

***IPTS WORKING PAPER on
CORPORATE R&D AND INNOVATION - No. 12/2009***

**The global economic and financial downturn:
What does it imply for firms' R&D strategies?**

Peter Voigt and Pietro Moncada-Paternò-Castello



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¹ IRMA activities correspond to the implementation of the approach set out in "Investing in research: an action plan for Europe" (COM, 2003) and in further Communications of the Commission: "More Research and Innovation – Investing for Growth and Employment – A common approach", COM (2005) 488 final, "Implementing the Community Lisbon Programme: A policy framework to strengthen EU manufacturing – Towards a more integrated approach for industrial policy", COM (2005) 474 final.

Abstract

R&D as well as the entire innovation process are likely to be affected by the current crisis. Apart from changes in R&D spending, as any crisis usually provides also chances it may stimulate a new wave of networked / open innovation and in this regard lead to 'creative destruction' as Schumpeter called it. Thus, high-technology manufacturing is far better-positioned to face the crisis compared to low-tech manufacturing, which is assumed to fare especially badly. The figures of R&D expenditure are assumed to evolve accordingly. And small companies and particularly those which are financially restricted (many SMEs) are supposed to suffer most.

In general, the downturn is supposed to accelerate the shift of EU manufacturing towards higher value-added, highly integrated, and internationally oriented sectors. Assumed that the latter tends to be characterized by higher R&D-intensity this in turn may have a positive impact on R&D investment figures. But, as structural changes usually happen slowly, this leverage effect may appear just in the long-run.

Empirical evidence from a series of recent business surveys (mainly capturing R&D-performing / higher R&D-intensity sectors) suggests that the perception as well as the funding of corporate R&D and innovation activities are holding up fairly well so far which suggests an anti-cyclic firm behaviour in terms of R&D engagement in the light of the current economic and financial crisis. For 2008/09 the estimates of R&D expenditure changes differ significantly among the sources – mainly due to the corresponding assumption on the further evolvement of the current financial and economic crisis with the estimate of 4.1% for EU – based on the JRC-IPTS' IRMA-Survey – well in-between. However, across the sources, the corridor for the R&D investment change is assumed to be above the corresponding assumptions on GDP and sales growth.

Evidence suggests that the impact of the crisis on R&D activities and the correspondingly assumed adjustments of firm strategies is sector specific. However, looking at micro level, there is no unique company strategy obvious commonly applied to face the crisis. In fact, some companies leave their R&D engagements unchanged, others cut them down, and a third group even accelerates their R&D and innovation activities (inclusive a significant leveraging of spending on R&D). In this regard experiences from past downturns suggest that companies having the farsightedness and the courage to invest more in R&D and innovation activities while others are cutting back have a significant advantage in the inevitable upswing that will come. Market rewards will follow – but not immediately.

JEL Classification: O33

Keywords: corporate strategy, R&D and innovation, R&D spending, economic crisis

1 Introduction

As the global economy is currently facing the most significant economic and financial downturn of the post war history it seems to be indicated complementing the analyses of private top R&D investors with a section dedicated to consider possible effects of this crisis. Thus, in contrast to data stemming from annual reports, hereinafter we need to rely on information from company announcements, business newsletters and recent surveys.² Accordingly, the results will differ compared to the other parts of this report. We will develop hypotheses and deliberate arguments as the available empirical evidence is (still) widely too scattered for providing an overarching image.

The core focus of this paper will be on adjustments of firms' R&D strategies in the light of the economic turmoil rather than on elaborating a forecast of aggregated R&D investment figures (for the latter see: IRMA-survey). We will discuss how the crisis may affect corporate R&D activities in general, how companies have already decided to or may adjust their R&D strategies in the near future, and how the policy response to the global economic and financial downturn could change the R&D landscape.

2 How does an economic crisis affect corporate R&D? A short literature review

The current crisis is challenging companies belonging to any sector and around the globe. Rising economic pressure commonly translates into cost reduction strategies and thus companies tend to rethink also their engagement in R&D.³ Hence, the shortage in finance may cause a short-term drop in R&D, referring mainly to a delayed launch of new R&D projects; some scheduled projects may finally turn out to be realized 'slimmer' while others may even be given up entirely simply because the company cannot afford investing in R&D.

In turn, such an ad hoc drop in the R&D spending may affect the effectiveness of R&D activities also in the mid-run since innovation systems, technological clusters, university-industry links, etc. might be sustainably damaged ('financially dried out').

And any rethinking of R&D strategies may also imply a final re-orientation and thus may have a long-term effect too not only in terms of technological development but also for the whole business; for instance in concentrating corporate R&D activities on fewer – core – business areas, emerging technological sectors and markets only. The latter may lower sustainably accumulated R&D budgets, but it may also intensify individual R&D efforts.

With regard to past crises, the International Monetary Fund [IMF] pointed out that recessions which are accompanied by financial crises tend to be “two to three times as deep and two to four times as long” as those that are not. They also lead to “negative growth of 4.5 % of GDP”.⁴ This may suggest that the spending on R&D eventually will be affected by similar rates

² As the dimension of the current crisis seems to be unique in economic history (global & simultaneous), making reference to academic sources and evidences from past crises trajectories has to done cautious.

³ For a company's view on 'R&D in a downturn' see e.g. Barrett et al (McKinsey Quarterly: 02/2009).

⁴ [Financial Times Reports](#) (25.11.2008), authors: David Rhodes and Daniel Stelter.

and persist as long too. In fact, evidence from past crises demonstrates that R&D is almost always suffering from recession periods.⁵ However, according to the economic literature, the impact of an economic downturn on the dynamics of R&D investments appears to be controversial.

Traditionally, one would view corporate R&D investments as evolving in an anti-cyclical way as the negative impact of a recession on profitability forces firms to focus on the most productive segments. Thus, the opportunity costs of achieving productivity growth are lower in recessions, providing incentives to undertake research activities in downturns (Aghion and Saint-Paul, 1998; Canton and Uhlig 1999). Moreover, R&D-personnel will be subject to "labor hoarding". Hence, the most qualified scientists and engineers will be kept at the expense of lower skilled personnel.⁶

However, with respect to innovation, the cyclical view appears the most common. In fact, innovation and/or the implementation of new ideas tend to be postponed in a recession until the next upswing (Shleifer, 1986 and Francois and Lloyd-Ellis, 2003). Thus, the so-called innovation acceleration hypothesis of Gerhard Mensch (1975) whereby radical innovation would be favored in depressions out of despair remains subject to debate (Clark, Freeman and Soete, 1981).

In general, the share of long-term investment in total investment should be countercyclical, whereas the share of short-term investment is assumed to be pro-cyclical.⁷ Thus it is implicitly assumed that firms can borrow sufficient funds to innovate. But exactly this is getting more difficult in the current downturn, which first of all is due to a financial crisis.⁸ In fact, even fast growing companies operating in emerging markets may now have limited access to finance. In this regard, Aghion et al. (2005, 2008) analyzed the role of credit constraints on R&D investments and thus emphasized that the latter tends to be more pro-cyclical in firms facing tighter constraints in terms of capital supply (many SMEs). In particular, (i) the share of R&D investment over total investment appears to be countercyclical without credit constraints, (ii) it becomes more pro-cyclical as firms face tighter credit constraints and (iii) this effect is only observed during downturns: namely, in presence of financial constraints. In other words: R&D investment share plummets during recessions, but it does not increase proportionally during upturns. Further (iv) the level of R&D investment is lower in more credit constrained firms regardless of the firm's position within the business cycle - but it decreases more during recessions.

⁵ According to OECD figures, spending on R&D and innovation is often one of the first investments to be cut in a recession. BERD across industrialised countries was scaled back in the recession of 1990s, falling as a proportion of GDP from 1990 to 1995. See: Lord Sainsbury (2007) 'The race to the Top: A review of the government's science and innovation policies'. London: HM Treasury, Chart 2.1.

⁶ Luc Soete (UNU-MERIT, NL): "Challenges for making European research an engine of competitiveness", presented at VINNOVA workshop on "How can a future ERA support and stimulate research, innovation, and sustainable economic growth in Europe? Berlin, March 17th, 2009.

⁷ Stephan (2004): Pro-cyclical investment suggested by aggregate figures (mainly driven by large scale companies). But the author also found that R&D expenditure of SMEs is sometimes even anti-cyclical due to the fact that e.g. engineers in times of low capacity utilization devote more time to product improvements instead of extending the production capacity as they do in times of high capacity utilization.

⁸ If firms can choose between short-run capital investment and long-term R&D investment, innovating requires that to cover liquidity costs firms can rely only on their short-run earnings plus borrowing. Whenever the firm is hit by an adverse (idiosyncratic or aggregate) shock, its current earnings are reduced, and therefore so is the firms' ability to borrow in order to innovate / conduct R&D. Shortening of capital supply in the light of the current financial crisis further tightens companies' credit lines.

Hence, shortage in capital supply due to the financial crisis and the following credit constraints, by preventing the R&D share from being countercyclical, may amplify the business cycle, increase productivity growth volatility and decrease average productivity growth. Accordingly, the crisis is adding to an anyway important risk of facing financial constraints for innovative and R&D performing firms. Accordingly we may expect significant R&D investment cuts across sectors and countries.

But, recessions do not affect companies and sectors *erga omnes*. Instead, e.g. high-technology manufacturing is far better-positioned compared to low-technology manufacturing which is assumed to fare especially badly.⁹ In this regard, Stephan (2004) stressed that high-tech firms usually adjust their R&D expenditures less to the business cycle in contrast to low- and medium techs. This might explain why R&D expenditures in fact are less cyclical compared to those of tangible investment or sales. Hence, we also may assume smooth R&D expenditure figures in the face of the current crisis.

However, a more or less significant contraction of R&D activities in the light of the economic downturn is only one way the crisis may affect R&D activities. Indeed, there is evidence that investing in R&D is increasingly seen as risk taking, and will not be for the timid.¹⁰ Hence, the perception of R&D may change and, assumed a slowdown of R&D activities, the appearance of new technologies, products and services including new medicines could be (at least) delayed. And there is also reason to believe that the crisis may affect the off-shoring of business R&D, eventually leading to an (increasing of) on-shoring, triggered by companies from China, India, etc. which are stepping into the gap western companies may provide by cutting back their R&D and innovation activities.¹¹

Further, the pressure companies are exposed to due to the crisis may turn their attention on business innovations rather than on technological innovations. Thus, the downturn tends to reward firms who can find more effective ways to innovate, that are more agile, incremental, customer-focussed and however open and capable to adjust their business (and R&D) strategies. With less investment in big R&D projects there will be a premium on smaller but effective solutions to 'real-world problems', which in turn can have a large cumulative impact on productivity and quality. This likely will reward firms dedicated to quality, which are close to their customers and with strong cultures of learning.

And, as the global economic crisis deepens, some knowledge based companies may revoke or reduce campus offers.¹² By that means, the financial crisis may also snowball into the higher education sector, universities, public research infrastructures, etc. and affects the market for highly skilled labor.

In general, the recession tends to deepen further the shortages the EU has in terms of 1) R&D spending, 2) higher education, and 3) access to finance, particularly what concerns young/small firms.¹³ And, with the financial and economic crisis, a social crisis is likely to emerge too.

⁹ See: NESTA (2008), p. 13

¹⁰ EurActive.com (28/10/2008)

¹¹ Wolf Gehrisch (deputy secretary general of the European Industrial Research Management Association; EIRMA) in *Research Europe*, 11/12/2008.

¹² Poornima Mohandas; In: [The Wall Street Journal](http://TheWallStreetJournal.com), (12/11/2008).

¹³ European Commission (2008): The Effects of the Financial Crisis on European Research Policy.

3 Corporate R&D investments in the light of the crisis: The aggregate view

When considering the impact of an adverse shock (like the current crisis) on corporate R&D activities a certain time lag between changes in the business cycle and the R&D expenditures needs to be assumed. This is mainly due to the R&D budget planning horizon (usually a minimum of one year). Therefore, it will take some time until the full impact of the crisis on the R&D spending can be observed (eventually until the annual reports for the business years 2008/09 will be issued).

However, the ongoing adjustments can be anticipated by means of dedicated business surveys. In this section evidence from a series of recent company surveys is presented and summarized in order to capture general trends. Further below, the biotech (3.1) and energy sector (3.2) are considered exemplary. Finally, in section 4, individual evidence from company announcements will be discussed.

