

The Value of R&D

Creating Value Growth through Research & Development

- A detailed investigation of the relationship between value creation in the stock market and R&D spending
- Investment in R&D boosts share prices in some sectors and can destroy value in others
- The stock market rewards R&D perceived as promising and punishes under-investment in R&D
- Our findings identify key obstacles to creating value from R&D and how to overcome them
- Implications are explored for performance measurement, management, incentives and strategy

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“ The use of the antiquated accounting measures and excessively short term rewards is stifling managers in many companies and discouraging good “soft investments”. Managers often claim that this is due to the lack of patience on the part of the investment community. This study demonstrates the long term view of investors in sectors where these “soft investments” typically lead to defensible competitive advantages. Investors aren’t the problem. Boards of Directors should take a more progressive view and install performance measures and incentives that encourage owner like thinking. Companies that take this approach adapt better to the new economy.”

Greg Milano, Managing Director, Stern Stewart Europe Limited.

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Executive Summary

The global economy is changing rapidly. To survive in this environment companies have to adapt with increasing speed. Outdated management models need to be overhauled or replaced. One of the most important changes is the replacement of machinery with knowledge as the key driver. Expenditures on intangibles such as research and development (R&D) are increasingly important to management as we move toward a knowledge based economy as evidenced by the strong increase in global R&D spending. The past year saw an unprecedented increase in world-wide spending on R&D with US companies leading with a 17% increase while the average for the major European economies was less than half that rate. Within Europe, Germany is leading with a 10% increase, Italian companies are lagging behind with the lowest increase in R&D at 3%, while the UK reflects the European average as the Exhibit below shows.

Exhibit: Increase in R&D spending by companies from major European economies compared to the US and Japan

<u>Country</u>	<u>Increase in R&D</u>
Germany	10 %
Switzerland	8 %
France	7 %
United Kingdom	6 %
Netherlands	4 %
Italy	3 %
Average	6.3%
USA	17 %
Japan	9 %

Source: R&D Scoreboard 1998, UK Department of Trade and Industry

The lower increase in investment in R&D by European companies is often blamed on the stock markets' perceived short-termism. To address that issue, we investigated 300 companies in 14 sectors listed on the London Stock Exchange based on our Market Value Added database¹.

The stock market rewards R&D seen as promising

Our results show that the stock market is far from short-sighted or naïve in its approach to R&D but rather highly selective. In certain sectors, share prices increase when companies increase R&D expenditures. In other sectors, a rise in R&D can be detrimental to share prices. The stock market evidently rewards R&D that is seen as promising and punishes under-investment. Our results identify key obstacles to creating value from R&D and how to overcome them. Finally we explore implications for performance measurement and incentives.

¹ Stern Stewart calculates annually the MVA (Market Value Added) of the top 500 UK companies. The FT200 MVA 1997 Ranking was published in the Sunday Times on 27 September 1998.



Intangibles are becoming increasingly important

The “New Economy”

The global business environment has changed dramatically over the past few years. The new environment is characterised by fast paced changes, increasing globalisation and rapid product development. To survive, companies have to learn and adapt rapidly. Outdated management models have to be overhauled or replaced. One of the most dramatic changes is that knowledge is replacing machinery in this revolution. This is most obvious when looking at the lists of top companies of the major economies. They have witnessed dramatic changes over the past few years. Many venerated traditional firms have vanished. They have been replaced by companies like Microsoft in the US and SAP in Europe, companies characterised by a high degree of innovation and based on knowledge. New companies like Amazon.com are ready to displace incumbents around the world that do not act. In the “new” economy, intangible or knowledge assets replace the physical assets of the “old” economy. New disciplines have come to the forefront like knowledge management, the art and science of turning “brainware” into software and hardware for global distribution.

Intangible investments and shareholder value creation

Growth, competitiveness and ultimately survival of companies and the wellbeing of entire populations are increasingly dependent on technology development and innovation. Investment in R&D is a major driver of innovation along with other “soft” investments in training of human capital enabling new products and services, and investments in advertising and brand capital creating the desired awareness.

