

Two common mistakes on Research & Development – overspend and underspend

Numerous studies have shown strong connections between research and development (R & D) efforts and economic prosperity. However, the payoffs are often slow, and the benefits to society do not mainly accrue to the knowledge creator. There are also diminishing returns: if you double your R & D spend you will not get twice the number of product and process innovations, quality improvements, material cost savings etc. On the other hand, just slashing away at R & D will cut off the lifeblood of future possibilities for competitive advantage and differentiation, and hence growth and profitability.

So while in theory for a particular business there must be a “right” level of R & D spend, establishing it is problematic. In the PIMS data base we have thousands of businesses spending very different amounts on R & D, and while some succeed spectacularly others fail dismally. There is no simple relationship between R & D spend and success. However, if we dig deeper, patterns are discernible, and we set them out in this paper.

Is R & D the culprit?

Despite superficial appearances to the contrary – and accounting logic - it is frequently not true that high R & D spend causes low profitability. The explanation is that the kinds of businesses that invest heavily in R & D frequently have other characteristics which in turn cause low ROI (Figure 1). So high R & D spending is often found in businesses that have low profits for other reasons.

	Characteristics of high R & D businesses	Characteristics of high ROI businesses
Investment intensity	High	Low
New products/sales	High	Average
Relative direct costs	High	Low
Relative quality	Average	High

Figure 1: Drivers in opposite directions

When is R & D too high?

Some businesses normally spend substantial amounts on R & D; they are forced to do so by the nature of their industry or their circumstances. The important thing is for a business to know when it exceeds or falls

short of what is “normal” for other businesses in similar circumstances. To help determine what level of R & D is “normal”, the PIMS data base can identify the usual characteristics of businesses that have low ratios of R & D expenditures to sales, as compared with those that have high R & D/sales ratios. Based on these general patterns, we can then compute the “normal” level of R & D for a specific business. For example, investment intensive businesses tend to spend more on R & D than do non-investment intensive businesses. Therefore, the “normal” level of R & D for a business with high investment intensity is higher than that for an otherwise similar business with low investment intensity. Figure 2 below displays some of the major characteristics of normally low and normally high R & D spenders. The more closely a business resembles one of these extreme types, the lower or higher is its “normal” amount of R & D.

	Normally low R & D spenders	Normally high R & D spenders
Lifecycle stage	Mature	Growth
Real market growth	Low	High
Vertical integration	Low	High
Investment intensity	Low	High
New products	Few	Many
Market share	Follower	Leader
Customization	Standard	Custom

Figure 2: Characteristics of high vs low R & D spenders

Real market growth is the deflated growth rate of the market served by the business. Vertical integration is the ratio of value added (adjusted for unusual profitability) to sales. New products are step-change products introduced in the last three years by this business.

We can now define “over-spenders” as those businesses which spent considerably more on R & D than normal, and “under-spenders” as those businesses spending less on R & D than normal. Figure 3 shows average levels of ROI for PIMS businesses, classified by their rates of R & D expenditure relative to “normal” levels.

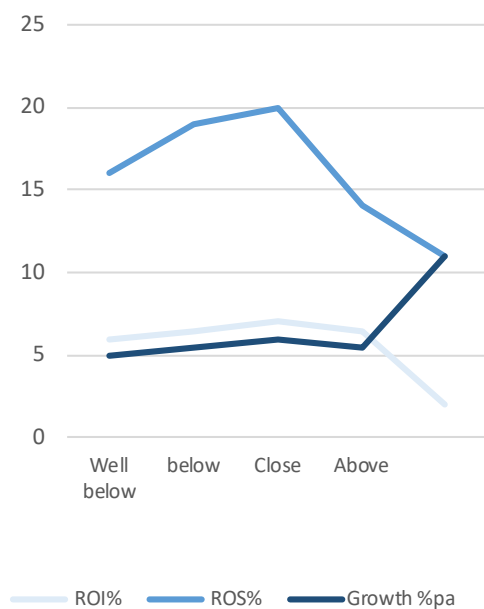


Figure 3: There is a profit penalty for abnormal R & D spend and only a small growth benefit for R & D overspend

“Normal” equals “About Right”

We observe that even though people often feel perplexed about what level of R & D spending is right, what they do, i.e., spending the “normal” amount, seems to be a good approximation to the right thing to do. What is important is not the level of R & D as a percentage of

sales, but whether it is higher or lower than would be expected for a business in similar circumstances.