How are corporate R&D and innovative activities affected by the crisis? Do we see, in aggregated terms, either pro- or rather anti-cyclic trend patterns; i.e. is there evidence of significant R&D investment cuts due to the crisis, a zero-growth or even an increase?

The answer may appear to be surprising: The climate and funding of R&D and innovation activities are holding up fairly well so far which suggests an anti-cyclic firm behavior in the light of the current crisis.

For instance, according to a *Dallas Business Journal* survey comprising 73 technologically leading companies in the US (10/2008), there is one part of corporate budgeting that appears to remain priority: namely R&D. For 2009, overall, an 8% increase in R&D spending is predicted, for the top 10 delineated by R&D even a 10.7% rise.¹⁴ More recently (03/2009), this image was supported by the 13th BusinessWeek annual ranking (BW 50): Accordingly, innovation is still alive and well (among the largest US companies).

Similar figures are presented by the UNCTAD's *World Investment Prospects Survey 2008-2010* with respect to Foreign Direct Investments [FDI]. Accordingly, the majority of respondent companies still plan to increase their international investment expenditures, albeit at a more moderate level, over the next three years. This is largely due to an underlying and persistent trend towards expanding the share of multinational corporations [MNC] production, employment, and sales abroad. This trend towards internationalization will affect all corporate functions, including R&D and decision-making centers, which so far have tended to remain in MNCs' home countries.¹⁵

Further, according to a *DLA Piper* survey (Oct 2008), two-thirds of the respondent senior technology industry executives said the economic slowdown will not hurt them as badly as the bursting of the tech bubble in 2000. Only 27% said they were cutting sales and marketing expenditures, and only 15% said they were reducing planned R&D spending. The executives were surveyed between Sept 23rd and Oct 6th 2008. Thus, a particularly bright spot appeared from renewable energy, which saw investment surge 71% from the second quarter 2008 to a record of \$1.08 billion.¹⁶

¹⁴ [Dallas Business Journal](#) (27/10/2008)

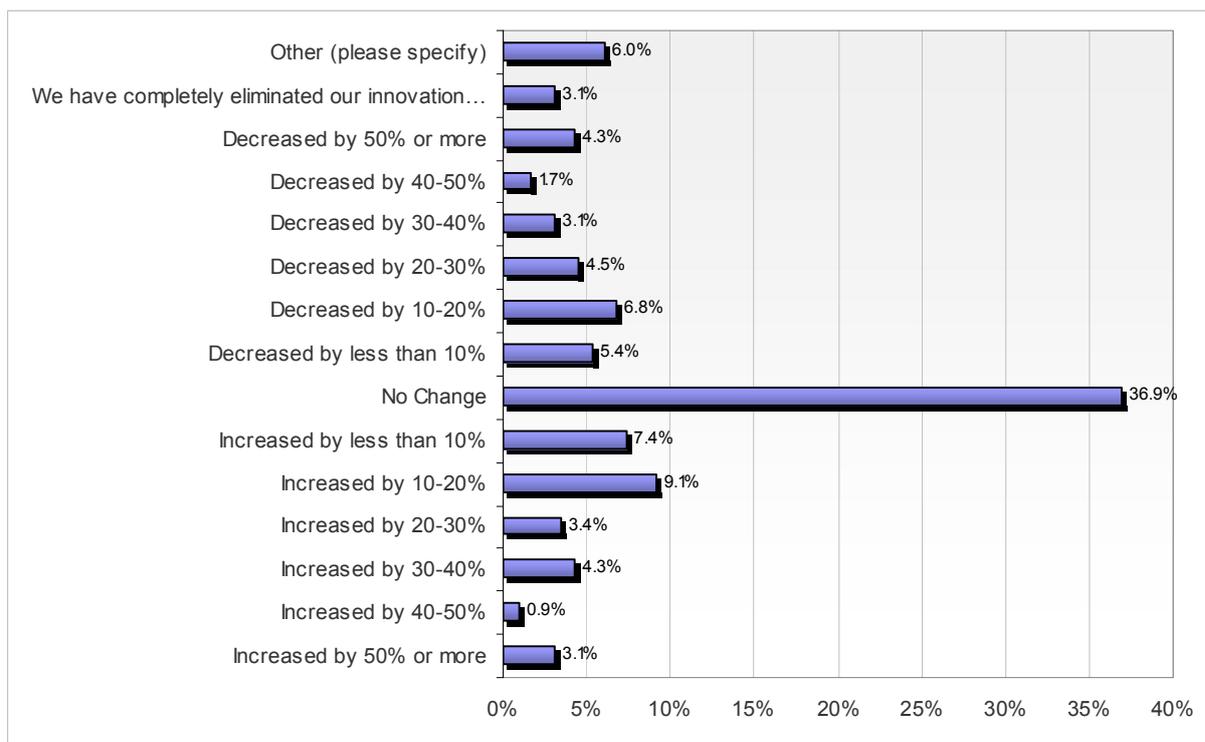
¹⁵ [UNCTAD](#) (2008)

¹⁶ [Reuters](#) (20/10/2008)

According to a business survey conducted by *PriceWaterhouseCoopers* in Finland (01/2009), comprising answers from about 100 companies selected since either being large in sales, top in R&D investing or an innovative SME, spending on R&D is widely assumed to remain unchanged in aggregated figures. Accordingly, even the specifically high R&D intensity in Finland (BERD/GDP ratio of 3.5%) is assumed to be affected by the current crisis only to a limited extent (eventually may drop by about 0.1%).¹⁷

Finally, by means of a very recent *Innovationtools* survey (03/2009) overall 352 respondents were asked to quantify the changes in their organization's innovation climate and funding since the global recession hit, and about the specific strategies they are utilizing to keep R&D and innovation alive in their firms.¹⁸ Thus, over one-fourth of respondents (27%) said that the climate for innovation has "improved slightly" since the onset of the global recession, while another 20% said it has "improved significantly". Another 26.7% said there has been "no change" in the climate for R&D and innovation in their companies and only 17.9% stated that it got "slightly worse" and 8.0% it got "significantly worse", respectively. This suggests companies are aware of an even rising importance of R&D and innovation activities in order to thrive through the downturn. Further, also the funding for R&D and innovation activities appears to be holding steady, at least at the time the survey was conducted. Over one-third of respondents (37%) reported that there has been "no change" to their organization's level of funding for R&D and innovation. However, a similar percentage share of companies has indicated having reduced (28.9%) and having increased (28.2%) their spending on R&D and innovation activities (see Figure 1 below). This suggests there is no common strategy across firms and sectors to face the crisis (to be further discussed in the following section).

Graph 1: Adjustments of funding for R&D and innovation initiatives since the economic downturn started (survey results; 03/2009)



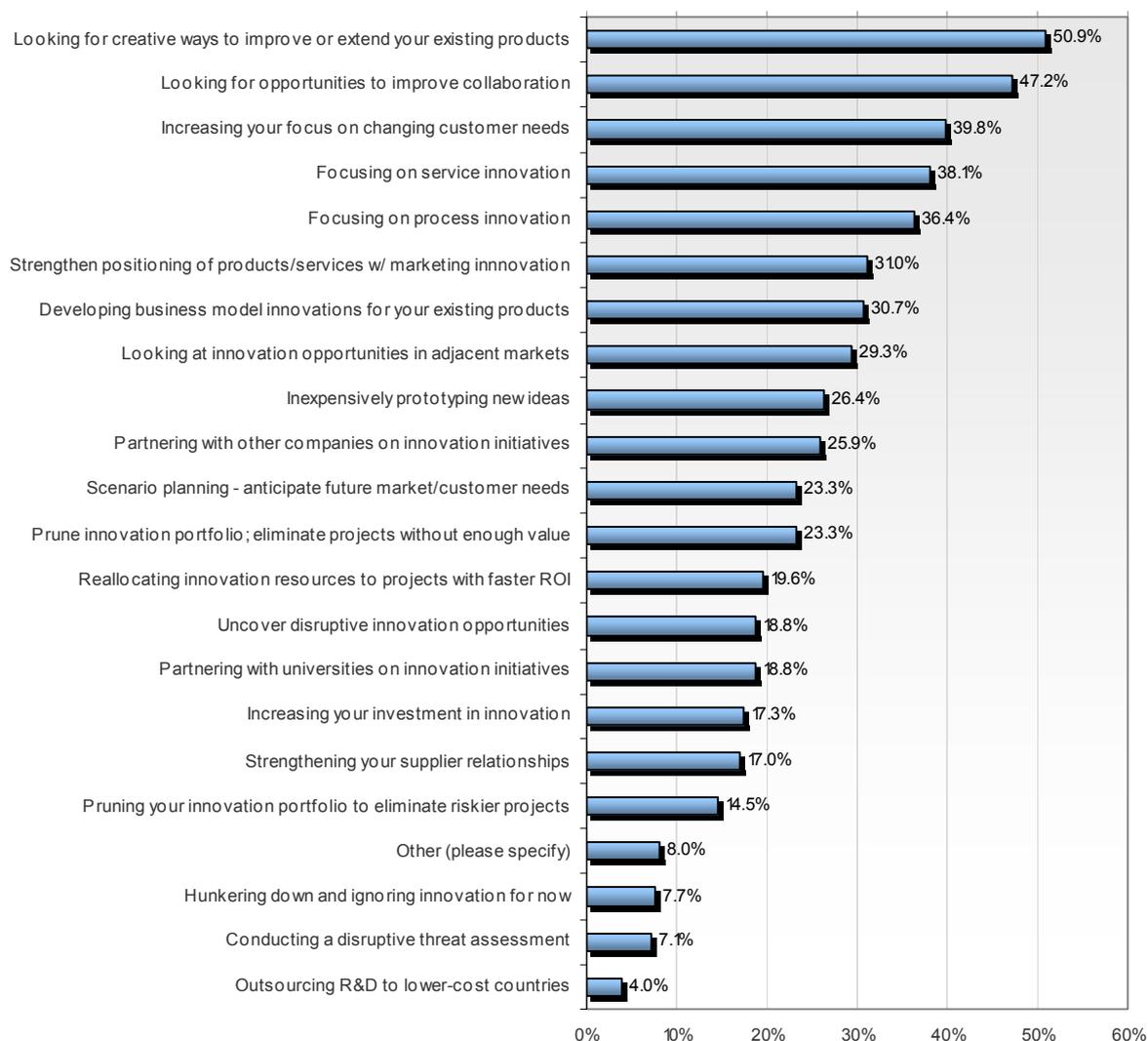
Source: Innovation Climate Survey, InnovationTools (2009), p.3; www.Innovationtools.com

¹⁷ See PriceWaterhouseCoopers Oy (2009): Innovating through the downturn.

¹⁸ See <http://www.innovationtools.com/reports/MS94N6/download.asp>

Similar to the figures of the *InnovationTools* survey (focus on US firms in particular) are the results of the European Commission's *Innobarometer 2009*, recently released by the Gallup Organization. With respect to their innovative activities in 2009 compared to previous years, 28% of the surveyed companies assume shrinking and 12% rising budgets, but the majority of 51% expect to maintain their spending. Thus, a 'negative turnaround' (i.e. spending forecasted to decrease, despite a rise between 2006 - 2008) was most often seen in the low-tech /medium-low-tech manufacturing sector (14%), in the largest enterprise segment (13%) and in countries classified as "catching-up" (13%) by the 2008 European Innovation Scoreboard (EIS) classification. Forward-looking attitude (i.e. rising spending in times of a crisis) was particularly characteristic of high-tech manufacturing firms (13%). But this segment was also – however marginally – the most likely to have cut their innovation budgets (24%); supposed to be due to problems related to sufficient access to finance and thus pointing to the high share of SMEs in this group of companies. Graph 2 below illustrates a number of company strategies to face the current crisis (according to the *InnovationTools* survey).

Graph 2: Corporate strategies in order to face the crisis (envisaged innovation activities as reported by the *InnovationTools* survey respondents; multiple answers possible).