As a result of this trend, we see an unprecedented growth in worldwide expenditures on R&D and concern for the competitiveness of European industry. “US ahead in high-tech sector” the Financial Times recently noted². Last year’s Department of Trade and Industry R&D scoreboard³ showed that US companies increased spending by 17% while companies from the leading European economies showed a more modest increase on average at less than half that rate. Among the major economies, Germany was leading with a 10% increase followed by Switzerland with 8 %, France with 7 %, the United Kingdom with 6% (reflecting the average), the Netherlands with 4 %, and Italy with the smallest increase among the European majors with about 3%.

The key question for management is whether investors reward companies that invest in the future by investments in intangibles like R&D, or whether investors are shortsighted. Many managers are concerned about the market’s reaction to the impact on earnings as accounting treats expenditures on such intangibles as period costs. This reduces current profit, rather than reflecting an investment into the future. That is, accounting practice misses the picture. Does the market miss the picture as well?

² Financial Times, 20 May 1999 reporting on research commissioned by the London Stock Exchange.

³ Financial Times, 25 June 1998.



Earnings down yet share price up

“Monsanto warns R&D spending may depress third-quarter net” ran the headline in the Wall Street Journal as Monsanto announced increasing its Searle R&D spending by 40%. Security analysts reduced earnings per share estimates by as much as 13%. Bob Shapiro, Chairman and CEO of Monsanto, replied “Aggressive funding is warranted to make sure that [new] products reach the market quickly”. The stock market appeared to agree. The share price rose. This suggests that R&D induced declines in accounting earnings do not necessarily tell us much about value creation in the stock market. Is this only an isolated case that only applies to the US and Wall Street, or does it reflect a more general view of investors and apply in Europe as well?

We investigated this question focusing on the relationship between expenditures on R&D and value creation for shareholders in the stock market. Our results suggest the market recognises R&D as an investment in the future when it is seen as promising.

We investigated 300 companies listed on the London Stock Exchange in 14 sectors

Focus on R&D

Data availability prompted us to focus on R&D expenditure as opposed to other soft investments such as training or advertising, and the United Kingdom as opposed to Continental Europe since the UK is the only major market in Europe with a history of systematic disclosure of R&D expenditures⁴. We investigated the question of how the stock market views R&D by analysing 300 companies in 14 industry and service sectors listed on the London Stock Exchange. We looked at the relationship between increases in companies’ expenditures on R&D and Market Value Added (MVA) as a measure of shareholder value creation⁵. If the market views R&D as a cost, we should expect a decline in Market Value Added as R&D increases, while viewing it as investment in the future should yield the opposite result.

The stock market is highly selective in evaluating R&D

Overview of Results

Our results show that the market, far from being naïve or indiscriminate, is highly selective in its approach to R&D. In certain sectors, share prices increase when R&D is increased - in other sectors a rise in R&D can be detrimental to share prices. There are industry groups where R&D helps to create shareholder value, industries where R&D has a neutral to negative impact and industries where R&D can be harmful to share values (Exhibit 1).

⁴ In addition the UK is close to the overall average among European nations in terms of increases in R&D

⁵ Market Value Added (MVA) is the difference between total market value (MV) of both equity and debt less total capital i.e. $MVA = MV - \text{Capital}$. Capital is the amount of money that investors initially put into the firm. MVA takes into account dividends paid and is automatically risk adjusted as the stock market value of a company incorporates investor views about performance as well as risk. It is the external measure of management performance and captures the market’s view of the effectiveness with which managers have used the capital under their control. MVA also reflects the market’s view of how well the company is positioned for the long-term.



