Should we keep investing in R&D ?

By
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Against a backdrop of rapid technological development, requirements for differentiation and innovation with respect to clients and competitors from developed countries, upholding barriers against competitors from Less Developed Countries (LDC's),… the answer would appear to be an obvious yes. However, this is not the case.

Many companies have significant R&D budgets and, at the same time, are struggling to grow or maintain their competitiveness and profitability.

R&D does not necessarily create value in mature industries, and can often be an overinvestment. In industries experiencing significant growth, it does not create value for *all* actors, especially for market followers.

In all instances, it is only a competitive lever amongst others, not always the most important one – namely the most differentiating one – and it is certainly not the final barrier against competitors from low productions cost countries.

Therefore, the issue is not only about optimising objectives, organisation, and the allocation of R&D resources within teams and budgets which remain more or less untouched. It also concerns the role and how to best fit R&D within the company's overall strategy.

Five facts

1. It is not possible to invent faster than the industry's learning curve

Major inventions, innovation breakthroughs, significant technological changes, … are not solely linked to the skill of researchers and financial resources made available. They are directly correlated to an industry's learning curve.

In recent industries marked by high growth, innovation breakthroughs are frequent. In mature industries, characterised by low growth, innovation breakthroughs are rare. For instance, the power of semiconductors keeps doubling every twenty four months, in an industry which grows by approximately 15% per annum, and where the cumulative industry experience doubles every 7 years. Conversely, in the steel industry, there has been no significant innovation in 30 years (minimills). The industry grows by approximately 3% per annum and the cumulative industry experience doubles every 40 years (cf. table 1).

Average R&D budgets, expressed as a percentage of sales revenues, in industries are, on average, and also segment by segment, inversely proportional to the cumulative industries of these industries (cf. table 2).

R&D linked to technological breakthroughs and research in innovation are thus justified in industries marked by high growth. R&D can, however, be an overinvestment, and therefore destroy value in mature industries, where it must be challenged by senior management.

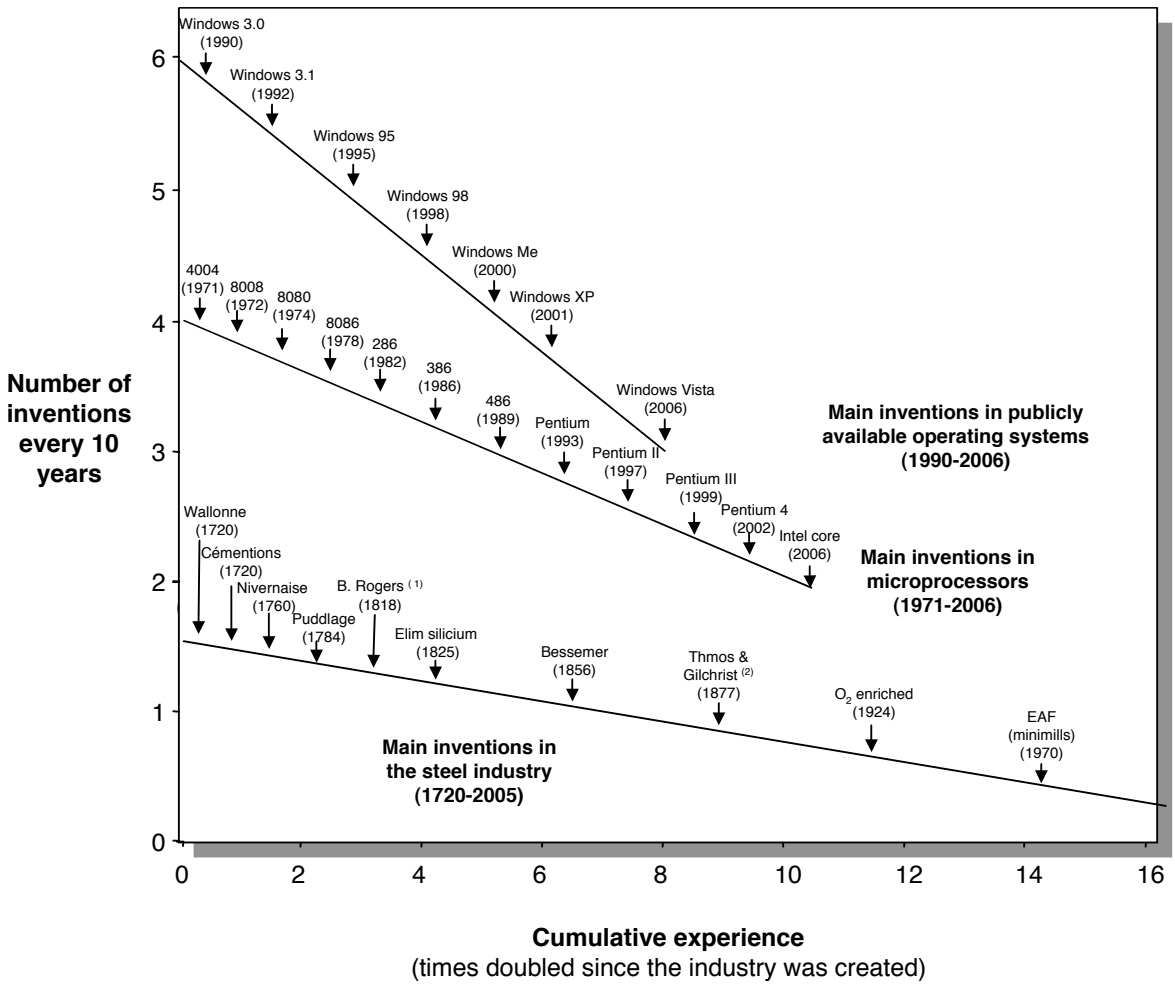
2. Manufacturers of horse drawn stage coaches did not invent the railway