Source: Innovation Climate Survey, InnovationTools (2009), p.5; www.Innovationtools.com

Accordingly, the top strategy, employed by about half of the survey respondents (50.9%), is to look for creative ways to improve or extend their existing products – in other words, incremental innovation. Breakthrough innovation and disruptive innovation are pushed too, but to a lesser extent. In fact, focusing on incremental innovation in times of a downturn might be a very wise course as risks and investments associated are usually lower than for disruptive innovations, and they can leave a company better positioned for the next upturn – provided that those new models and line extensions are aligned with the evolving needs of their customers – the No.3 response to this question, at 39.8%.

Another major area of focus cited by the survey respondents was improving collaboration (47.2%), the No.2 response to this question. Collaboration technologies are plentiful today and affordable for companies of nearly any size. In addition, organizations are exploring ways to work more effectively with firms “upstream” (suppliers) and “downstream” (dealers, retailers, etc.) to increase the efficiency and value of their collaborative relationships.

Interestingly, outsourcing of R&D to lower-cost countries apparently is seen by the respondents as a less promising strategy for maneuvering through the crisis. Overall, the most frequently ticked strategy options commonly put emphasis on internal workflows. Accordingly, companies see an ample potential for challenging the current crisis in re-structuring and re-focusing their own activities.

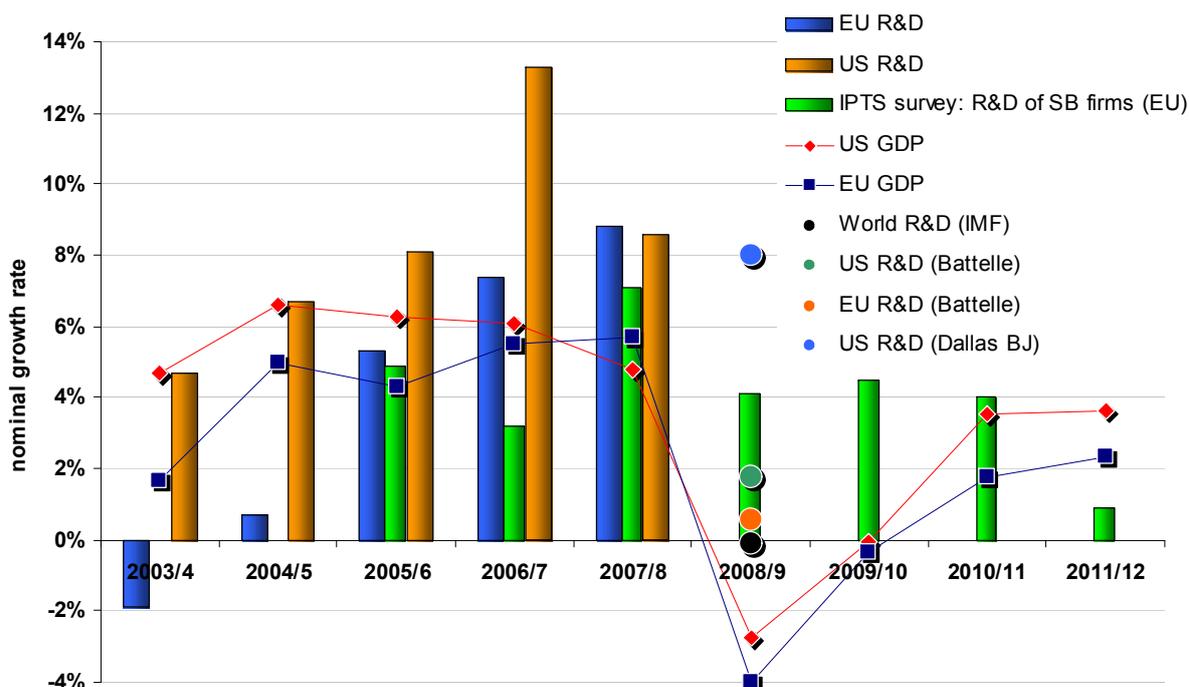
In general, the empirical evidence from the surveys mentioned above are in line with our own survey on the expectations on future R&D spending comprising 130 top EU R&D investing companies (all respondents are listed in the EU R&D Investment Scoreboard). Accordingly, R&D spending is expected to increase, although rising slower as during recent years. In Graph 3 below we are merging the available forecasts, estimations and survey results and thus depict graphically several possible scenarios; the worst case expectation (flat R&D spending worldwide; acc. to IMF)¹⁹ up to 8% growth (Dallas Business Journal, see above), with the JRC-IPTS survey results well in-between (4.1% increase in the EU for 2008/09; 4.5% and 4% in the following years, respectively).²⁰ Depending on the further evolvement of the crisis R&D spending may either be close to the selling or to the worst case scenario.²¹ However, based on the currently available information, a drastic drop in R&D spending is not assumed and the expected change in terms of R&D investments is well above the corresponding assumption concerning the GDP growth (across references) and thus corresponds to the literature mentioned above assuming it to be anti-cyclic.

¹⁹ IMF in its *World Economic Outlook*, released Oct 2008, assumes that the world economy decelerates quickly, which will also affect global R&D spending. Some global R&D growth is assumed, but will be absorbed by the inflation rate for a net result of flat R&D spending. The Research-Technology Management R&D trends forecast for 2009 by IRI Inc. arrives to the same conclusion. www.iriinc.org

²⁰ The expectation of R&D spending growth in 2008/09 is based on the 2008' IPTS-IRI survey. IN contrast, the forecasts going beyond 2009 are derived from a currently ongoing survey (to be completed in July 2009). Hence, the provided results are preliminarily and therefore should be considered with caution!

²¹ *BATTELLE, R&D Magazine 2009 Funding Forecast* (12/18/2008) assumes global R&D spending will reach \$1,140 billion in 2009, 3.2% higher than in 2008. Thus, much of the global growth is fuelled by continued expansion of R&D in Asia, although global effects have slowed R&D growth there as well.

Graph 3: Expenditures on R&D in the light of the economic and financial crisis



Data IMF forecasts for GDP (April 2009); 2008 EU R&D investment Scoreboard; IPTS-IRI Survey 2008 & 2009.

Note Expected nominal year to year R&D expenditures' growth 2009/10 ff according to preliminary results of an ongoing IPTS-IRI Survey (to be completed in 07/2009; the presented results are based on altogether 40 replies from top R&D investing Scoreboard [SB] firms across sectors in Europe)

Source Own illustration.

This overall rather positive image of constant or even rising R&D investments in times of an economic downturn (given the particular survey sample) might be seen in the light of a comprehensive US study of a large sample of companies over 20 years, which included the 1990-91 recession.²² Many of the industry leaders at the end of the considered period were companies that had increased their R&D during the recession. Intel, for instance, more than doubled its R&D in the period 1989-92.

Accordingly, the positive impression provided by the surveys presented above may indicate parallels to the current situation. In fact, the evidence suggests that technologically leading companies / top R&D investors may strategically raise their R&D investments in a down-turning market in order to have a strategic advantage over their competitors already at the very beginning of the next upturn.

With regard to the concept of sector innovation systems²³ – existence of sector specifics in terms of technology, R&D and innovation patters – we consider below exemplary two sectors (& pharmaceutical & biotechnology as well as energy sector)²⁴ in order to eventually identify such characteristic corporate (R&D) strategy adjustments due to the current crisis.

²² Michael Tubbs, [Financial Times Reports](#), 02/12/2008.

²³ See Lundvall (1985) or Freeman (1995) for a discussion of the general concept of innovation systems. In the face of the current crisis, rational is put forward considering innovation systems as strategic national assets that need to be protected, just like the financial and housing sectors. See for instance: PWC (2009) p. 19., and for related policy implications: Mahroum (2008).

²⁴ Sectors were chosen as both are emerging and R&D intensive sectors with commonly rather long-term cycles of returns to the R&D activities (comprising both basic as well as applied research).

3.1 Biopharmaceutical sector: Rethinking R&D strategies?

As far as the distribution of R&D investment among industrial sectors, given the sample of Scoreboard companies, firms aligned to the pharmaceutical & biotechnology sector commonly rely on R&D and innovation as a vital element of their business concept. They are characterised by a combination of high R&D intensity, high share of R&D in total investment and high usually R&D investment growth rates too. But, to what extent the impact the current crisis may have on corporate R&D and innovation activities is sector specific? Are there characteristic patterns? The answers to these questions are tackled throughout the formulation and the introduction of three hypotheses reported below.

Hypothesis Bio-ph1

Business R&D in the pharmaceutical and biotech sector is conducted, on the one hand, in a series of large scale laboratories (operated mostly by the market leading companies) and, on the other, by many medium and also rather small but highly R&D intensive companies. Given this sector specific structure, the global economic and financial crisis likely will affect the companies belonging to this sector and their R&D strategies differently:

- For the large scale companies, providing an opportunity to continue a strategy devised to address concerns about a business model that was being questioned by the markets, perform strategic mergers & acquisitions [M&A], and facilitate access to IPR and highly skilled staff by taking over / acquire them from distressed small companies (Hypothesis Bio-Ph1.1);
- Is especially challenging for small & highly R&D intensive companies (Hypothesis Bio-Ph1.2).

With respect to large scale companies (**H Bio-Ph1.1**), recent media reports suggest that there is currently a tendency of concentrating R&D activities on fewer areas of interest and to bundle it in smaller but specifically dedicated laboratories. Pfizer might be seen as an example. The company has announced to reduce the former size of its major laboratories from 500 – 1000 researchers to about 200 and, overall, to lay off about 10% of their investigators. And, after the merger with Wyeth, the company's research will in fact be focussed on fewer areas. Further, instead of having a single R&D unit, the company will divide efforts into two distinct groups.²⁵ By that means, the company seeks to sharpen the R&D focus, achieve less bureaucracy, and clearer accountability in drug discovery. Moreover, another team of scientists will seek and evaluate new technologies and early-stage drug candidates from outside Pfizer, paving the way for further M&As (meant to acquire knowledge).

In general, there is evidence of a new wave of takeover activities in the global biopharma sector.²⁶ Large scale companies may opt to do strategic M&A in the light of the crisis as the situation appears favourable. For instance, apart from the Pfizer - Wyeth merger (pharma – pharma), Roche – with its takeover of Genentech – will even overtake from Pfizer as the largest pharma company and thus represents a prominent example of a biotech – pharma merger. Accordingly, for big biopharma companies the current turmoil may appear as a kick off rather than a general threat.

²⁵ Pfizer's current global R&D head, Martin Mackay, will lead PharmaTherapeutics Research Group, which is focused on small molecules. BioTherapeutics Research Group will concentrate on large molecules and vaccines under the direction of Wyeth's current research president, Mikael Dolsten. It also will incorporate Pfizer's entrepreneurial Biotherapeutics & Bioinnovation Center, headed by Corey Goodman. See: [C&EN - Chemical & Engineering News](#) (13/04/2009)

²⁶ Times, 02/2009: [GlaxoSmithKline boss ruled out joining the wave of takeover activity that is expected to engulf the global pharmaceuticals industry.](#)

However, as companies seek to achieve synergies by doing M&A related R&D projects are supposed to be merged too (overlapping's slashed). Hence, in the light of the expected wave of takeover the overall engagement in R&D and innovation activities across the sector might be decreasing.

On the other hand, many of the large scale companies are currently facing the problem of loosing patent protection for their main drugs. As stressed by *El Pais* (21.01.2009, p. 34), three best sellers in the pharmaceutical market (highest volumes in sales) are about to expire, namely Plavix (Sanofi-Aventis), Diovan (Novartis), and Lipitor (Pfizer); together representing about € 10 billion.

Therefore an increase in R&D and innovation activities, particularly for the big players, would appear to be indicated in order to maintain their leading position in the market. But, there is evidence that large biopharma companies are even about to reduce their own R&D efforts and 'invest indirectly' in R&D by snapping up small firms whose prices are distressed as they struggle with shortage of finance due to the crisis.²⁷ The latter holds in particular for companies relying on R&D and innovation activities as this implies a constant supply of capital.²⁸ (**H Bio-Ph 1.2**) Moreover, newly risk-averse investors are shunning biotechnology stocks, which are among the riskiest investments as many experimental drugs fail. According to the investment bank *Rodman & Renshaw* (as reported by the NYT), up from 68 in the first quarter of 2008, just six months later already 113 biotechnology companies had less than a year of cash given their rates of spending. In addition, biotech companies by end 2008 make up about 25% of the 344 companies that could be delisted from the NASDAQ because their share prices have dipped under \$1.²⁹ And the way from an incremental innovation to a marketable product in this particular sector as very long and costly. In fact, developing a new medicine and getting it on the market in average costs about €620 million, and in case it is biotechnological even €930 million.³⁰

With the financial markets down and venture capital slowing³¹, small biotech's are taking steps to make their cash reserves last as long as possible in order to survive, as reports the *New York Times* (28/10/2008). Generalising, market concentration in the biopharma sector can be assumed as further increasing and aggregated R&D investment figures are more likely to decrease in the nearest future.