Exhibit 1: Changes in Market Value Added vs. Changes in R&D

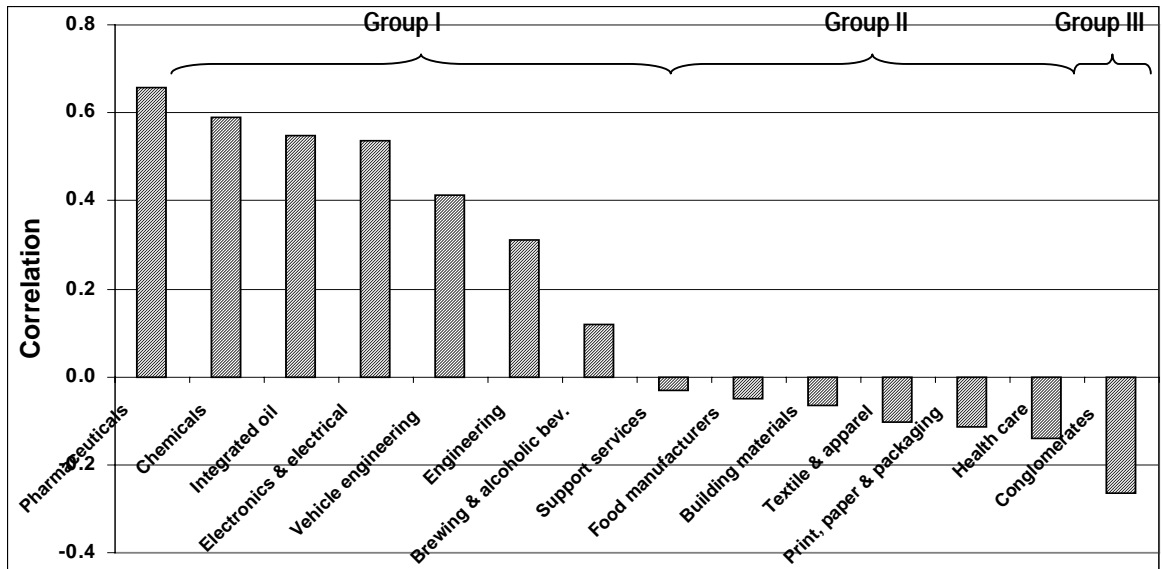


Exhibit 1 shows the correlation between changes in R&D and changes in MVA for 14 industrial and service sectors listed on the London Stock Exchange (LSE). It highlights the strong differences in the markets response to R&D between the different industry sectors. The positive correlation between changes in R&D and MVA is strongest for Pharmaceuticals. The negative correlation between increase in R&D and MVA is strongest for Conglomerates.

As a rule, the market appears to reward increases in R&D in industries labelled as Group I in Exhibit 1. In the sectors labelled Group II the market appears to take more of a case by case view. Some companies increase in value after an increase in R&D while others decline. Conglomerates in all observed cases destroyed value when increasing R&D. We will first discuss the results in more detail before proceeding to show what it means for performance measurement and incentives.

Where R&D helps the share price

The first group of industries comprises pharmaceuticals, biotechnology, chemicals, integrated oil companies, electronics & electrical engineering, vehicle engineering, engineering and brewing & alcoholic beverages. Increasing R&D investments in these sectors lead to higher market values. The market clearly sees long term value and bids up share prices in anticipation of future results. All of these industries have one characteristic in common: they are generally regarded as medium to high tech industries with the exception of brewing & alcoholic beverages. But then brewing and alcohol production is based on one of the oldest biotech

In High Tech sectors the stock market rewards increases in R&D



processes: fermentation. The important characteristic is they have a track record of being able to create a defensible competitive advantage.

Impact of R&D on MVA

The stock market evidently has strong *ex ante* expectation of positive benefits from increases in R&D expenditures for companies in Group I industry sectors. The market appears to be driven by expectations about those firms' R&D pipeline.

R&D drives Market/Book and P/E multiples

What does this mean for traditional "multiples" like Market/Book and Price/Earnings (P/E) ratio? An increase in MVA also implies an increase in Market/Book ratio and P/E ratio as the market value increase all else being equal. For Group I industries this translates into higher Market/Book and P/E multiples as R&D increases. Conversely in type II, and especially conglomerates, an increase in R&D tends to drive down Market/Book and P/E multiples.

Our results are not unique to the UK

Are these results unique to the UK? Numerous researchers outside the UK have found strong relationships between R & D expenditures of firms and their subsequent earnings and stock market performance⁶. Chan, Martin, & Kensinger (1990,1992), and Pinches, Narayanan, & Kelm (1996) find in particular that the US stock market rewards firms that announce major R&D investments upon announcement. That is the stock market recognises R&D as an investment, even if accounting convention does not. These findings corroborate our own results that the stock market is not inherently short-term oriented. The market tends to reward increases in R&D where seen as creating value and punishes under-investment in R&D by reducing MVA and the share price.

Both Current performance and R&D impact on MVA

So far we focused only on the relation between increases in R&D and value creation. What about the influence of current performance on the result? To investigate this, we looked at the relationship between the impact R&D has on MVA and current performance measured by increases in EVA (Economic Value Added). EVA, a measure of economic profit, is simply the net operating profit after tax less a charge for the capital invested in the business⁷.