However, major breakthroughs occur from time to time in mature markets, which allow a technology, even a whole industry, to be substituted by another. Discovering such breakthroughs remains the fantasy of many actors in these industries, whether they are in marginal competitive positions and are seeking to fundamentally alter the rules of play to their benefit, or whether they are in leadership positions and are looking for sources of growth to boost the market.

Manufacturers of horse drawn stage coaches did not invent the railway. The iPod was not invented by DVD manufacturers; the espresso machine which uses individual doses is a marketing invention from coffee manufacturers (Nestlé) and not a technological breakthrough launched by manufacturers of household appliances. Video games were not invented by the makers of traditional family games or by Hollywood studios. PC's and the Windows operating system were not invented by IBM. Microsoft did not invent the internet research engine.; etc…

- Table 1 -

The frequency of occurrence of innovation breakthroughs is correlated to an industry's maturity



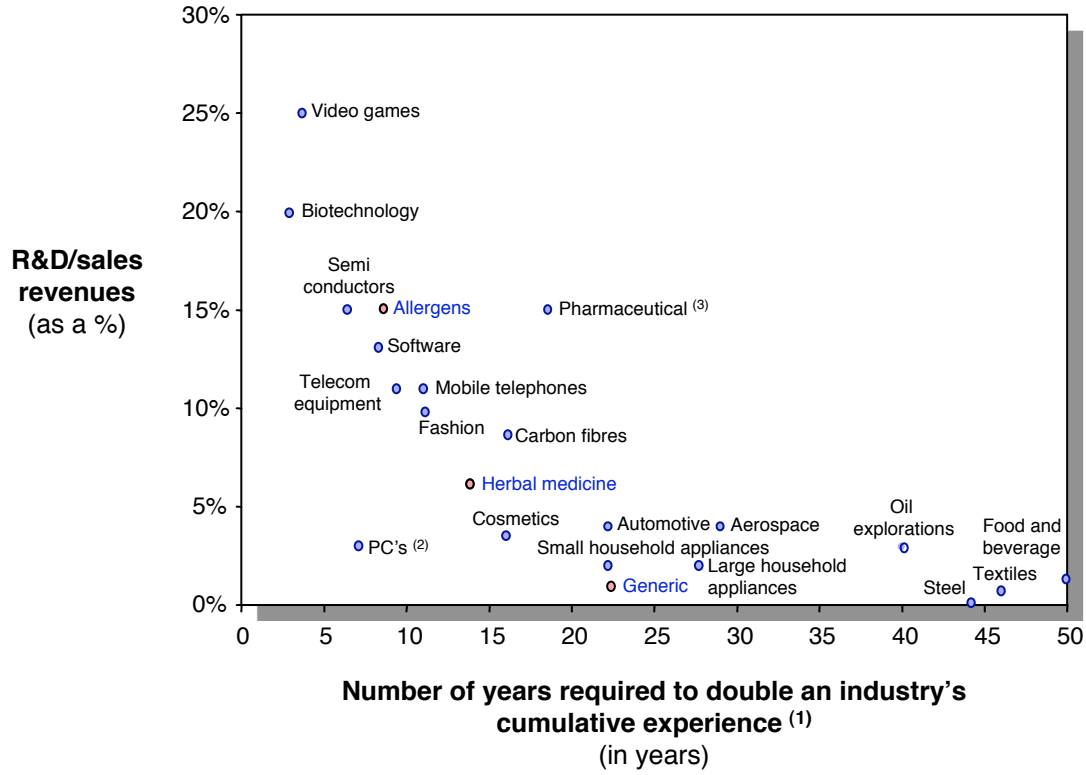
(1) Ground cooled by air from below; (2) Dephosphorisation,
Sources: Estin & Co analyses

Major breakthroughs challenging technologies which underpin mature industries always come from other sectors experiencing rapid growth, which spread their technology to areas which can appear far apart. Thus, it is imperative to strongly challenge research teams (and their budgets). Within large corporations and in markets characterised by low growth, they will claim to revolutionise their industry instead of simply improving the value of products or the competitiveness of production processes.

Major North American corporations tend to manage their activities more and more by ring fencing their in house teams to the running of "business as usual" and by acquiring small innovative companies where new technologies or new business models which may appear to withhold promise.

- Table 2 -

The level of R&D as a percentage of sales revenue is linked to an industry's maturity



(1) estimated using growth levels in each industry; (2) most investments necessary for R&D are carried out by the manufacturers of components; (3) pharmaceutical includes different types of medicines at different stages of maturity, eg allergens in blue, herbal medicine, and generics,
Sources: Estin & Co analyses

3. Market followers are not advised to make significant investments in R&D

In sectors characterised by significant growth, R&D is key and is a competitive weapon in the hands of leaders. On the other hand, more often than not, market followers tend to suffocate by attempting to keep abreast of leaders in the area of technological innovation.

R&D, similar to other areas, presents significant economies of scale. For example, in the pharmaceutical industry, R&D expenditure for markets leaders accounts for approximately 15% of sales turnover; it can account for up to 25% for challengers (cf. table 3). The same holds true in the video games industry. The leader, EA, spends approximately 20% of its sales revenue on development; the followers in this market devote approximately 35% of their sales revenue on development expenditure.