²⁷ Flanagan et al (2008): Implications of the financial crisis for the biopharmaceutical sector. Exemplary might be seen the outlook provided by Sanofi-Aventis CEO, Christopher Viehbacher (11/02/2009), who foresees "cuts to internal R&D and increased acquisitions of small- to mid-sized biotech companies". In fact, only in the first half of April 2009 the group acquired Laboratorios Kendrick in Mexico (April 2nd), Medley in Brazil (April 9th), and BiPar Sciences, a US Biopharmaceutical company (April 15th). See: http://en.sanofi-aventis.com/rd/p_research.asp

²⁸ See e.g. Flanagan et al (2008): *Collateral Damage: The Biopharmaceutical sector* or Mitchell (2009) in *Nature Biotechnology* 27, 2009: "Biotech feels the panic".

²⁹ [FierceBiotech](#) – The Biotech Industry's Daily Monitor (29/10/2008)

³⁰ EL PAIS, 21 January, 2009, p. 34.

³¹ Though angel investments dropped considerably in 2008, the total number of deals held steady, according to an analysis released by the University of New Hampshire's Center for Venture Research (CVR). Total investments fell 26.2% from 2007 to \$19.2 billion, while the number of deals fell only 2.9%. Deal size, however, declined by 24%. CVR concludes that although the current economic climate has not reduced angel activity significantly, it has caused scaling back the size of investments.

Hypothesis Bio-Ph2

The attractiveness of investing in biopharma was comparatively low before the crisis as the sector has underperformed. R&D and specifics in the sector innovation system appear to be a key in this regard and, accordingly, common patterns may change.

In general, companies operating in the biopharma sector might be assumed to be less directly affected by the economic downturn than most others as the fundamental drivers of demand for drugs, medical treatments, etc. are relatively independent of the wider economy. These drivers – the prevalence of disease, unmet medical needs, population growth, and the aging population – likely will push demand to be further growing and thus are relatively inelastic to adverse shocks as financial crises.

However, over the past few years, the biopharma industry has been in a state of flux. Multiples have been declining, effectiveness of R&D activities has become a critical issue, cost level, and operating models in general have been fundamentally questioned. Overall, the sector has underperformed over the past five years (2.1% average shareholder return compared to S&P 500 average of 3.9% for the period 12/2000 – 09/2007).³² The reason for this is commonly seen in the failure of replacing drugs going off patent, together with a generally tougher market environment. As a result, the price-to-earnings ratios of biopharma companies have decreased by half since 2000 and, at least until the financial crisis, lagged behind those of many other industries. And the fundamental, systemic issues facing the industry have not gone away; if anything, the crisis has further illuminated them. R&D might be the way out, but (as outlined above in terms of H Bio-Ph1) the large scale companies tend to replace own R&D by snapping small companies and the latter – while struggling with shortage of finance – may even skip doing R&D at all.

Nevertheless, the disruption caused by the crisis may offer biopharma companies an opportunity to change industry dynamics, built competitive advantage, and tackle these fundamental issues.³³ In this regard, some evidence suggests that there is a re-focusing of R&D engagements in the light of the global turmoil going on. *El Pais* (Jan 21st 2009) has called it the 'end of the Dinosaurian Laboratories'. And, according to the *Wall Street Journal* (15/04/2009),³⁴ Pfizer's chief of worldwide research, Rober MacKenzie, stressed that the traditional pharma R&D strategy has created a system steeped in bureaucracy and lacking in accountability. "We believe that the big research organization model really doesn't work particularly well". Hence, several big pharma companies have announced R&D strategy changes, including Pfizer and GlaxoSmithKline, seeking "to marry the strength of biotech spirit and entrepreneurship with big pharma's resources," said Zhi Hong, head of GSK's infectious diseases division. But this shift isn't isolated to big companies. Francis Cuss, head of discovery at Bristol-Myers Squibb, says the mid-sized company isn't worried as much about the size of its drug discovery units, but it has nonetheless taken steps to change its R&D culture. "What we are trying to do is completely change the culture, or at least more in the direction of that looser biotech culture," said Cuss, who compared BMS' structure to that of Amgen.

All this might be seen as a response to the crisis. But it appears to happen rather due to revolutionary changes in the way innovation in the sector is achieved nowadays.³⁵ Indeed, the economic crisis may not have caused this process in its origin. But it likely has accelerated it.

³² See BCG (2008): *Collateral Damage: Industry Focus (Biopharmaceutical sector)*, p.2, p.5, Exhibit 2.

³³ Anthony (2009): any crisis - via unleashing creative destruction - opens up opportunities for innovation.

³⁴ See: *The Wall Street Journal*, 15/04/2009, referring to the Windhover Pharmaceutical Strategic Outlook conference in New York, April 15th 2009.

³⁵ For instance in terms of human genomic research, faster progress due to stronger networking of small and highly specialised research teams across companies/countries.

Hypothesis Bio-Ph3

In the light of changing sector specific R&D and innovation patterns (see H Bio-Ph2) off-shoring becomes increasingly important. In fact, the industry has become more globalized in its R&D approach as part of efforts to improve productivity and efficiency. Networks of offshore partnerships and academic collaborations are now enabling companies to harness external expertise on a project by project basis. The current crisis, by pushing companies to rethink and reorganise their R&D engagements, tends to reinforce this trend.

Leading pharma and biotech companies have undergone / are doing major R&D restructuring and now adopt a focused, streamlined global approach which is increasingly reliant on offshore strategic partnerships, academic collaboration, and outsourcing to establish networks of scientific expertise. Scientific and technological excellence within emerging economies is a key incentive for offshore investment, enabling companies to enhance innovation and productivity within their R&D programs. According to the president of Novartis/Spain, Jesús Acebillo, (*El Pais* interview, Jan 21st 2009): during the last 18 months 18 major research centres in Europe and the US have been closed, while 14 have been opened in emerging countries.³⁶ This appears to go beyond 'natural' internationalization of S&T in the pharmaceutical and biotech sector. In fact, it suggests changes in the firms' business strategies. This may enable companies to focus on core competencies such as drug discovery or technology development whilst contracting out non-core processes to experts, often at lower costs. As offshore investments begin to mature and provide returns on investment, the opportunity to migrate individual components or whole segments of R&D portfolios will continue to rise.

According to recent report on *Trends in off-shoring pharmaceutical R&D*³⁷ firms that have allocated over 60% of their R&D expenditure offshore have displayed greater shareholder return, operating margins, market capital growth, and return on assets. The US currently attracts 53% of total industry R&D spend. However it is forecasted that 20% of this expenditure will migrate to Asia Pacific by 2010. Australia, China, and Singapore are emerging as key areas for scientific and technological investment.

3.2 Energy sector: Strategic adjustments in R&D engagements due to the crisis?

The downturn of the global economy and the drop in future expectations likely in no other indicator is as apparent as in the oil prices. In fact, the price of a barrel oil dropped by ¾ from the peak in 2007 to the low in early 2009. This, of course, has affected the energy sector significantly. Shrinking profit margins in the carbon-based industries lead to cost reduction pressure also in the energy business. Decreasing oil-prices indirectly let appear alternative energy sources economically less attractive and the systemic change towards sustainable energy might be decelerated. Hence, a rethinking of R&D strategies appears to be likely too. Accordingly, the energy sector is hit twice these days; by the corresponding shortage of capital supply due to the crisis as well as by the oil price ups and downs.

³⁶ For instance, in February 2009, Pfizer set up a \$60-million manufacturing facility in northeast China's Dalian city, while Bayer announced plans to invest up to €100 million over the next five years for an R&D centre in Beijing. GlaxoSmithKline has more than 20 medical projects in China under or to be under clinical research, and the China R&D centre has in two years become the largest laboratory in the Asia Pacific region, said Zang Jingwu, senior vice-president and China R&D chief of GSK. In turn, GSK closed several manufacturing sites and trimmed its sales force in the US (see: *China Daily*; 09/04/2009).

³⁷ See: Key Trends in Offshoring Pharmaceutical R&D: Company strategies, emerging markets and impact on ROI; www.reportlinker.com (Key findings announced by Reuters: 08/04/2009).

Searching for company announcements on strategic adjustments of corporate R&D strategies in the energy sector in response to the crisis, unfortunately, very little can be found. In fact, companies active in the energy business seem to avoid pointing out whether and how the crisis may affect their business. Hence, we have to rely on the available scattered information and use anecdotic evidence in order to develop a series of hypotheses to be validated.³⁸

Hypothesis En1

The crisis provides an opportunity for carrying out those structural shifts, which have been considered as necessary over the past years, in a rather radical way. R&D is central for ensuring such a shift.

Supportive evidence is provided by an in-depth article on the German car industry:³⁹ Thus, Daimler-boss Dieter Zetsche calls 2009 a "Darwin-year" for the sector and Gregor Matthies, a senior sector expert, states the crisis provides an opportunity for addressing a number of structural problems, without vanity and sentimentality. Accordingly, R&D expenditures in Mercedes-Benz Car rose by about €200 million from 2007 to 2008 despite a decrease in turnover of 9%. Moreover, the Daimler Group envisages expanding their R&D expenditures from €4.4 billion in 2008 by about 15% to a total of €10.1 billion in the period 2009-2010 (see Daimler Annual Report 2008; released 27/02/2009).

Similarly, CEFIC [European Chemical Industry Council], while reflecting the impact of the turmoil on companies operating in the chemical sector, assumes that the current crisis – in the light of the European Economic Recovery Plan – "...may become an opportunity to accelerate the shift to a more sustainable economy..."⁴⁰; namely overcoming a structural backlog and boosting 'green' technologies.

There is reason to believe in similar trends with regard to the energy sector. In fact, the energy sector needs to transform itself in order to become less dependent on imports, meet the climate change and the renewable targets. Also in the energy sector, new technologies are not yet simply available on the market and require some (basic + applied) R&D efforts. In this regard, the importance of R&D for getting out of the crisis is underlined by a survey of 530 innovative companies: 47% announced that they would increase their R&D activities, while only 5% aim for a reduction.⁴¹

In this regard, it might also be worth taking a look at the effects of the crisis on merger and acquisition activities [M&A]. In general, deployment oriented deals are more likely to be debt-financed, and these activities become more difficult.⁴² On the other hand, deals in technologically challenging activities such as offshore wind energy are typically more equity-financed, and become more likely,⁴³ which may lead to more concentration in this area and eventually can boost the related R&D activities.⁴⁴

³⁸ Thus we rely on a JRC-IPTS internal note on *The financial crisis and corporate investments in low carbon energy R&D*; authored by Karel Haegeman, Guillaume Leduc, and Tobias Wiesenthal.

³⁹ *Wirtschaftswoche* 10/2009 – 02.03.2009; pp. 46-54.

⁴⁰ See CEFIC letter to the president of the European Commission, J.M. Baroso, Feb 24th 2009.

⁴¹ *Financial Times Deutschland*, 27th Dec 2008.

⁴² For instance, JP Morgan puts further projects on hold after having financed 54 wind parks in the US during the last five years. According to *Der Spiegel*, No. 7/2009, p. 77, leading wind turbine producers in the US already have started to reduce their stuff by up to 20%.

⁴³ See *New Energy Finance*, 10/2008, p. 9 (graph): M&A activity by energy sector in the quarter Q3 of 2007 and 2008. The dominance of wind energy is less pronounced than in 2007, but still present. Also in Q4 some wind M&A deals took place. The dominance of solar M&A activities also draws attention.