R & D spending strategies

Although spending at the normal rate gives the best ROI, there are sometimes distinct strategies associated with

over- and underspending. Deliberate overspending can be an aggressive move, focussed on creating a strategic advantage by increasing product quality, developing new products and processes, or reducing costs. This advantage is then expected to yield a strong competitive advantage and growth in market share, thereby trading current for future profits. Deliberate underspending may mean either of two things:

» that managers are unable or unwilling to forego current profits, or

» that managers have taken advantage of opportunities to increase quality or reduce costs without the help of R & D expenditures. Such an opportunity might lie, for example, in copying a product feature, exploiting a supplier’s innovation in materials / components, or making a minor improvement and then taking advantage of more aggressive marketing or a superior distribution network. However, just copying a competitor with no attempt at differentiation is not recommended: this just leads to a downward spiral of destructive competition.

Both underspending and overspending strategies can work.

However, several factors affect the likelihood of success of either.

1. Market leadership: profit penalties for overspending hurt particularly when market share is low (Figure 4). Additionally, overspenders with low market shares do not usually succeed in offsetting the damage by gaining share at a much faster rate. Overspending is a risky strategy for the weak.

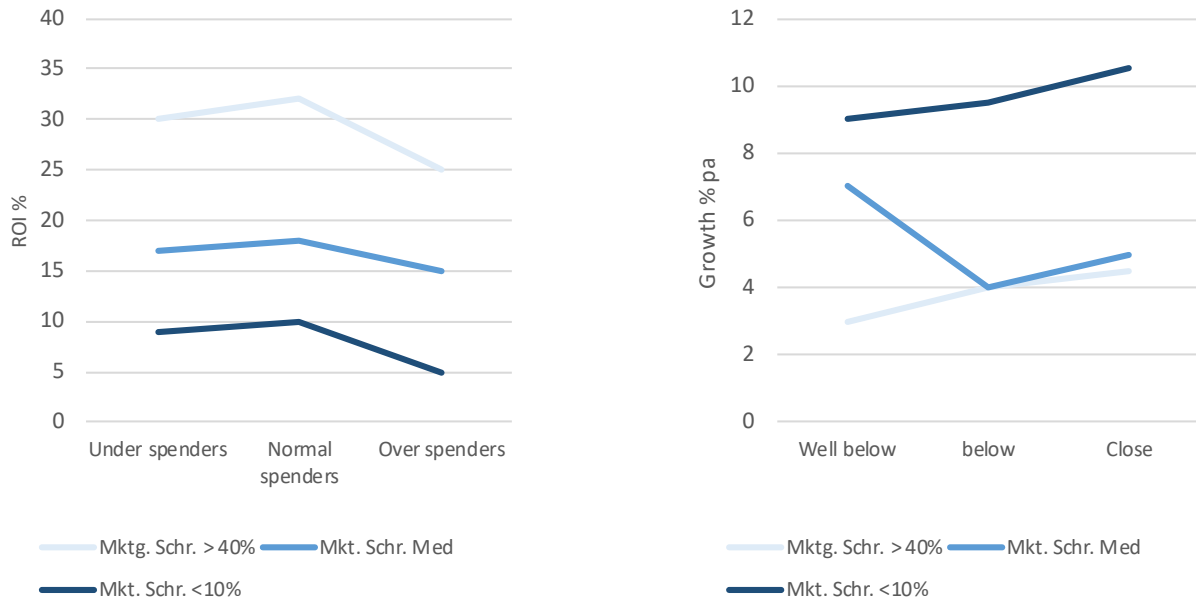


Figure 4: For low share businesses R & D overspending halves ROI but only adds 2% to growth

2. New-product introductions: new products are important tools for a growth strategy. An underspending strategy can be a successful and cheap way to gain share if there is a source of new

product ideas other than R & D (e.g., copying or market research).