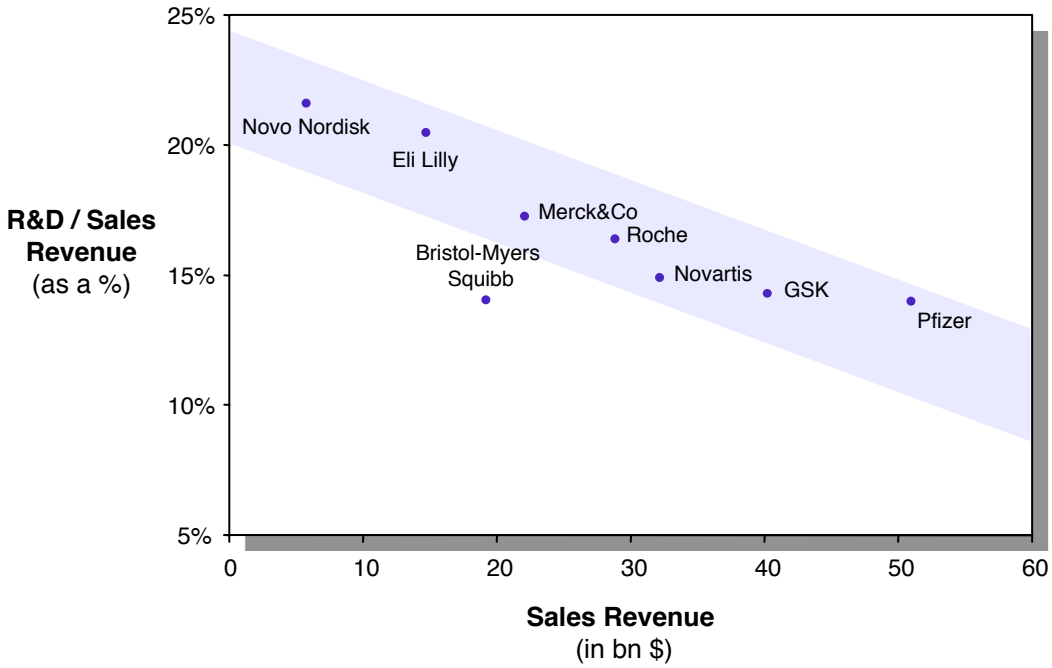
Similarly for microprocessors; Intel, the market leader with more than 85% of market share, invests 4 billion Euros in R&D (13% of its sales revenue). It has four research laboratories working in parallel, thus enabling it to never miss a market cycle. AMD, its main competitor, only has an R&D budget close to one billion Euros (19.5% of its sales revenue) and focuses its efforts on product design (as opposed to fundamental research) and on optimising the manufacturing process. Cyrix, founded in 1988 by former Texas Instruments engineers, invested heavily in R&D for ten years in order to be independent of Intel in the design of microprocessors. From 1999, it was struggling to raise the speed of its processors to 300 MHz

whereas its competitors were at 450 MHz and above. Within a few years, its processors became middle and low range products, and it had to ultimately exit the market.

How to spend differently, or in a more focused manner, or by subcontracting and sharing investments? One thing remains a certain fact. In industries characterised by high growth, head on competition in R&D is lethal for market followers.

- Table 3 -

Economies of scale in pharmaceutical R&D



4. R&D is not always the best lever for innovation

In mature markets, innovation requirements aimed to differentiate a company from its competitors, renew product ranges in order to service the market, or to adapt itself to better address ever increasingly specific client niches are not necessarily best served by R&D.

A significant proportion of these requirements is equally or even better addressed by innovations in marketing, new positioning, new product associations or services; novel distribution concepts, etc…. Changes in the business model can lead to breakthroughs which are equally significant as technological innovations.

For instance, in 2001 Philips launched SENSEO (a new concept in coffee machines using individual doses) in a partnership with Douwe Egberts, the coffee manufacturer and distributor. This system was a significant success (over 8 million units sold between 2001 and 2004). In three years, Philips almost doubled its market share in the countries where SENSEO was launched. This system's success relied less on a technological breakthrough than an offer tailor made to changes in consumption patterns (heightened individualisation, reduction in the size of households, and changes in tastes in the manner of consuming coffee). Moreover, this product could rely on a successful design and Douwe Egbert's sales and distribution channels.

The fundamental issue in such mature markets, one which is rarely really addressed given organisational compartmentalisations, difficulties encountered in making staff and skills progress, and in house political wrangles, is the allocation of resources among the different levers. Is it better to allocate resources to R&D, to marketing, etc…? In what proportion? How to alter that proportion given the development of the industry? What is the maximum R&D budget required to service the product ranges and technologies, and to develop the aforementioned at least at the same rate as that of the competition, *and over and above which*

one overinvests? Beyond the natural overall development of the industry, where will the key differences be made in the face of competitors?