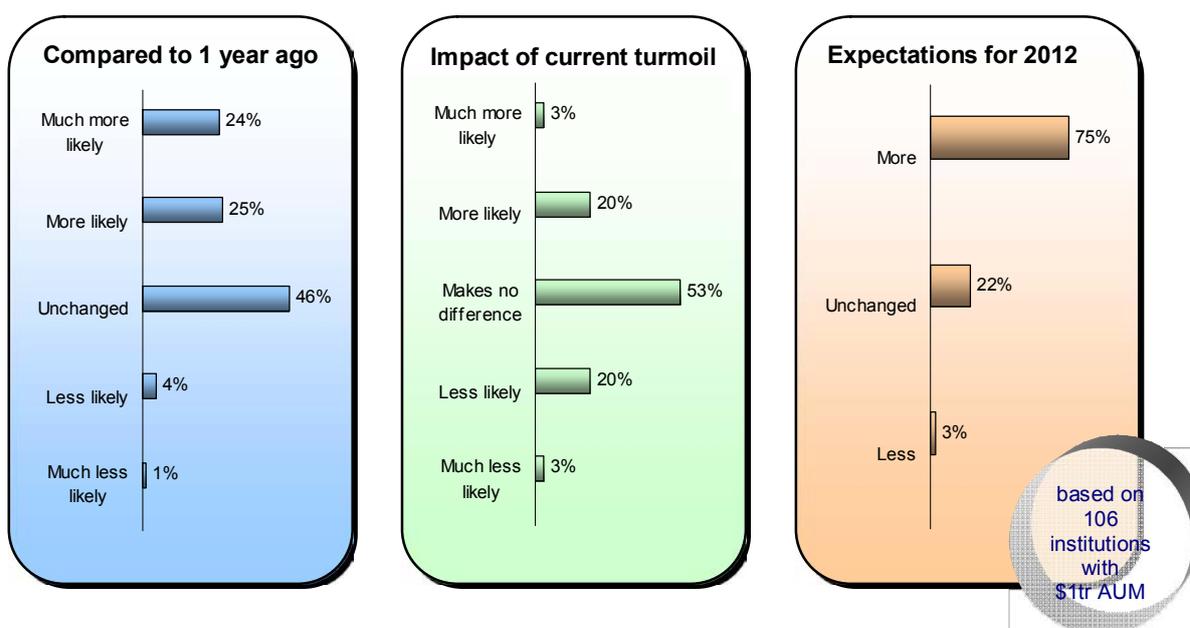
⁴⁴ Evidence from the US suggests investments in hydrogen and fuel cells shift significantly out of basic research while maintaining its level in applied research and moving strongly into development. The same is expected for renewable sources, although with an expected decrease in applied research too. The

Hypothesis En2

The crisis will hit the energy sector to a lesser extent than other sectors: According to an expert survey in Germany, energy is among the sectors that are likely to have the best perspectives for growth in the current financial crisis (UGW Expertenumfrage). Battelle R&D Magazine – 2009 Global R&D Funding Forecast (12/2008) asserts that renewables and especially wind energy are among the 'hot spots' of global research interest; also the employment chances in the renewable energy sector are very good.

Admittedly, the crisis has affected investment in energy too (e.g. a drop of 44% in terms of clean energy). But this relates rather to deployment projects than to R&D (see New Energy Finance [NEF], press release 02/04/2009; www.newenergyfinance.com). In fact, according to a survey conducted on behalf of NEF (12/2008 – 02/2009) institutional investors assume significantly rising investment in (clean) energy in the aftermath of the crisis as illustrated in Graph 4.

Graph 4: Institutional investor attitudes to clean energy investment



Note Survey conducted Dec 2008 to Feb 2009

Source New Energy Finance; www.newenergyfinance.com

Hypothesis En3

The effect of the crisis on R&D is most likely only of a short-term temporary nature, in particular for sectors that have a strong public support such as renewable energy.⁴⁵

Given the EU climate change and energy targets for 2020 and beyond, a stable regulatory framework for the market introduction of many low-carbon technologies is likely to prevail. Furthermore, public support to these sectors seems to even increase in a couple of Member States as recovery plans and stimuli packages being directed to those future-oriented technologies. The EC Communication on lead markets also includes renewable energy as

expected shift for traditional energy sources seems to go in the same direction, but with a lower intensity. (see Battelle, R&D magazine, p. 25)

⁴⁵ According to the European Renewable Energy Centers (EUREC), 3rd Feb 2009, 3.5 billion Euros are expected to be spent by the European Commission on energy technologies. Further, Two European research centers are preparing to work together on energy research (Research Day Europe 03 Feb 09).

one of the priority areas. In addition, some banks which were recapitalised by public money are obliged to lend money for energy issues.⁴⁶ And finally, a high volatility of oil prices also encourages investment in more stable priced (renewable) energy sources⁴⁷.

The raised hypothesis is also supported by the World Economic Forum:⁴⁸ "A repeat of the collapse in investment in clean energy which followed in the wake of previous spikes in energy prices in the 1970s and 1980s ... does not look likely. For one thing, there is a web of policy in place around the world which supports a mandated level of activity far in excess of previous levels. Secondly, no serious commentator expects oil prices to revert to the US\$ 25 per barrel median price (in 2008 money), which prevailed throughout the 1990s. Growing demand for oil – much of it fuelled by the rising middle classes in China and India – is demanding the exploitation of ever more expensive sources of supply – deeper offshore fields, shale oils and tar sands – driving up the cost of marginal production."

Hypothesis En4:

The crisis may cause a shift of investments from basic research to applied R&D.

Evidence from a survey conducted by the Industrial Research Institute [IRI] supports this hypothesis.⁴⁹ Accordingly, nearly half of the IRI members anticipate flat R&D expenditures in 2009, following several years of increase. But, the surveyed companies also anticipate "reduced internal direct basic research and increased support for external technology activities, including participation in technology alliances, joint ventures, university engagements, and technology-focused and acquisition activities."⁵⁰

Thus, these trends are based on responses in four industry segments (chemicals, consumer products, food and tobacco, and petroleum) and do not reflect the potential reduction/growth of R&D spending in different subsectors. Regarding the chemicals and petroleum sectors, the total R&D spending is not expected to decrease, but significant changes in relative distribution of R&D costs are very likely to occur (reduced directed basic research and increased R&D support to new business projects).

In general, the arguments above corresponding to the outlined hypotheses suggest that the impact of the current crisis on the energy sector is likely to be less drastic as for many others. Admittedly, it is difficult to say whether individual firm strategies will change due to the crisis. But, obviously the sector will change as a whole on the move from carbon-based energy towards renewable sources. And this will continue, with or without the crisis. In fact, the current turmoil may – likewise in the Biotech / pharmaceutical sector – have an indicative influence and may trigger or decelerate this process. However, with respect to the energy sector it does not seem to cause fundamental changes in terms of corporate R&D strategies. As the CEO of Vattenfall, Lars Josefsson, put it: the change of energy sources "...is not a question of money or technology. It requires a redesign of society."⁵¹

⁴⁶ For instance, according to the Irish government, the Bank of Ireland and the Allied Irish Bank establish EUR 100 mill funds to support environment-friendly investments and innovations in clean energy.

⁴⁷ See "Volatility is our friend" in Knowledge@Wharton: 'A Trickle in the Pipeline: Renewable-energy ventures scramble for renewed financing', 21st Jan 2009.

⁴⁸ World Economic Forum (01/2009): Green Investing – towards a Clean Energy Infrastructure; pp. 23-26.

⁴⁹ Industrial Research Institute's R&D Trends Forecast for 2009, January-February 2009.

⁵⁰ In particular, for hydrogen and fuel cells in the US, investments are expected to shift significantly out of basic research while maintaining in applied research and moving strongly into development. The same movement is expected for renewable sources, although with an expected drop in applied research too. The expected shift for traditional energy sources appears to be similar, but with a lower intensity.

⁵¹ Said at the M.I.T. Energy Conference: The future of clean energy is...coal?" Cambridge, 07-09/03/2009.

Since the sector specific perspective does not lead to an all-embracing answer on whether and how the current crisis may affect individual corporate R&D strategies, in the following section we will attempt a cross-cutting consideration. Thus we seek to take into account evidence from companies belonging to different sectors, being located and engaged in different markets, applying different technologies, and, however, are heterogeneous in their company characteristics (size, legal form, being listed in the EU Industrial R&D Investment Scoreboard or not). By that means we ensure providing the most comprehensive image that is currently feasible to achieve given the generally scattered information on the effects of the crisis on companies and their R&D efforts.

4 Common corporate R&D strategy patterns in responses to the crisis? Firm-level evidence

Recalling the considerations made above from a theoretical point of view, basically there are two ways a certain company may face the systemic crisis of our time and the corresponding cost pressure: (1) reducing costs and by doing so reducing R&D efforts too in order to survive the crisis and perhaps re-launch the R&D efforts in the aftermath. In contrast, (2) a company may also opt to keep its R&D activities alive and eventually even increase them in order to achieve a comparative advantage for the time after the crisis.⁵² In any case, companies which elect to reduce investments and cut down their R&D projects in order to face the crisis should be aware of those competitors that chose to take precisely the opposite approach in order to be rewarded for this at the beginning of the economic recovery. As outlined above, at the start of previous recessions a number of companies increased R&D as sales decreased to enhance their range of products and services compared with those of competitors and hence strengthen their position in the upturn that followed. Examples of companies that increased R&D during 2001 to 2003 include Intel, Nokia, Adobe, Altera, Autonomy and Renishaw. Sales in 2004 and 2005 were in all cases well above the 2001 level and share prices rose.⁵³

Joseph Schumpeter argued in this regard: recessions could provide a platform for innovation and economic growth by unleashing a process of 'creative destruction'.⁵⁴ Periods of economic turbulence have been associated with the development of new technologies and ways of working – like the spread of mass production between the wars.⁵⁵ A different way is to see recessions as a 'pit-stop': a pause which allows firms to make adjustments and to rethink their strategy.⁵⁶ Hence, the key lesson from past recessions is: A crisis can be used as the catalyst for structural innovation. If that opportunity is not taken, the long-term costs (e.g. due to a competitiveness and/or technological gap, lost markets, etc.) might be even higher.

⁵² A possible option in-between could lie in contracting out R&D activities in order to lower investment costs (esp. for R&D infrastructure), relocating R&D capacity to outstanding knowledge centers and/or world regions with lower wages and relevant market potential.

⁵³ Michael Tubbs, [Financial Times Reports](#) (02/10/2008)

⁵⁴ Schumpeter, J.R. (1943): Capitalism, Socialism, and Democracy.

⁵⁵ For example, Bernstein, M (1989): The Great Depression: delayed recovery and economic change in America, 1929-1933; Beaudreau, B.C. (1998): Mass production, the stock market crash, and the Great Depression: the macroeconomics of electrification. And for a somewhat contrary view see: Szostak, R. (1995): Technological change and the Great Depression.