We split the group of High Tech firms (Group I excluding alcoholic beverages) into three sections: firms with high levels of EVA improvement, those with medium, and those with low levels. Intuitively, one would expect that higher current performance would lead the market to attach a higher value to R&D investments, as these companies are more likely to deliver the resulting products more efficiently. This intuition is borne out by the data.

⁶ Examples include Baruch Lev & Theodore Sougiannis (1993), Bronwyn Hall (1994), Su Chan, John Martin, & John Kensinger (1990,1992), and George Pinches, V.K. Narayanan, & Kathryn Kelm (1996).

⁷ In formulae: $EVA = NOPAT - C \times \text{Capital}$. In an industrial corporation NOPAT is the Net Operating Profit After Tax, C is the (weighted average) cost of capital, Capital is the net investment of debt and equity holders. In financial activities NOPAT includes interest income and expenses, Capital is the net investment of equity holders, and C is the cost of equity capital.



Exhibit 2: High current performance enhances the impact of R&D on MVA and share prices in Group I industries

	<u>Slope</u>
High EVA Improvement	+ 1.26
Medium EVA Improvement	+ 1.11
Low EVA Improvement	+ 0.51

Source: Stern Stewart Research

Exhibit 2 summarises the results. The higher the current economic performance as measured by EVA improvement, the higher the positive impact (slope) of increases in R&D on MVA and share prices and vice versa. In these industries the impact of higher R&D on MVA is still positive even if current efficiency as measured by EVA is low. The market may assume that if operating efficiency problems persist, but if the R&D pipeline is good the company in question will possibly be taken over to unlock this value.

Where R&D is neutral or potentially damaging to share prices

The second group is characterised by a weak and in general negative relationship between changes in R&D and changes in market value creation. Here increases in R&D expenditures are on average associated with declines in share prices and MVA (Market Value Added). This includes sectors such as support services, food manufacturing, building materials, print, paper & packaging and health care (not including pharmaceuticals). Group II type industries are traditionally regarded as medium to low tech industries. The market does not expect that more R&D will translate into a sustainable competitive advantage in these industries.

In terms of traditional multiples this means that on average an increase in R&D will lead to a decline in the Price/Earnings and Market / Book Ratio. Our results do not necessarily say that R&D is regarded as unimportant in these sectors, but rather suggests that the stock market appears to value R&D expenditures by firms in these industries more on a case by case basis. Many individual firms do show an increase in value as R&D increases and vice versa.

EVA improvement and R&D Impact on MVA

What about the influence of current performance on the result in group II? To investigate this question we conducted the same test against EVA performance as we did for group I.

In Medium to Low-Tech sectors the market adopts a case by case view



Exhibit 3: High current EVA performance reduces the negative impact of R&D on MVA and share price in group II sectors

	<u>Slope</u>
High EVA Improvement	- 0.546
Medium EVA Improvement	- 0.763
Low EVA Improvement	- 1.047

Source: Stern Stewart Research

Exhibit 3 summarises the results. On average, the higher the current economic performance, the smaller the negative impact of increases in R&D on MVA (Market Value Added) and share prices, and vice versa. Unlike in high tech industries (see Exhibit 2) the MVA impact is still negative on average even if EVA shows high levels of improvement. In this segment, the market appears to prefer that firms focus on current efficiency before thinking about investing into the future.

Conglomerates

Group III is the Conglomerates. This group shows a distinctive overall negative relationship between market value creation and R&D. Increases in R&D are associated with a decline in value. For Group III sector companies the market evidently has a strong negative up front expectation about the potential value creation of R&D expenditures. Here we found no increase in MVA for any company increasing R&D. A solution for conglomerates appears to be either break-up or spin-off of high tech businesses or stronger emphasis in measurement and reward systems on accountability for investments.

The market treats Conglomerates with suspicion: Increases in R&D tend to lead to lower share prices

Putting it into practice

What does this mean for business and what has to be done differently? The implications for accounting and performance measurement, and for rewards and motivation, are counter-intuitive for most “EPS-watchers”. We capture this in our EVA management framework.