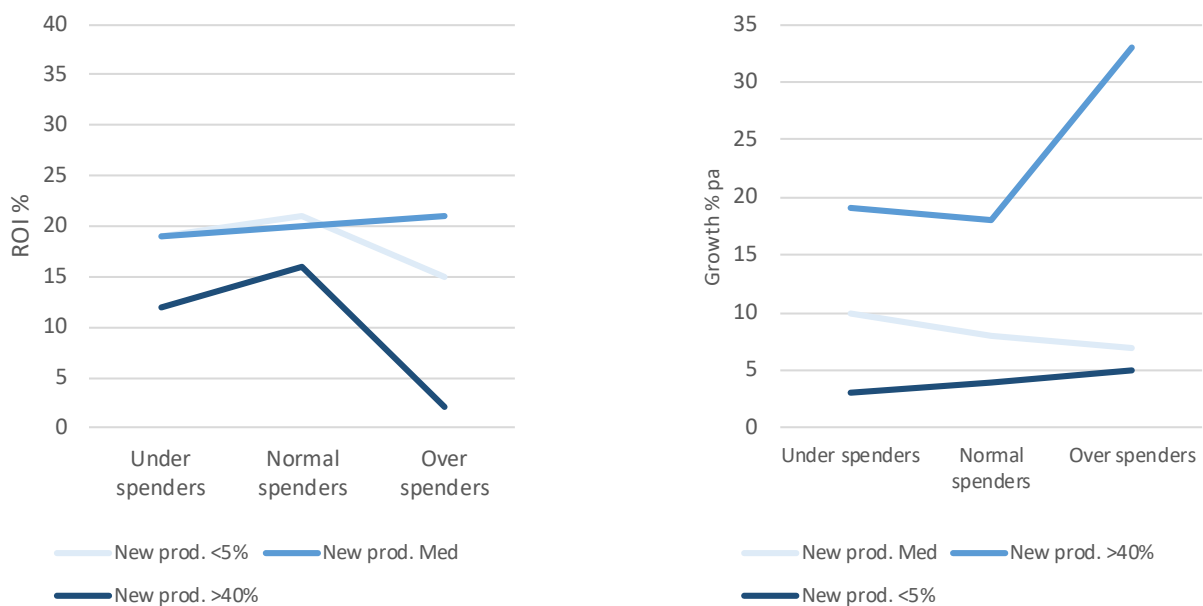


Figure 5: R & D overspenders are more sensitive to innovation (than normal spenders) for both profit and growth results

However, the evidence (see Figure 5) shows that another successful strategy can be to devote significant R & D resource to projects for profit improvement rather than new products: overspenders with few new products did get better profits and reasonable growth. This is possible if the R & D effort cuts product cost and/or improves quality, allowing an improvement in the customer value proposition. Overspenders who instead went for innovation got spectacular growth but with a severe profit penalty, perhaps because their more intense R & D effort resulted in radically innovative products that were not easily copied – but created production or marketing cost problems.

3. Growth markets: over- or underspending on R & D are both expensive ways of attempting to succeed in a growth market, because they both result in decreased ROI (Figure 6) without much effect on growth. Normal spending can yield share gains comparable to those of overspending without incurring an ROI penalty. A similar pattern – of a bigger profit benefit from sticking to “normal” R & D levels, without a growth penalty – is seen in low capital intensive businesses, businesses offering inferior customer value, and businesses with longer development cycles.