5. Innovation can be a sand dyke in the face of competition from LDC's

Western corporations back R&D and innovation heavily in order to remain competitive with respect to competitors from countries with low production costs. In mature industries, this barrier is structurally weak: the weight of R&D is low; innovation breakthroughs are rare (cf. table 2). The barrier (when it does exist) is linked more to marketing innovations (cf. above).

Moreover, clients do not always take on such innovation at its true face value: together with the indirect cost of range complexity which it entails; the direct cost of innovation can sometimes be difficult to feed into prices.

In all instances, when it rests solely on technology, this barrier is provisional: with respect to quality and technology, the catching up period for Chinese competitors is narrowing progressively. For example, it took Haier 20 years to become the world leader in refrigerators, 15 years to be world leader in air conditioning, and 10 years to be world leader in washing machines. Today, it is one of the main players in the large household goods sector with products which are at the forefront of technological know-how. Within less than three years, it broke into the high definition television market with an LCD screen, and in 2006 launched the first wireless high definition television with an LCD screen incorporating UWB (Ultra WideBand).

This barrier could even be reversed in several industries: large Chinese corporations' R&D budgets are increasing and in certain sectors are progressively getting ever closer to those of their Western competitors. In industries where they are established world leaders, they are at the forefront of technology.

In the telecommunications sector, for example Huawei, the Chinese leader, significantly increased its technical nature over the last ten years. In 1995, it only manufactured digital commutation switches for land lines; in 2000, it supplied 2G mobile networks. Today, it manufactures 3G mobile networks and holds 5% of key worldwide patents for the UMTS standard. All Huawei products currently rely on ASIC (Application Specific Integrated Circuit) chips, which is the core technology underpinning the telecommunications industry. Today, Huawei is the world leader in this technology in terms of creative capability and reverse engineering.

Innovation is thus an important competitive factor, albeit a provisional one, and not always a sufficiently differentiating one. In the long run, it does not make up for the lack of commercial or industrial competitiveness. Coupled with competitive positions and strengthening such positions even further, it is a positive lever. Relying solely on non competitive positions, it is a porous dyke and thus a dilution of resources.

Three stakes

1. The role and best fit

The issue, of course, is not to eliminate R&D or efforts linked to innovation, renewal or adaptation. It is to define the true role of R&D within a company's strategy, the best fit for required investments and their correct allocations.

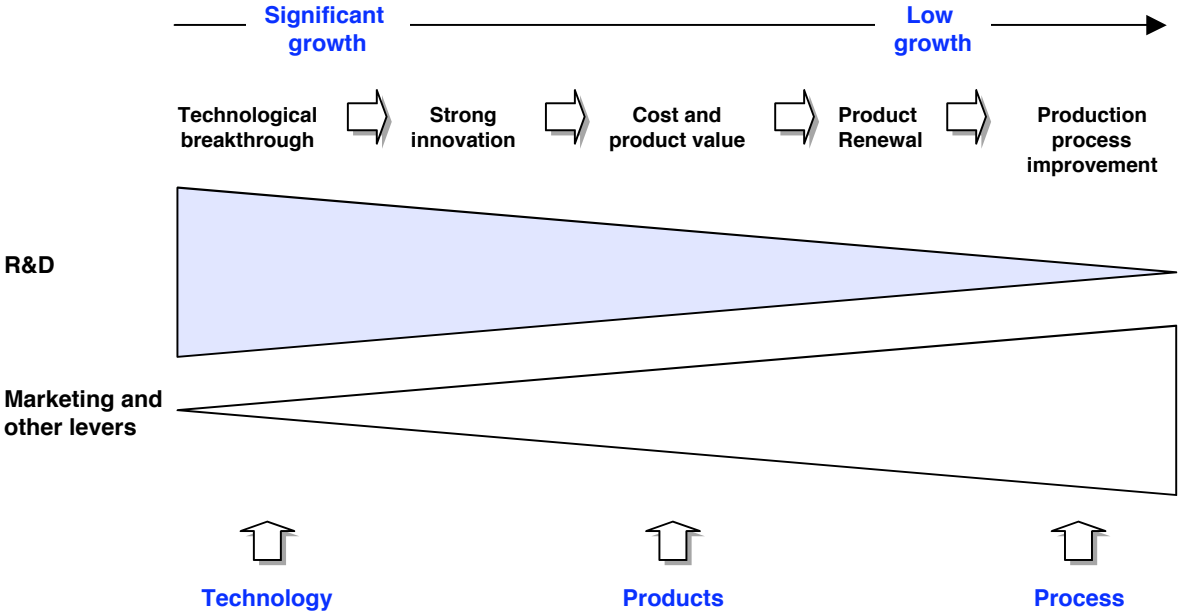
A study carried out in several industrial sectors - wholly independent of what has been evoked above - shows that corporations' R&D investments are often correlated to one single parameter: profitability. When profitability is high, the proportion of R&D investments increases; when it is low, the proportion of R&D investments reduces.

