/=	The overall budget varies according to the decisions reached (nonzero-sum game)
Projects are evaluated according to defined corporate norms	=/=	Each project has an inter-firm trade value which may differ from its value for the originating company
Gaining value from the project is based on the expertise of downstream sales personnel	=/=	Gaining value from the project is an on-going activity from the outset and is based on R&D expertise

Conventional representations do not make it possible to picture the decisional framework associated with the "porous funnel" configuration. For example, following the chosen strategy, the same project may be positioned at two very different locations in a conventional "bubble diagram", as is shown in the figure 6 below:

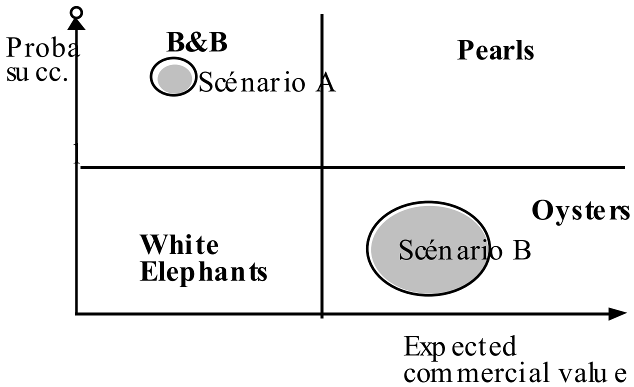


Figure 6: The representation of various scenarios associated with the same project in a "bubble diagram" representation of conventional type

At bottom right, the representation picturing internal development implies high risk and investment, while promising large profits in the event of success. At top left is the assessment of the same project if value is gained from it during development by means of a trade with another pharmaceutical firm: the risk and the investment are smaller (because return on the project is immediate and simultaneous with the trade, and the other firm will complete the development), but the profit in the event of success is obviously lower (sale price plus royalties on any future sales for example).

GROUP CONTROL AND PROJECT PORTFOLIO MANAGEMENT TOOLS

Project portfolio management cannot be analyzed without taking into account the organizational principles applied by the company to its R&D. The choices which are made will back up or, conversely, undermine major organizational issues such as the definition of the job profile of the project manager, the centralized or decentralized nature of R&D decisions, or the mechanisms in place for organizational learning.

Bringing research and market closer together; decentralizing R&D and the system for project portfolio management

The last two decades have seen a continuing trend toward a closer relationship between R&D and market, a rapprochement which is encouraged by the increasing decentralization of research resources in organizational structures consistent with chosen strategic goals (SBUs or BATs by product, by market, by technology, etc.). R&D approaches then develop within the decentralized organization to fit local strategy. As we saw in the first section of this paper, certain approaches to portfolio management may place local consistency of R&D choices in jeopardy on the grounds of centralized optimization, which, as we have seen in the previous period, is not synonymous with efficiency.

Maturity of project management and portfolio management tools

The concept of the post of project manager covers a wide diversity of actual practice ranging from straightforward, informal co-ordination conducted very much on a part-time basis (the "lightweight project manager") to "heavyweight project managers" [19] who enjoy very high levels of responsibility, autonomy and resources. Recent history points in the direction of greater professionalism and a policy of strengthening of such corporate roles [20, 21]. The ways in which the project portfolio management approach interfaces with the dynamic driving development of the roles of project managers is manifestly of great importance.

This is particularly true when the company has achieved a degree of maturity in terms of project manager profile. Jolivet & Navarre [22] have developed, starting out from the principle of subsidiarity, the notion of "metarules", a concept allowing the contradiction between project autonomy and management of overall group coherence to be surmounted. The only issues which are referred to portfolio management are those which cannot be dealt with at the level of the individual project. It may easily be imagined that certain tools, which "feed back" to central committees a plethora of technical and commercial data, are totally out of step with the principle of the empowerment of project managers.

Tools that drive the learning process

The "sales argument" most often used to promote the adoption of new project portfolio management tools focuses on the decisional process: the tool is profitable, the argument runs, because better decisions are taken in the area of strategy through the competitive advantage created and the costs arising. However, numerous research publications [6, 23, 24, 25] tend to concur that the contribution of management tools to organizations relates more to their ability to structure the collective learning process over the medium term than to assistance they provide for decision-making in the short term.