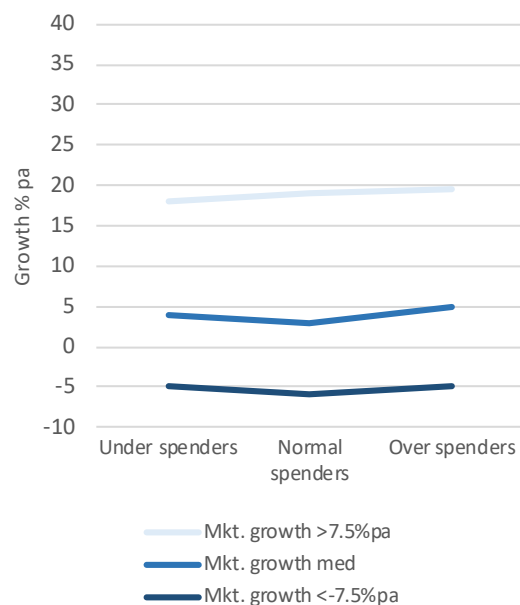
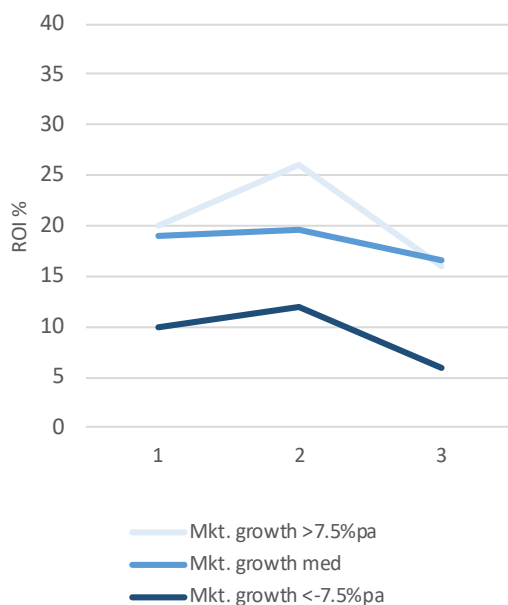


Figure 6: High growth markets are more profit sensitive to R & D over/underspend

4. Intellectual property advantage: R & D is perceived to be a more secure source of competitive advantage when its results can be protected by patents or trade secrets. Figure 7 confirms that overspenders with product and/or process patents (or trade secrets) get profit and growth advantages over businesses

with neither. It also shows that if you start with both, you can “live off the fat” with good ROI and growth despite low R & D. Process advantages have particularly durable profit results: further R & D efforts may just lead to over-elaboration.