In actual fact, setting a rational best fit for R&D should be a function of an industry's maturity, a corporation's competitive position, the core objectives being sought (technological breakthrough, innovation, technical support for innovative marketing, simple product range renewals, improving production processes…) and the relative value of different levers (R&D, marketing, sales, production costs, services,…) in competitiveness and growth (cf. table 4).

It is a fundamental question in assessing the role of R&D and the allocation of resources within a company. As in the case of other strategic stakes, benchmarking with competitors can be deceptive. One should be doing more, or less, or better or differently. To do things in the same manner is always a dilution of resources.

- Table 4 -

A simplified vision



2. Financing and deciding where to locate

In instances where R&D remains a significant budget, and when margins are strained, the key issue is one of financing. In industrial activities, this issue is closely linked to the decision as to where to locate production factors.

Industrialists often have a limited view on the relationship which ought to tie R&D and production. They are wrong. Will R&D still be possible if control over production processes is forsaken as a result of outsourcing most of such production processes, or if factories are relocated to LDC's?

In actual fact, the issue is the following. In many industries, given the level of competition and prices, and more specifically given the ever increasing power of LDC's, R&D can no longer be sustained and financed by margins generated from production factors which imply high wage costs.

Being able to keep a significant R&D activity in developed countries requires high structural margins, thus the need to locate production in countries with low production costs.

Major players who continue make significant R&D investments therefore follow two alternative strategies:

(a) on the one hand, coupling advanced R&D in developed countries (USA, Europe, Japan) with the production of prototypes and small volume series linked to beginning or end of cycle products in these same aforementioned countries. On the other hand, locating the production of large volume series of well established mid-cycle products in LDC's (cf. table 5);

(b) coupling R&D and production in LDC's, in sectors where it is crucial to link the two processes. For example, Alcatel set up its first R&D centre in Shanghai in 2002 close to its main Chinese production centre. This was followed by two additional centres in Chengdu in 2003 and 2005 in order to service the Chinese market's continuous development. Its R&D

activities in China cover all key areas in telecommunications such as 3G mobile, the new generation of networks, optics and “triple play” services (voices, data, video).

- Table 5 -

Some «□average□ ratios (1)