Accounting & Performance Measurement

One problem for investors and managers alike is the accounting treatment of R&D. Companies write off R&D each year in line with generally accepted accounting principles. This reduces taxable profits, which conserves cash and creates value. Yet there is a performance measurement argument in favour of recognising R&D expenditures as investment in the future. Just like investments in physical assets, the EVA approach capitalises R&D expenditures and amortises them over time.

There are several behavioural benefits to this approach. The incentive to reduce R&D investments in order to improve short-term earnings is reduced as only a fraction of the reduction in R&D would impact current



period earnings. Managers are encouraged to embark on all desirable investments without facing the deterrent of a full earnings charge up front. On the other hand, accountability is enhanced as managers have to earn a return that covers both capital charge and amortisation resulting from the R&D investment. This encourages managers to make only those investments that they believe will pay off adequately in the future. No longer can they spend money and forget about it in the future.

The appropriate time horizon for the amortisation of R&D is technology or industry specific. It depends on the time period over which benefits are expected. This in turn can depend on the speed of technological progress in a particular industry, the ease of imitation, and the degree to which a technology requires cumulative learning. That is, a company has to participate successfully in the development of the current generation product in order to be able to develop the next generation and so on. In practice the optimal amortisation period can be determined by empirical analysis of sector companies to test different amortisation periods in the calculation of EVA. It is the period that gives the best correlation between EVA and share price. This is the investor view, and managers are often surprised to find the investor view is often longer than their own.

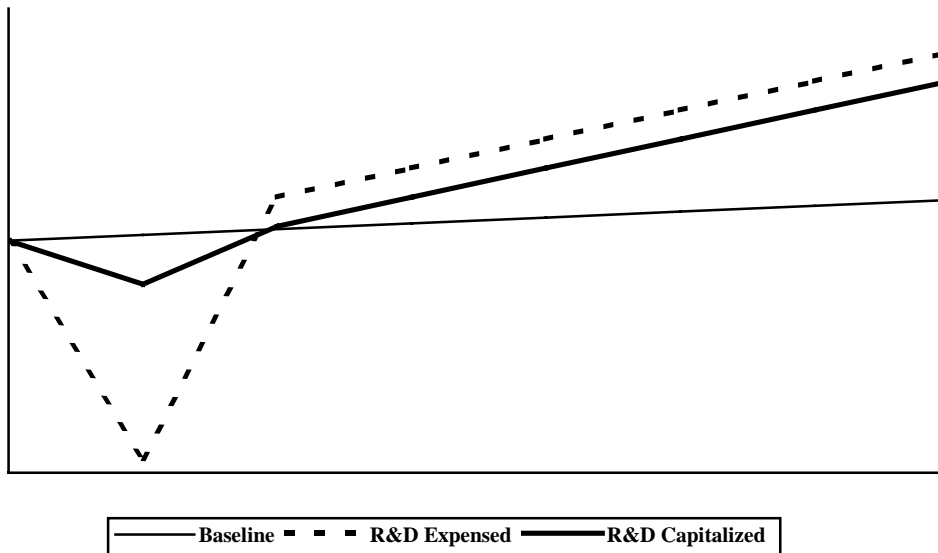
Capitalised R&D is based on “full cost” accounting rather than “successful efforts” accounting. Unsuccessful trials are part of the investment in the search for successful solutions. This approach ensures that managers are held accountable for the full investment made to achieve success. Given our findings, capitalising R&D expenditures for management reporting and incentives to reflect true investment levels appears to be most justified in sectors belonging to Group I industries while requiring a more careful case by case approach in the remaining sectors.

This approach is briefly illustrated here. The graph in Exhibit 4 illustrates the performance of an investment in R&D with and without this adjustment. The curve represented by “Baseline” is the expected future performance of a business with no R&D spending. The “R&D Expensed” curve is the expected performance of the business after a significant R&D investment is made and expensed in the period spent. In the early periods, the performance is much worse than Baseline, and in later periods is much better than Baseline. Why? Because the total cost of the investment has already been charged and the later period performance realises the benefits of the R&D investment without any charge for it. The “R&D Capitalised” curve shows improved performance that is much more stable, and spreads the cost of the investment with the term over which the benefits are realised, showing why this adjustment is necessary to properly measure sustainable contributions to value creation through periods of significant investment.

In addition, the initial impact of the R&D investment is much smaller, encouraging managers to sustain investment in value-enhancing projects even when operating profits are under pressure.