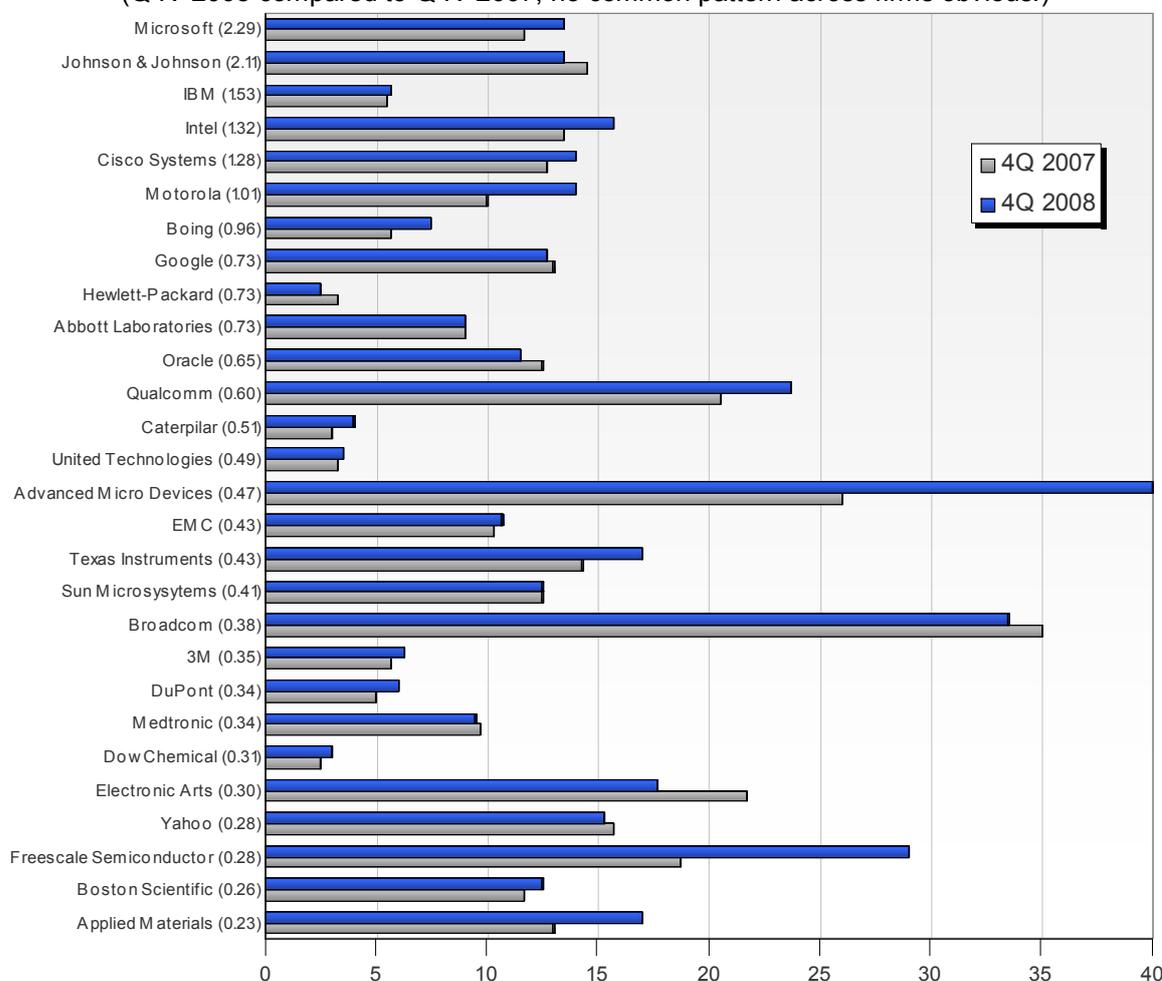
⁵⁶ Geroski, P.A. and Gregg, P. (1997): Coping with Recession - UK company performance in adversity.

In fact, according to an ample study of corporate strategies in a downturn,⁵⁷ top companies are assumed to do more than just thinking about short-term survival during a recession. They position themselves to thrive during the subsequent upturn by investing in infrastructure, R&D, IT, and staff. Further, successful companies also pursue transformative and opportunistic M&A. As pointed out in the same study, downturn mergers generate about 15% more value – measured as total shareholder return – compared with boom-time mergers.

The conclusion for any company relying on R&D and innovative activities therefore is 'taking a hard look at R&D in a recession' can mean having the farsightedness and the courage to invest more while others are cutting back. Market rewards will follow – but not immediately.

However, what is about empirical evidence in this regard? Do top R&D investors really expand their R&D spending? Graph 5 illustrates (for 28 top R&D investors in the US) the changes in R&D spending between the last quarter of 2008 compared to Q4 in 2007. Accordingly, while revenue dropped by 7.7% in average R&D spending remained about constant (-0.7%), but did not rise. Nevertheless, based on this data the Wall Street Journal (April 6th 2009) stated "Big companies invest to grab sales in recovery" and called this the "iPod lesson".

Graph 5: R&D spending behaviour of US companies in the light of the crisis (Q IV 2008 compared to Q IV 2007; no common pattern across firms obvious!)



Source: Wall Street Journal, April 6th 2009 ([link](#))

⁵⁷ See [Harvard Business Review](#) (02/2009), D. Rhodes & D. Stelter (Boston Consulting Group): A downturn opens up rare opportunities to outmaneuver rivals.

In fact, Graph 5 suggests that – even among top R&D investors – there are no common patterns with regard to spending on R&D in times of a crisis.

***But, what determines the way a company is facing the current crisis?
How much does the crisis influence corporate strategies?
To what extent R&D activities are affected?***

In order to provide an answer and to eventually deduce common patterns for the current crisis, numerous company newsletters and press releases have been scanned for announcements on changes in business and/or R&D strategies.⁵⁸ Exemplary, below we list some messages grouped according to the general strategy adjustments as outlined above:

(3.1) Cutting the R&D spending; eventually shifting to other forms of innovation efforts:

Pfizer announces to reduce scientific workforce by 10%, 18/01/2009

Pfizer has announced to reduce the number of scientists by 800 before the end of 2009 as part of an attempt to restructure the company and to re-focus its R&D engagement on core areas only.⁵⁹

Sanofi-Aventis: overhaul of the company's R&D system (11/02/2009)

Christopher Viehbacher, the new CEO (formerly GlaxoSmithKline), is assumed to reinforce cost cutting efforts and an overhaul of the company's R&D system. Overall, cuts to internal R&D and increasing acquisitions of small- to mid-sized biotech companies are expected.

AstraZeneca: profits surge but R&D spending falters; 29/01/2009 (BNET Pharma)

After having laid off 7,600 people since 2007 (around 700 R&D jobs in terms of the restructuring of the R&D department; expected to cost around \$100m over the next two years)⁶⁰ new cuts bring that total to 15,000 lost jobs by 2013. About 38% of those job cuts will come prior to 2010, the company said. Restructuring is assumed to cost \$2.9 billion.

GlaxoSmithKline: R&D staff to be reduced, 02/10/2008

The company confirmed that about 6% of its R&D workforce was likely to go, mostly from its largest research centres in the UK and the US, as well as some in continental Europe.⁶¹ In contrast, according to www.fierceBioReseracher.com R&D engagement in emerging countries (as e.g. China) and M&A are likely to be pushed.

Orion to slash R&D jobs in Finland, 19/11/2008

Finland's largest pharmaceutical company will cut up to 300 R&D jobs in 2009 as a result of a reorganisation.⁶²

EADS: R&D to be reduced slightly, 14/11/2008

The EADS self-financed investments in R&D are decreasing slightly (5.8% comparing the first 9 months of 2008 with the same period in 2007).⁶³

BMW plans cuts in workforce and may 'slow down' R&D activities, 12/02/2009

While BMW prides itself on engineering innovation, executives said they still want to cut R&D spending as a percentage of total revenues, from about 6.1% currently to between 5.0 - 5.5%.⁶⁴ Postponing of long-term focused R&D engagements possible (valid for entire industry).⁶⁵

⁵⁸ Exemplary for mayor US companies, Graph 5, Appendix, provides a comparison of R&D spending of (Q4 '08 to Q4 '07). The Wall Street Journal thus concluded: No significant change in R&D spending.

⁵⁹ EL PAIS, 22 January, 2009, p. 34.

⁶⁰ DrugResearcher.com (30/07/2007)

⁶¹ FinancialTimes.com (02/10/2008)

⁶² HelsinkiTimes.com (19/11/2008)

⁶³ LaRevenue.com (14/11/2008)

⁶⁴ edmunds.com (02/12/2008)

Peugeot cuts outlook and plans major production cuts, 24/10/2008

The group was targeting a reduction of 50% in R&D-related costs in 2009, instead of the previous aim for a 30% cut.⁶⁶

(3.2) Expanding corporate R&D engagements in order to achieve strategic advantages in the aftermath of the crisis:

Microsoft: boost R&D spending by \$1 billion in 2009; 03/03/2009

About 2,000 to 3,000 new jobs as part of a broader realignment plan for the next 18 months (add on to the already approved R&D budget. According to Kevin Turner, chief operating officer, while Microsoft is eliminating jobs in some areas, new opportunities would arise at the same time elsewhere (no indications where the jobs are going to be created).

Samsung: increasing R&D and capital expenses

According to JaeMin Kwon (analyst Standard & Poor) Samsung will take advantage of the economic slowdown to hone its competitive edge by increasing its R&D and capital expenses. For instance, Samsung announced to plough \$1 billion into China in 2009 and cut non-R&D spending to cope with the economic downturn (www.chinadaily.com.cn, 27/02/2009).

Notebook firms in Taiwan to expand R&D despite downturn, 05/12/2008

Despite sales decline, contract manufacturers of notebook PCs in Taiwan (incl. Compal Electronics Inc., Wistron Corp., Quanta Computer Inc.), still plan to expand in-house R&D teams, with some expected to raise R&D personnel by several hundred. Companies are eager to hire R&D people for new designs so as to introduce new products equipped with LED 16:9 screens in 2009 and later.⁶⁷

Bayer: R&D budget in 2009 the highest ever in firms' history, 02/12/2009

Bayer plans to increase spending on R&D up to 2.9 bill Euros in 2009.⁶⁸

BASF: investments in R&D as highest priority, 11/01/2009

The company has lost in 2008 about 50% of its value on the stock exchange, and despite cutbacks and shut down of production sites, BASF continues to focus on R&D. According to the Managing director, Jürgen Hambrecht, the company sees investments in R&D as highest priority
<http://www.icdmuenchen.um.dk/en/servicemenu/News/FinancialCrisesAndRD.htm>

Daimler suspends output, but increases engagement in R&D, 26/02/2009

Revenue dropped by 7% in 2008 and Daimler goes ahead consequently with cost efficiency programs in all businesses. But, the aggressive R&D and product plans are to be continued.⁶⁹ Thus, R&D expenditure is assumed to rise from 4.4 bill Euro in 2008 to 10.1 bill in 2009/2010.⁷⁰

Michelin: R&D spending in 2009 expected to be slightly rising, 17/12/2008

Michelin is bracing for the slowdown and has achieved savings in industrial operations, overheads, logistics, R&D, and raw materials of so far 500 million Euros. Hence, Michelin is on track to meet the goal of savings between 1.5 - 1.7 billion Euros by 2010 (profitability plan Horizon 2010). The latter may provide room for M&A, like for instance a strategic take over of Continental.⁷¹

FAW: 61% rise in R&D spending in 2009, 19/02/2009

⁶⁵ Automotive Briefing & Forecasts (03/02/2009): <http://viewswire.eiu.com/>
⁶⁶ [Reuters](#) (24/10/2008)

⁶⁷ Taiwan Economic News: [CENS.com](http://www.cens.com) (05/12/2008).

⁶⁸ FOCUS: 02/02/2009, p. 14: Interview with Werner Wenning, CEO BAYER.

⁶⁹ allheadlinenews.com (26/10/2008)

⁷⁰ According to an interview with the Daimler R&D chief (see Reuters: 26/02/2009) referring to the Daimler Annual Report for 2008 (released 27/02/2009).

⁷¹ [Reuters](#) (17/10/2008)

Despite the crisis the major Chinese automaker, First Automobile Works (FAW) Group, will increase R&D spending in 2009 to a total of 619 million USD, Group President Xu Jianyi said, as FAW used the crisis "as an opportunity for structural adjustment and innovation."⁷²

Noray BG: Rising business despite the crisis, 22 November 2008

The group (SME operating in biotech) – despite the crisis – expects rising revenues, workforce and R&D spending by 20% annually until 2013.⁷³

(3.3) No clear change in terms of R&D investments, but possibly a restructuring / refocusing of R&D or eventually a sequential combination of the first two options:

Nokia restructures its R&D (shifting focus!)⁷⁴, 04-11-2008 / 19-02-2009

As forecasts for lower mobile phone sales in Q4 and 2009 continue to be made, Nokia announced plans to cut more than 600 jobs and close a site as part of an overall company reorganization. Thus, at least 130 R&D employees will lose their jobs, as the Finland-based company said it aims to "sharpen its focus on fewer but stronger research areas."⁷⁵ On the other hand, Nokia has completed a EUR 500 million loan agreement with the European Investment Bank (EIB). According to a Nokia press release (Feb 19th 2009) the five-year loan will be used to part-finance software R&D projects Nokia is undertaking during 2009-2011.

Merck: Further structural adjustments, but no cuts in R&D, 04/12/2008

Merck continues its transformation into a more lean and flexible business and further reduces the costs, while strongly supporting key products and growth opportunities. However, during 2009, Merck plans to fully fund its R&D opportunities seeking to position Merck for future growth.⁷⁶

Johnson & Johnson: Open innovation against the crisis; 02/02/2009

According to Paul Stoffels, the group chairman of pharmaceutical R&D, J&J is shifting their innovation ecosystem towards an open innovation model. Thus, the scientists are taking a networked approach across internal organizational disciplines and geographies, including Asia and other emerging markets, and increasingly with external public and private partners to generate ideas and intellectual property (see: *The Boston Globe*).