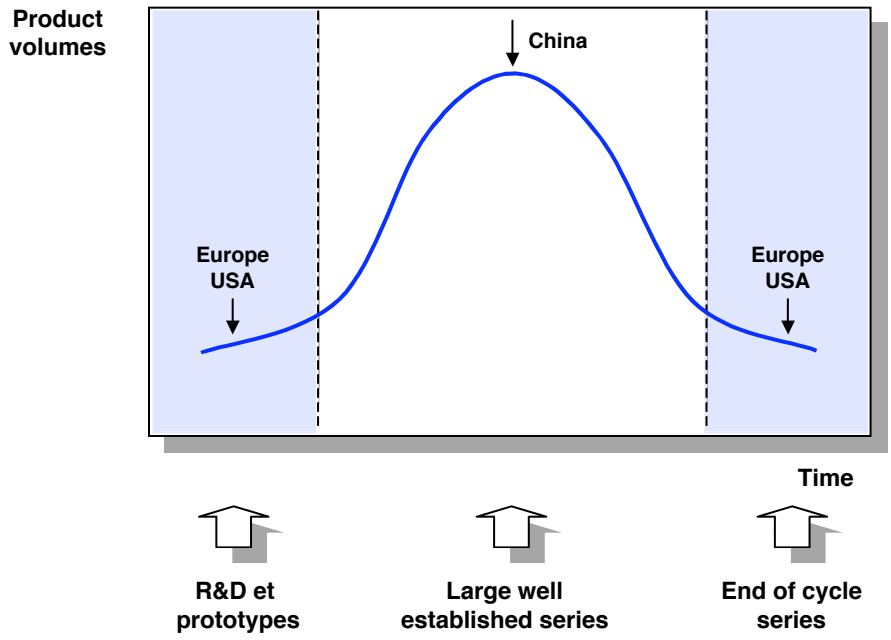
	Video games	Pharmacy (USA)	Small household equipment	Steel industry
R&D	25%	15%	3%	1%
Marketing	8%	8%	4%	1%
Sales	10%	15%	10%	20%
Total	**43%**	**38%**	**17%**	**22%**

(1) As a percentage of sales revenue

These strategies can also be differentiated because of the level of complexity and technology included in such products; R&D for complex products or else products at the forefront of technology in Europe, the USA or Japan. R&D (or development on its own) of more simple products is relocated together with production to low production cost countries (cf. table 6).

- Table 6 -

Differentiation depending on the life cycle



3. Consistency

The business graveyard is riddled with ill marketed innovations, inadequately supported by advertising budgets and sales teams, reaching the market at the wrong time, adding complexity (and costs) to product ranges and reducing their readability.

For a given success rate, R&D budgets and innovation flows must be adapted to levels which the sales teams and marketing budgets can promote. Thus new products must be sufficiently differentiated, in limited numbers, and must push out some of the old products in order that the range may increase its value and not its complexity.

Therefore, R&D must be focused and paced in line with global resources and the corporation's overall strategy and not only its very own internal dynamics. (IBM's R&D, under the stewardship of Lou Gestner, generated more innovations having a significant impact on sales revenue and margins than over preceding years, with a budget that was reduced by half).

For every industry sector, and for every competitor, there is an "ideal" ratio for R&D, marketing, and sales expenditure. R&D investments which are over and above, or below this ratio are not efficient. (cf. table 7).

- Table 7 -

Differentiation by product type and technology

	Products and simple technologies	Products and complex technologies
Research	USA / Europe / Japan / China (in house)	USA / Europe / Japan (in house)
Development	China (in house)	USA / Europe / Japan / China (in house)
Industrialisation	China (sub-contracted)	USA / Europe / Japan / China (in house)
Production	China (sub-contracted)	USA / Europe / Japan (prototypes) China, well established series (in house)

Conclusion

Should we still invest in R&D? yes, but:

- Not over and above what the industry and the competitive position can justify structurally,
- By targeting relevant goals which take into account industry cycles and the company's position (technological breakthrough, innovation, simple range renewal, improvement in production process,…)
- In line with what the overall channel (R&D, marketing, sales,…) can promote with the correct timing,
- By allocating resources in an optimal manner within this channel among the different levers (R&D, marketing, sales,…),
- All other things being equal, the starting point must be from competitive cost bases.

Therefore many conditions must be fulfilled prior to defining a competitive R&D strategy!

However, R&D can only be of value as a component of strategy, which must be analysed and defined as such, in a manner consistent with other levers and investments within a corporation. These actions must be performed beyond the mere optimisation of its organisation and internal processes.

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Estin & Co. is an international strategic consultancy firm based in Paris, London, Geneva and Shanghai. The firm advises senior management of large European and North American corporations on their growth strategies, and private equity funds on the analysis and valuation of their investments.