The project portfolio management field is typical in this respect. On the one hand, decisions on projects are sufficiently rare, singular and complex for the "efficiency gain" obtained through greater use of tools and automation to be unspectacular in many cases. Furthermore, most case studies highlight the importance of the decisional process in which the tool is applied, the debate between experts on which data quality is based, and so on. On the other hand, organizational learning on the management of R&D projects is a process which is particularly difficult to put in place, the reasons being, among others, the length of time separating decisions from their perceived results, the multiplicity of points of view integrated into projects, the character of project histories themselves, in principle highly particular and consequently difficult to extrapolate, and the chaotic manner in which projects unfold. The shaping and instrumentation of project portfolio management can in this case offer a particularly useful lever for the promotion of the learning process within the organization. It can ensure the required traceability for experiential feedback. It encourages the minimum uniformity of approach essential to inter-project comparisons. It reveals the disparity and interdependence of the points of view to be taken into account. It formalizes ideas which are ambiguous, subjective and abstract, such as the notion of "risk" or "value", and it can thus improve internal debate (where it does not seek to replace it).

All methods are not equally effective with respect to the collective learning process. An example is provided by tools based on scoring, which evaluate projects by aggregating, using agreed weightings, criteria which are both qualitative and quantitative (such as the degree of innovation of a project, its competitive value, etc.). This kind of logic, which is often appreciated for its virtues of simplicity within a logic of rapid decision-making (an overall grading is obtained for each project) and "objectivity" (because the base data used in the computation is dependent to only a limited extent on expert subjectivity) has virtually no advantages for learning. Conversely, approaches based on "bubble diagrams", such as that implemented in the case studied here, encourage debate at a fundamental level between the various experts (between, for example, biologists, epidemiologists and marketing personnel with the aim of arriving at sales forecasts related to the properties of the drug concerned) and forces quantitative data to be matched up with the opinions of the experts. Such comparison and contrast between subjective outlooks, added to their periodic calibration and traceability, can build powerful forces to drive the corporate learning process.

CONCLUSION: THE ORGANIZATIONAL ISSUES AT STAKE IN DECISIONS ON PROJECT PORTFOLIO MANAGEMENT TOOLS

"Management fashion" phenomena [26], added to the mimetic strategies of companies [27], tend to disseminate management innovation rapidly throughout a management world which is now planet-wide. Faced with these different philosophies, one of the problems of management is to develop an ability to select and to contextualize "products" which are very highly standardized, to take into account the specific features of the company's business, organization and history. The current fad for sophisticated instrument sets for the management of project portfolios typically stems from this logic. Such tools are frequently a source of major tension within "global" industrial groups. Leaving aside facile invocation of the notion of "resistance to change", it has been possible to demonstrate that the positions adopted reflect differences, frequently profound, as to strategies for research and the vision of project management and global control of such groups. According to the tool chosen, the vision favoured may be more or less centralized, involve exploration of "technology push" or "market pull", "lightweight" or "heavyweight" project management. However, the choice of a project portfolio management system is a decision which is well-nigh irreversible, given the high level of investment in time and resources needed to agree and put in place shared concepts and tools in international, diversified organizations. Hence the importance of the process of experimentation and implementation of such systems, and the time and expertise which must be deployed. There is here major potential scope for fruitful co-operative endeavours and experimentation between management science researchers and companies. The research currently under way is a move in this direction.

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NOTES

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[18] For example, an average success rate of 1 in 30 (p = 1/30 = 0.03333) yields the following table of probabilities of obtaining 0, 1, 2 or more successes for a given number of attempts.

Probability for:	**0 successes**	**1 success**	**2 or more successes**
10 attempts	0.72	0.24	0.04
20 attempts	0.51	0.34	0.14
30 attempts	0.37	0.37	0.26
40 attempts	0.26	0.35	0.38

It should be noted that even if the mathematical expectation of gain is 1 (30 attempts), the probability of total failure is just as great as the probability of a single success.

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