Volkswagen: Short time for 61.000 employees; but R&D remains unaffected

With sales expected to drop by around 10% in 2009, VW has put around two-thirds of its employees on short-time to avoid over-production. But, the R&D department and parts of its components manufacturing section would remain unaffected as stated by VW (24/02/2009).

Robert Bosch: R&D spending untouchable, 25/03/2009

In the light of major technological challenges as the development of new car concepts (electric, hybrid, hydrogen, etc.), even the current economic crisis would not justify a cutback in R&D efforts and spending (Franz Fehrenbach, chairman of the Bosch board of management).

Alcatel-Lucent: Outsourcing IT and some R&D activities in response to crisis

Alcatel-Lucent is looking at the possibility of outsourcing their IT globally as well as some of the R&D work for its most mature equipment (see: cnbc.com, 06/04/2009). Moreover, developing co-sourcing partnerships is envisaged, but no deals have been reached yet.

⁷² People's Daily.com (19/02/2009)

⁷³ elEconomista.es (18/11/2008)

⁷⁴ Note: Nokia eventually could be placed in the (3.1) category too due to the announced cuts in R&D spending and workforce. However, it is assumed that this refers to a shift in the focus of R&D activities away from R&D on mobile devices towards strengthening of software related R&D and applications.

⁷⁵ edn.com (04/11/2008)

⁷⁶ The Wall Street Journal (04/12/2008)

Overlooking the various company announcements, there is little evidence of a common business strategy in response to the current crisis. In fact, constant and even significantly rising figures are announced likewise notable cuts in workforce and R&D budgets. And this heterogeneous image appears even if companies within a certain sector, world region or size class are considered solely. The latter suggests that it is neither the market itself nor the individual business environment that determines a firms' response strategy to the present crisis but firm specific internal variables.

In this regard, it is striking that cuts in R&D budgets and workforce are frequently reasoned with a necessary re-structuring of the business and particularly with a re-focusing of the R&D strategy; namely concentrating on core scientific and technological areas, reducing size and number of research centres, and leveraging R&D efficiency (see e.g. Nokia, Pfizer, ...). As outlined above, such adjustment of the business strategy likely would have been necessary with or without the current crisis as there are emerging fields of R&D-intensive technologies which increasingly request a networked and efficient management of R&D activities. Hence, the crisis also appears to serve as an excuse.

Moreover, apart from the implied challenge for the firm's internal and external knowledge management, reorganisation pressure appears to go along the supply chain.⁷⁷ In this regard, respondents to a 2009 forecast survey on "How can PCB [Printed Circuit Board] assemblers cut costs in 2009?" unanimously pointed to smart management and lean manufacturing. Evidence suggests: Growth is achievable in a down market, with brain power, an improved organization, and sacrifice.⁷⁸

5 Policy response to the current crisis: Between Schumpeter and Keynes?

In the face of the most significant global economic crisis since world war II, government responses around the globe to the recession likely determine its outcome, its depth and duration. Thus, immediate and effective crisis management is essential and the way governments will react – be it minimizing public intervention following Neo/Ordo-liberal approaches (*Eucken, Friedman, etc.*) vs. supply or demand side focused supporting policies (*Schumpeter, Keynes, respectively*) – possibly may shape the future course of entire economies for a generation or more.⁷⁹

Hence, assumed a policy perspective, the crucial question for anticipating the impact of the global downturn on investments in R&D in general and on corporate R&D strategies in particular is whether and how governments will use policies to foster R&D and innovation as a mean to stimulate the economy, especially in the medium to long term. Since such policy measures are used to be embedded in comprehensive policy packages, which in turn are supposed to affect the businesses in several ways thus going far beyond their pure R&D

⁷⁷ When markets get tight, for instance in a crisis, suppliers and subcontractors may struggle more than the parent company and by that means erode the performance of the latter; eventually those of entire markets too. Hence, companies all along the supply chain have to find ways to beneficially work together.

⁷⁸ See SMT-blog: Meredith Courtemanche (2009): [The-Restructuring-Supply-Chain](#)

⁷⁹ For instance, the US depression in the 1930s spawned in Europe policies which led to the creation of modern welfare state and also the *New Deal* in the UK. Further, the UK recession of the 1970s and early 1980s paved the way for restructuring of many manufacturing industries as well as the creation of more flexible labour and capital markets. See NESTA (2008, p. 6 ff) for more examples.

activities, it seems to be indicated to reflect the general aspects of the available policy options and their possible micro-level effects.

Currently many governments (US, UK, ...) have adopted *Keynesian* economics.⁸⁰ This stipulates a strong role for the state in stimulating the economy during recessions by injecting massive amounts of cash into the economic system through both "bail out" and "stimuli" packages. The broad objective is to stimulate demand, create employment and prevent the economy from contracting. But in a world economy that is globally networked,⁸¹ applying *Keynesian* economics appears to be tricky. In fact, considering the geography of nowadays supply chains the beneficiaries of national stimuli packages are likely to be spread across many countries. This level of global economic integration makes a successful application of *Keynesian* economics very challenging. This is, for instance, accentuated in the case of Germany, an economy mainly driven by its exports. To stimulate demand à la *Keynesian*, the German government would need to spend money overseas, as it is there where much of the demand for its products and services lie. China is arguably in a similar position if not worse; it is an economy overly dependent on foreign investment and consumption.⁸²

But globalization is not the only challenge *Keynesian* economics policy is facing today. Over the past 10 to 15 years, most science, technology and innovation policies in OECD countries have been guided by *Schumpeterian* principles. Unlike *Keynesian* economics, these see government's primary role in providing the support and creating the conditions for economic stimulus through supply-side factors (seed capital, human capital, and venture capital, etc.). While Keynes' focus was on triggering short-term business cycles that can drive an economy out of a recession (e.g. by stimulating consumption), *Schumpeter's* focus was on long-term business cycles generated through successive waves of 'creative destruction' and ignited not by the state but by innovative entrepreneurs. Given the current global downturn and all the policy initiatives seeking to combat it, R&D and innovation policy has yet to make a shift in thinking. And at this point the announced spending of billions of taxpayers' money becomes a tricky issue. Should the created funds provide support for entrepreneurs with business plans expected to yield results in the long term (5+ years)? Or should it preferably support entrepreneurs with more short-term or immediate plans to enter the market and by that mean combat the effects of the crisis ad hoc instead of strategically?

No doubt, the general focus of the corresponding policy measure will translate into business strategy adjustments and favor either this or that business (concept), with a tendency to be more supportive concerning corporate R&D activities as longer the horizon of the political crisis response is defined.

By establishing comprehensive financial and economic stimuli-packages, extensive start-up funds, etc. as a policy response to the crisis, governments may find themselves struggling with how to use what is essentially a *Schumpeterian* policy instrument to achieve a *Keynesian* objective. The crucial question accordingly is how to wed supply-side (*Schumpeterian*) with demand-side (*Keynesian*) economics in R&D and innovation policy while achieving a positive pay off in the short, medium and the long run?

⁸⁰ Exemplary might be seen the German scrapping bonus (merchandise appeal for ~ 600.000 new cars).

⁸¹ A recent NESTA paper entitled *Attacking the Recession – How Innovation can fight the recession* called the current global economic crisis the "world's first networked recession". Networks in this context can be understood as another word for what the business world calls "supply chains".
http://www.nesta.org.uk/assets/Uploads/pdf/Interim-report/attacking_the_recession_discussion_paper_NESTA.pdf

⁸² Argumentation follows Sami Mahroum, NESTA, in: *Science Business*, 24.12.2008,
<http://www.nesta.org.uk/innovation-policy-in-a-networked-crisis-between-schumpeter-and-keynes/>

A possible answer may lie in a combination of the policies. On the one hand, investments in infra-structures and direct economic stimuli are assumed to have a stabilizing effect, relevant particularly in the short term (following *Keynes*). On the other, supportive measures may encourage entrepreneurs in performing R&D and innovation and bringing new or improved products or services into the market.⁸³ Seed and start-up may serve for that purpose (following *Schumpeter*).⁸⁴ In fact, all this is not new to the markets and is implemented in various ways already. But in response to the crisis it shall be reinforced while putting emphasis on the particular horizon of the supportive measures. Business strategy will adjust accordingly and – as known from textbooks – structure follows strategy.

Finally, networking is the key for both policy making as well as the private sector. Since many of the factors supporting R&D and innovation in one country will be dependent on factors in another, inward-looking and isolated approaches to R&D and innovation are doomed to failure. This gives reason to believe that in the aftermath of the current crisis the R&D and innovation landscape will look differently, being multi-national rather than focused on geographical proximity and depending on competitive advantages rather than on policy frameworks in certain territories. Companies which adjust their business and R&D strategies in time are supposed to be rewarded. Others may struggle.

In a nutshell, there is indeed room for policies between *Keynes* and *Schumpeter*. In fact, eventually a combination of the two approaches shall be envisaged.⁸⁵ Thus, with regard to the implications this may have on companies' (R&D) strategies measures and targets should be well disentangled and also the time horizon of the expected returns to the initiative appears to be crucial for the selection of tools. If it can be achieved that the billions of tax payers money being spent on combating the current crisis will lead to a stabilizing of the economies (in the short run) and – beyond this – also to a re-encouragement of entrepreneurs in terms of R&D and innovation activities (mid – to long-run) the money appears to be well spent. So the crisis may in fact be the catalysts for a move to a really knowledge based society and thus indirectly contribute to face the challenges of the 21th century.

6 Conclusions

Evidence from recent surveys and from individual business news suggests that in the face of the current economic and financial crisis corporate R&D investments will decelerate. But the overall trajectories are assumed to remain positive in 2009 and thus are well above the assumptions in terms of GDP growth rates and aggregated sales figures. This certainly is good news and provides reason to believe that companies in general consider their engagements in R&D as crucial for challenging the current crisis and – eventually even more important – for the business chances in its aftermath.

⁸³ With respect to (the US) stimulus package, according to the Innovation Technology & Innovation Foundation (ITIF), increased investment in scientific research, even if the increase is for only one or two years, will lead to long term payoffs in terms of additional innovations, increased competitiveness and generally improved research infrastructure. According to ITIF, investing additionally \$20 bill in the (US) research infrastructure may create or retain approximately 402,000 American jobs for one year.

⁸⁴ Amar Bhidé Columbia University professor discusses in this regard "venturesome consumption" and "venturesome demand" as tool for creating economic value with correspondingly different time horizons of the measurable effects; See: "[The Venturesome Economy](#)"

⁸⁵ For a discussion of particular policy options see the summary of an OECD Seminar on the effects of the crisis: http://www.oecd.org/document/24/0,3343,en_2649_201185_41707672_1_1_1_1,00.html

However, looking at micro-level, there is little evidence of a common business strategy in response to the crisis. In fact, cuts in workforce and R&D budgets are announced likewise stagnating and even rising figures. And this heterogeneous image appears even if companies within a certain sector, world region or size class are considered separately. Hence, there is no uniform answer to our key question whether and how the crisis may affect corporate R&D strategies. In fact, this appears to be rather company specific and thus related to the perception of the crisis by each company's management (given the specific market conditions), by the individual business philosophy and in particular by the propensity to take a risk (of rising corporate R&D investments) in a time when others cutting it down.⁸⁶

By means of this working paper it has been outlined how the crisis may affect corporate R&D in general as well as exemplary looking in more detail at the pharmaceutical & biotech and the energy sector. Thus, evidence suggests that the crisis – apart from reinforcing the Darwin principle 'survival of the fittest' – appears to be a stimulus and eventually a catalyst for rethinking companies' R&D strategies and in this regard for a strategic re-orientation and restructuring.⁸⁷ Further, there is reason to believe that smaller companies and in particular R&D performed in SME will be more affected by the crisis;⁸⁸ namely SMEs will drop R&D, be absorbed by large companies or simply be pushed out of the market. This may change entire business chains and by that means affect also business strategies of MNC.

