

# **TECHNOLOGY LED CORPORATE ENTREPRENEURSHIP**

**INCREASING THE ENTREPRENEURIAL SPIRIT OF R&D**

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2004 EIRMA HENDRIK CASIMIR AWARD**



# TECHNOLOGY LED CORPORATE ENTREPRENEURSHIP

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## CONTENTS

Introduction	3
R&D as the Driver of Corporate Entrepreneurship	3
Emergence of a Research and Technology Market	4
The Cases	5
R&D People as Entrepreneurs	6
The limitations of the individual researcher	7
Entrepreneurial spirit through teams rather than individuals	9
Business alignment	10
R&D In Cross-Functional Networks	11
Management Approaches to Support Entrepreneurial Spirit	14
R&D Function as Driver of Corporate Entrepreneurship	16
Conclusions	18
Notes	20

# Technology Led Corporate Entrepreneurship

## Increasing the Entrepreneurial Spirit of R&D <sup>1</sup>

This report was written by Rebecca Ward, postgraduate student at PREST, the University of Manchester, on completion of her period as winner of the 2003/2004 Hendrik Casimir Award. Contents are based on a paper she presented at the 2004 EIRMA Annual Conference, Increasing the Entrepreneurial Spirit of R&D, and the results of interviews and research with member companies concerning the title theme during 2003/2004.

### Introduction

After a period of decline corporate R&D functions are searching for ways to re-establish themselves within the corporation and justify their existence to increasingly hostile business units and corporate boards.<sup>2</sup> For a growing number of firms, entrepreneurship in R&D seems to be the answer. 'Entrepreneurial spirit' is an increasingly common term on corporate web pages and European policy makers are advocating its application in R&D.<sup>3</sup> The emerging focus on entrepreneurial spirit in R&D is being driven by two catalysts, one internally driven and the other relating to external factors. First, is the growing recognition afforded to corporate entrepreneurship and the role that R&D can play in this, and second is the emergence of a market for research and technology. In this paper we attempt to step beyond the rhetoric and establish what actually constitutes entrepreneurial spirit in R&D before identifying actionable management approaches with which to increase it. We do this by exploring the R&D management approaches that are emerging in nine European firms.

### R&D as the Driver of Corporate Entrepreneurship

Increasingly in recent years corporate entrepreneurship has been presented as a way of invigorating corporate organisations and mature businesses. If the dynamic and opportunity grasping characteristics of the entrepreneur can be recreated within the corporate organisation it follows that the corporation will become more competitive and more receptive to rapidly changing environments.<sup>4</sup> Gilford Pinchot III incubated the notion of corporate entrepreneurship in his seminal book 'Intrapreneuring' published in 1985, his thesis being that allowing pockets of imaginative and entrepreneurial activity *within* the corporation is a way of speeding up the innovation process.<sup>5</sup> More recently corporate entrepreneurship has been promoted as the saviour of large corporations enabling them to maintain competitive advantage, invigorate their operations and initiate corporate renewal.<sup>6</sup> In an era where corporate laboratories and technology functions are facing increasing demands to justify their

existence,<sup>7</sup> and where R&D is subject to more stringent financial accountability measures, a potential scenario where the R&D function is re-established at the heart of this process is a welcome one for R&D managers, and in many European companies they are starting to grasp this new opportunity. Indeed, this research is based upon initial proposals made by the European Industrial Research Management Association (EIRMA), whose 2004 annual conference was entitled 'Increasing the Entrepreneurial Spirit of R&D'.<sup>8</sup>

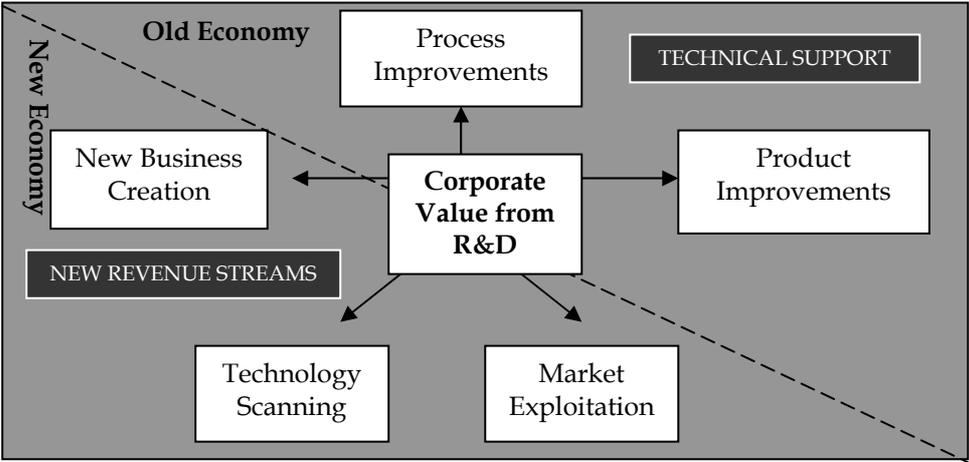
Increasing the entrepreneurial spirit of R&D is clearly an issue with a growing profile. However, although a substantial body of academic literature now surrounds the phenomenon of corporate entrepreneurship the existing literature largely fails to address the subject from the context of corporate R&D despite the fact that this function is often the main driver of corporate entrepreneurship. Although several authors have addressed the necessary conditions for facilitating corporate entrepreneurship,<sup>9</sup> none that we have found have focused specifically on the characteristics and operational routines of R&D, such as R&D HR management, R&D organisation and R&D strategy, which contribute to technology led corporate entrepreneurship. It is to this gap that we turn our attention: what constitutes an R&D function with entrepreneurial spirit? How can corporate R&D drive corporate entrepreneurship whilst also fulfilling its traditional obligations to the company? In doing so we identify the behavioural, organisational and strategic characteristics that R&D managers must implement if they are to become the drivers of corporate entrepreneurship, and we identify some of the fundamental tensions that managers need to overcome in order to achieve these.