Exhibit 4: Capitalised R&D Better Indicates Sustainable Value Creation



To better understand the R&D capitalisation process, consider the example in Exhibit 5, of a unit that spends \$7 million in every year for several years and amortises each year's spending over a 7-year term. In the first year, 1/7 of the spending — \$1 million — is amortised, with the remaining amount capitalised, in this case \$6 million. The following year another \$7 million is spent, with \$6 million being capitalised; however, the Change in Capitalised R&D line indicates that the increase was only \$5 million. What happened? The capitalised amount from year 1 also amortised another \$1 million. This dynamic continues, with each year of additional spending yielding a decreasing Change in Capitalised R&D until the seventh year, when equilibrium is reached. At equilibrium, or *steady state*, there is no Change in Capitalised R&D as long as spending is constant at \$7 million per year.

Many people challenge, if we are at steady state, the amortisation will equal the expense and the EVA improvements are flat. However, we believe the spending is stable only because it is charged to earnings and managers like smooth short-term earnings. It is unlikely that the number of R&D investment opportunities is precisely flat. More likely, managers overspend when opportunities are sparse and underspend when they are plentiful.



Exhibit 5: R&D Capitalisation Illustration

<u>Years</u>	<u>R&D Exp</u>	<u>12/Y1</u>	<u>12/Y2</u>	<u>12/Y3</u>	<u>12/Y4</u>	<u>12/Y5</u>	<u>12/Y6</u>	<u>12/Y7</u>	<u>12/Y8</u>
7	Total	\$7.0	\$7.0	\$7.0	\$7.0	\$7.0	\$7.0	\$7.0	\$7.0
	Capitalized @ 14%	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
	12/Y1	1.0	1.0	1.0	1.0	1.0	1.0	1.0	
	12/Y2		1.0	1.0	1.0	1.0	1.0	1.0	1.0
	12/Y3			1.0	1.0	1.0	1.0	1.0	1.0
	12/Y4				1.0	1.0	1.0	1.0	1.0
	12/Y5					1.0	1.0	1.0	1.0
	12/Y6						1.0	1.0	1.0
	12/Y7							1.0	1.0
	12/Y8								1.0
	12/Y9								
	Annual Amort of Current and Capitalized R&D	1.0	2.0	3.0	4.0	5.0	6.0	7.0	7.0
	Cumulative R&D Exp	7	14	21	28	35	42	49	56
	Cumulative Amortization	<u>1</u>	<u>3</u>	<u>6</u>	<u>10</u>	<u>15</u>	<u>21</u>	<u>28</u>	<u>35</u>
	Capitalized R&D	6.0	11.0	15.0	18.0	20.0	21.0	21.0	21.0
	Change in Capitalized R&D		5.0	4.0	3.0	2.0	1.0	0.0	0.0

Incentives

Billions of dollars in future value were lost by AT&T shareholders when a number of key personnel left to form Intel. Start ups like Intel often result from companies losing top scientists, engineers, and other innovators due to perceived R&D approval “red tape” and a lack of opportunity.

What is needed is an incentive approach that allows senior executives to de-centralise decision making along with accountability by aligning the interests of employees and shareholders. If the value of the business goes up, the managers earn rewards, if not they don't. This minimises the need for regulations and perceived “interference” from the top as managers will share the loss if they make poor decisions while simultaneously providing upside potential to encourage innovation.

With such an approach investors can draw comfort from the fact that managers are held fully accountable by putting their own money at risk. This is particularly important in industries that belong to groups II and III in Exhibit 1. Here the stock market makes a case by case decision about the benefits of R&D. Nothing will convince investors more than managers and the people who know best, senior scientists, engineers and other experts effectively putting their own money behind their decisions.



**Accounting reflects
yesterday's economy**

Making it work

Current accounting practice discourages expenditure on R&D, know-how creation and other soft investment. It encourages investment in physical plant and machinery the hallmarks of yesterday's economy while holding back the "new economy". Companies end up with too much equipment, and too little knowledge jeopardising long-term competitiveness, growth and job creation.

What should companies do? Ensuring that the right performance measures are used and giving managers the right incentives are important to engender the right behaviour and earns credibility with the market place. To start with companies especially in high tech industries should resist the urge to cut R&D when short-term earnings are under pressure.

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