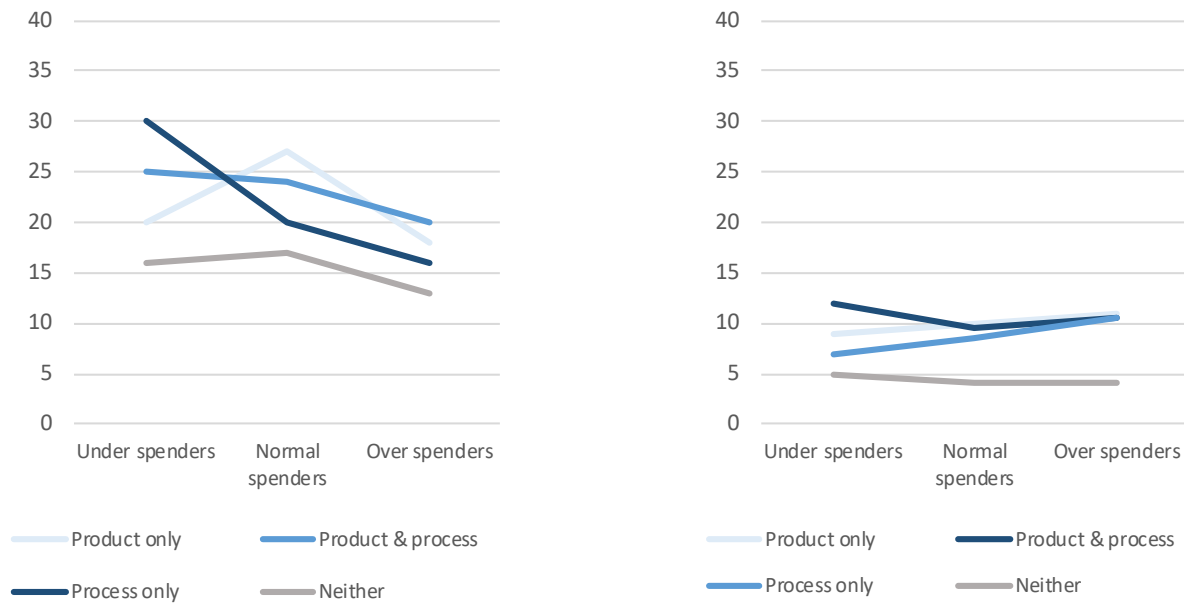


Figure 7: Effects of product and/or process patents (or trade secrets) on profits and growth

Conclusion

Cutting R & D, despite the fact that it usually has a favourable short-term impact on the bottom line, is not usually the way to increase longer-range profits. is not usually the way to increase longer-range profits. On the other hand, boosting R & D does not automatically increase market share, or do so at a reasonable cost. While there is often a tradeoff between short term profits and growth, some R & D strategies yield neither, and some yield both.

Some general guidelines about R & D spending:

1. Normal spending, in the absence of good reasons for over- or underspending, is usually the best strategy. This is particularly true in high growth markets, less capital intensive industries, long development-cycle businesses, and competitors behind the price-performance curve.
2. If it is possible, it may be more profitable to copy (while still differentiating on “surface” attributes) and make incremental changes than to innovate.

3. Growth is compromised by an underspending strategy if there is no alternate source of new products.
4. High share businesses, and businesses that can protect their intellectual capital, risk less by overspending than do low-share businesses, or businesses with “me-too” processes. In such cases, the risk/reward ratio tilts towards a growth strategy based on radical innovation.

Finally, it is important to realize that the “right” amount of R & D for any given business may be a little or a lot. By comparing itself to the profiles of normally low and normally high spenders, a business may arrive at a “ball-park” estimate of what would be the normal R & D spend for its own market circumstances. By comparing against “winning” and “losing” strategies of look-alikes in the PIMS database, its management team can discern whether deviating from that norm is likely to result in the success they are looking for.

Notes

1. Return On Investment (ROI) and Return On Sales (ROS) are measured pre-tax and prior to finance charges. Growth is real sales growth per annum at constant prices
2. Businesses are arranged in charts so that roughly equal numbers of businesses fall into each group, but at equal additive or multiplicative intervals.
3. R & D covers both product- and process-oriented R & D, but not customer technical service or current maintenance engineering. R & D encompasses all future-oriented development expenditures, including such activities as styling as well as technological research.
4. A small proportion of businesses in the PIMS data base benefit from R & D elsewhere in the corporation (e.g. they quite often launch new products) but are unable to capture this as a definable R & D spend. These have been omitted from this research. As a group, they are closer to average businesses than businesses reporting low but non-zero R & D. Businesses that cannot measure their R & D spend are anyway not the prime target of this document.
5. Research confirms the commonsense view that R & D drives performance with a time lag – typically four years. In this document we compromise between a long time series and a large cross-sectional sample by measuring the drivers as the average of years 1 and 2 of a 4-year observation, the profit consequences as the average of years 3 and 4, and growth rates as the average over all 4 years. Note that the ratio of R & D / sales for any particular observation varies only a small amount over time relative to the huge cross-sectional variation, so spend in years 1 and 2 is a good proxy for spend in years 0, -1, -2 etc.
6. The PIMS database currently contains the strategy experiences, good and bad, of over 4000 product and service businesses provided by participating companies. Each experience is documented in terms of the actions taken by the business, the nature of its served market, the kind of competitive environment, and its financial results. In all, 540 distinct characteristics of each business experience are available for study. The evidence shows that cross-industry modelling provides more appropriate R & D and innovation benchmarks than taking “best in industry” – which can be disastrous for weaker competitors if they then attempt to take on the leader on the battleground where the leader is strongest and has huge scale advantages.