The recession will accelerate the shift away from pipeline models of innovation towards more open, networked approaches as firms increasingly (have to) learn to share resources and to collaborate with universities, consumers, other firms, etc. in order to innovate.⁸⁹ Accordingly, the impact the current economic crisis will have on corporate R&D goes well beyond the total amount of money spent on R&D, cuts in budgets and/or workforce, and closing of research centres. What we currently see is acceleration in terms of structural change and a questioning of business models and strategies; corresponding R&D and innovation activities included.

Looking at the European economy in general, strategies to attack the recession are needed, not just to respond to it. Innovation – in business, communities, and public services – has to be core for this. The EU should aim to emerge as a more innovative, greener, more sustainable and diversified economy in the aftermath of the crisis. Thus, a mix of intelligent public investment, partnership with business and entrepreneurship is vital. Short-term measures to stimulate the economy should, wherever possible, promote long-term R&D and innovation activities for sustainable growth. That will be possible only if policy making sets out clear goals so that crisis management can pave the way for restructuring and regeneration.

⁸⁶ A recent business survey in Finland (PWC: 01/2009) has ranked the importance of entrepreneurship / entrepreneurial culture as highest among all determinants for future (two years) development scenarios.

⁸⁷ Phillips (2008): "Firms ... 'that stick to their knitting' risk being left behind. Some things that made sense before do not necessarily make sense now." See also e.g. PriceWaterhouseCooper (2009, p. 19): "...During economic downturns, innovation is the single most important condition for transforming the crisis into an opportunity."

⁸⁸ In fact, SMEs appear to be especially affected. See e.g. CEFIC (2009) [European Chemical Industry Council letter to EC president Baroso Feb 24th 2009. Further, according to a recent EuroChambers survey (03/2009) among 220 entrepreneurs, primarily representing SMEs, over two thirds of European businesses face growing difficulties in accessing credit, and as a consequence, 45% will decrease their investment activities over the next six months. The repercussions for workers could be severe, with 35% of companies warning that they may be forced to cut staff. See: EurActive.com (10/03/2009).

⁸⁹ Argumentation according to NESTA (2008): 'Total Innovation'. However, the general conclusions are also in line with those suggested by the Knowledge for Growth Group [KfG], to be discussed on its Conference '*S&T policy in times of crisis: European opportunities and challenges – Getting to the 2010 goals in times of distress*', scheduled for June 23rd 2009 in Brussels.

Accordingly, current aim of policy making across Europe (and elsewhere) is to focus on short term measures in order to combat the recession which will in parallel feed the EU's longer-term strength as an economy and society. The more we can use the short term crisis to address and accelerate our adjustment to longer-term challenges, the better.⁹⁰

However, with respect to individual business strategies and corporate R&D, public policies can be seen only as a supportive framework condition, an incentive, a stimulus. Companies will face the challenges as well as the chances provided by the crisis, thus take the public interventions into consideration, and make their own decisions. As discussed above, evidence suggests that it is neither the market itself nor the individual business environment nor any policy initiative solely that determines a firm's response strategy to the current crisis. In fact, it is a combination of several factors such as the demand side, business environment (economic and financial characteristics of the market and its regulatory framework conditions), and finally the firm's own features.

⁹⁰ OECD Secretary-General, Angel Gurría (press conference of *Going for Growth 2009*, March 3rd 2009): "The current crisis offers governments the opportunity to combine emergency action with the important structural reforms needed to improve long-term growth."

References

- Aghion, P.; Angeletos, G.-M.; Banerjee, A.; Manova, K. (2005): Volatility and Growth: Credit Constraints and Productivity-Enhancing Investment, NBER Working Papers 11349.
- Aghion, P.; Askénazy, P.; Berman, N.; Cette, G.; Eymard, L. (2008): Credit constraints and the cyclicity of R&D investment : Evidence from France . In: Banque de France (ed.), Working Papers, Notes d'Etudes et de Recherche, n° 193, 2008
- Aghion, P.; Gilles, S.-P. (1998): VIRTUES OF BAD TIMES Interaction Between Productivity Growth and Economic Fluctuations; *Macroeconomic Dynamics* (1998), 2:322-344 Cambridge University Press
- Anthony, S. (2009): The Silver Lining: An innovation playbook for uncertain times (forthcoming in May 2009, published by Harvard Business Press).
- Barrett, C. W.; Musso, C. S., Padhi, A. (2009): Upgrading R&D in a downturn. In: *The McKinsey Quarterly*, 02/2009.
- Beaudreau, B.C. (1998) 'Mass Production, the Stock Market Crash, and the Great Depression: the macroeconomics of electrification.' Westport: Greenwood Press.
- Bernstein, M (1989) 'The Great Depression: delayed recovery and economic change in America, 1929-1933.' Cambridge: Cambridge University Press;
- Bhidé, A. (2008): The venturesome economy: How Innovation Sustains Prosperity in a More Connected World, Columbia University.
- Boston Consulting Group: (2008, 2009): Collateral Damage Publications (series): www.bcg.com
- Canton, E.; Uhlig, H. (1999): Growth and the cycle: Creative destruction versus entrenchment, In: *Journal of Economics*, Volume 69, Number 3 / October, 1999, pp 239-266
- Castro, D.; Atkinson, R. (2009): Stim-Novation: Investing in Research to Spur Innovation and Boost Jobs. In: The Information Technology & Innovation Foundation (webmemo), www.itif.org
- CEFIS (2009); Cefic views on the impact of the economic crisis and suggestions for the implementation of the European Economic Recovery Plan; letter to the president of the European Commission, J.M. Baroso, Feb 24th 2009.
- Center for Venture Research (2009): The angel investor market in 2008: A down year in investment dollars but not in deals. University of New Hampshire, (603)862-3341; www.unh.edu/cvr
- Clark, J.; Freeman, C.; Soete, L. (1981) Long waves, inventions, and innovations. In: *Futures*, 13(4), August 1981, pp. 308-322
- European Commission (2008): The Effects of the Financial Crisis on European Research Policy. http://ec.europa.eu/research/social-sciences/pdf/ev22-synthesis-report_en.pdf
- European Commission (2009): Innobarometer 2009 – Analytical Report. Released by the Gallup Organization (ed.) as Flash Eurobarometer 267. <http://cordis.europa.eu/innovation/en/policy/innobarometer.htm>
- Flanagan, A.; Larsson, S.; Silverstein, M.; South, N.; Tollman, P. (2008): Collateral Damage: Industry Focus - Implications of the financial crisis for the biopharmaceutical sector; Issue 11/2008. The Boston Consulting Group.

- Francois, P.; Lloyd-Ellis, H. (2003): Animal Spirits through Creative Destruction. *The American Economic Review*, Vol. 93, No. 3 (Jun., 2003), pp. 530-550
- Freeman, C. (1995): *The National System of Innovation in Historical Perspective. Cambridge Journal of Economics.*
- Frey, C.; Callahan, R.H. (2008): Innovation strategies for the global recession
- Geroski, P.A. and Gregg, P. (1997): *Coping with Recession: UK company performance in adversity.* London: NESTA.
- Haegeman, K., Leduc, G., Wiesentahl, T. (2009): The financial crisis and corporate investments in low carbon energy R&D; JRC-IPTS internal document.
- Jaruzelski, B.; Dehoff, K. (2008): Beyond Borders: The Global Innovation 1000, In: *strategy+business*, Vol. 53, Booz&Co.
- Lord Sainsbury (2007): *The race to the Top: A review of the government's science and innovation policies.* London: HM Treasury
- Lundvall, B.-Å. (1985): *Product Innovation and User–Producer Interaction.* Aalborg University Press.
- Mahroum, S. (2008): Innovate out of the economic downturn; *BusinessWeek*, Oct 27th 2008.
- Mensch, G. (1975): *Das technologische Patt: Innovationen überwinden die Depression,* Umschau Verlag, Frankfurt / Germany.
- Mitchell, P. (2009): Biotech sector ponders potential 'bloodbath'. In: *Nature Biotechnology*, Vol. 27, 2009; pp. 3-5.
- Mohandas, P. (2008): Crisis-hit tech firms blink - engineering placements suffer. In: *The Wall Street Journal*, 12/11/2008 <http://www.livemint.com/2008/11/12003417/Crisishit-tech-firms-blink-e.html?h=B>
- NESTA (2008): *Attacking the Recession – How Innovation can Fight the Downturn*, Charles Leadbeater, Mike Harris, Theresa Crowley, Sami Mahroum and Brune Poirson; NESTA Discussion Paper: December 2008 [www.nesta.org.uk]
- Phillips, J. (2008): Critical Factors for innovation success.
- Rhodes, D.; Stelter, D. (2008): A downturn opens up rare opportunities to outmaneuver rivals. In: *Financial Times Reports*, 25.11.2008, http://www.ft.com/cms/s/0/9742b570-ba89-11dd-aecd-0000779fd18c.html?nclick_check=1
- Schumpeter, J.R. (1943): *Capitalism, Socialism and Democracy.* New York: Harper & Row.
- Stephan, A. (2004): *R&D Expenditures of Firms over the Business Cycle: Evidence for Germany.* German Ministry of Education and Science (ed.).
- Shleiffer, A. (1986): Implementation Cycles. In: *The Journal of Political Economy*, Vol. 94, No. 6 (Dec., 1986), pp. 1163-1190.
- Szostak, R. (1995): *Technological Change and the Great Depression.* Jackson, TN: Westview Press.
- Tubbs, M. (2008): Recession is a chance to increase R&D expenditure, *Financial Times Reports*, Dec 02/2008. <http://www.ft.com/cms/s/0/55d77f12-c010-11dd-9222-0000779fd18c.html>
- UNCTAD (2008): *World Investment Prospect Survey 2008 – 2010.* http://www.unctad.org/en/docs/wips2008_en.pdf
- World Economic Forum (01/2009): *Green Investing – towards a Clean Energy Infrastructure;* pp. 23-26. <http://www.weforum.org/pdf/climate/Green.pdf>

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Title: The global economic and financial downturn: What does it imply for firms' R&D strategies?

Author(s): Peter Voigt and Pietro Moncada-Paternò-Castello (JRC-IPTS)

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Technical Note

Abstract

R&D and the entire innovation process are likely to be affected by the current crisis. Apart from changes in R&D spending, as any crisis usually provides also chances it may stimulate a new wave of networked / open innovation and in this regard lead to 'creative destruction' as Schumpeter called it. Thus, high-technology manufacturing is far better-positioned to face the crisis compared to low-tech manufacturing, which is assumed to fare especially badly. The figures of R&D expenditure are assumed to evolve accordingly. And small companies and particularly those which are financially restricted (many SMEs) are supposed to suffer most.

In general, the downturn is supposed to accelerate the shift of EU manufacturing towards higher value-added, highly integrated, and internationally oriented sectors. Assumed that the latter tends to be characterised by higher R&D-intensity this in turn may have a positive impact on R&D investment figures. But, as structural changes usually happen slowly, this leverage effect may appear just in the long-run.

Empirical evidence from a series of recent business surveys [mainly capturing R&D-performing / higher R&D-intensity sectors] suggests that the perception as well as the funding of corporate R&D and innovation activities are holding up fairly well so far which suggests an anti-cyclic firm behaviour in terms of R&D engagement in the light of the current economic and financial crisis. For 2008/09 the estimates of R&D expenditure changes differ significantly among the sources – mainly due to the corresponding assumption on the further evolvement of the current financial and economic crisis with the estimate of 4.1% for EU – based on the JRC-IPTS' IRMA-Survey – well in-between. However, across the sources, the corridor for the R&D investment change is assumed to be above the corresponding assumptions on GDP and sales growth.

Evidence suggests that the impact of the crisis on R&D activities and the correspondingly assumed adjustments of firm strategies is sector specific. However, looking at micro level, there is no unique company strategy obvious commonly applied to face the crisis. In fact, some companies leave their R&D engagements unchanged, others cut them down, and a third group even accelerates their R&D and innovation activities (inclusive a significant leveraging of spending on R&D). In this regard experiences from past downturns suggest that companies having the farsightedness and the courage to invest more in R&D and innovation activities while others are cutting back have a significant advantage in the inevitable upswing that will come. Market rewards will follow – but not immediately.

The mission of the Joint Research Centre is to provide customer-driven scientific and technical support for the conception, development, implementation and monitoring of European Union policies. As a service of the European Commission, the Joint Research Centre functions as a reference centre of science and technology for the Union. Close to the policy-making process, it serves the common interest of the Member States, while being independent of special interests, whether private or national.