## **Emergence of a Research and Technology Market**

At the same time as being promoted from within, the scope and potential benefits of R&D entrepreneurship are also being extended by the emergence of a research and technology market which broadens the potential sources of knowledge, technology and innovation for the firm. Furthermore, a market for research and technology means that customers for corporate R&D outputs now potentially extend beyond the boundaries of the firm.<sup>10</sup> Simply put, this enables R&D to generate revenues from licensing, technical services and sale (of technologies or new businesses) and reap immediate cash value for their efforts. This means that new businesses or product lines emerging from R&D activities can always generate value for the company- either by spinning them into the business portfolio, or spinning them out and generating cash value. Essentially, the research & technology market provides a 'Plan B'. However, the rewards can only be reaped if R&D functions become more entrepreneurial and business aligned in their approach to R&D.

The emerging characteristics of technology management identified above essentially represent a multiplication of the roles for R&D, of which entrepreneurship in R&D is the most recent addition. Rather than simply enhancing corporate performance through an incremental improvement of products and processes, R&D can now play a greatly enhanced and central role in corporate entrepreneurship by driving corporate renewal, and generating revenues (see figure 1 below). In order to achieve this, however, it requires significant behavioural, organisational and strategic re-engineering. The R&D function that can reap the rewards is a long way from the isolated R&D function of old, styled as an expensive cost centre and a financial drain on the corporation.

Figure 1: The multiplication of roles for R&D in the New Economy



### The Cases

Exploratory, semi-structured interviews, lasting between 40 and 90 minutes were conducted with nine member companies of the EIRMA. The companies were selected to be representative of the EIRMA membership in terms of both size and sector. Additional data was gathered from EIRMA’s programme of Roundtable meetings and Special Interest Groups bringing together a total data source of over 50 European firms.

Figure 2: Characteristics of the sample firms

	Primary Industries	Nationality	Emp <sup>ees</sup>	Revenue
<b>DSM</b>	Speciality chemicals	Dutch	26 000	€8bn
<b>NKT</b>	Fibre optics	Danish	5 000	€672mn
<b>Siemens</b>	Electronics, engineering	German	417 000	€74.2bn
<b>Dow Corning</b>	Chemicals	American	9 000	€2.4bn
<b>Shell</b>	Oil exploration, extraction & production	Anglo-Dutch	119 000	€207bn
<b>Avecia</b>	Chemicals, Pharmaceuticals	UK	6 000	€714mn
<b>Lubrizol</b>	Chemicals	American	8 000	€1.6bn
<b>Haldor Topsoe</b>	Chemical plants	Danish	2 000	€269mn
<b>Imerys</b>	Mining, speciality minerals	Anglo-French	14 000	€2.2bn

By using a detailed interview approach we capture the operational realities of entrepreneurial spirit in R&D and explore how entrepreneurial activities are supported through behavioural, organisational, and strategic actions. By including each of these levels within the scope of our research we highlight the fact that individual entrepreneurship needs to be harnessed by the organisation if it is to be transformed into something of value to the corporation.<sup>11</sup> The oft cited sentiment that investing in research can be akin to ‘pushing a piece of string’ can equally be applied to entrepreneurial activity within the organisation, the difference being that this piece of string might well have a fuse at the end of it and be rather explosive. This conceptualisation acknowledges the importance of the individual – after all, all entrepreneurial events depend upon the creative acts of individuals – whilst also acknowledging that in order for these to be augmented, harnessed by the organisation, and translated into corporate entrepreneurship, organisational support to entrepreneurs must be present and entrepreneurial activity must be institutionalised.<sup>12</sup>

In this way, our research findings are reported under three main headings.

- In **R&D People as Entrepreneurs** we consider how individuals within the R&D function can become more entrepreneurial.
- In **R&D in Cross-Functional Networks** we look at how the R&D function can harness itself to the rest of the corporation and how it can implement management approaches to support entrepreneurial spirit amongst its staff.
- In **R&D as the Driver of Corporate Entrepreneurship** we establish how R&D as an entity can become more entrepreneurial by developing strategies that extract the maximum value out of R&D activities and exploit the research and technology market. Such strategies include the introduction of new business development activities, corporate venturing and spinning-out, and create the potential to establish R&D as the driver of corporate entrepreneurship.

## **R&D People as Entrepreneurs**

All entrepreneurial events originate in the creative acts of individuals. Therefore, in order to create an entrepreneurial R&D function capable of driving corporate entrepreneurship, we can assume that a key goal is to increase creativity and entrepreneurial activity undertaken by researchers. R&D managers must make R&D *work* for the company by focusing researchers on what the business needs and creating entrepreneurs out of R&D staff. But, how do you transform the lab happy scientist of the ivory tower<sup>13</sup> into the go getting entrepreneur required for entrepreneurial R&D functions?

## The limitations of the individual researcher

Most papers talk of the need for entrepreneurial 'employees', making no distinction between types of employee. Consequently they avoid addressing some of the potential conflicts that logically arise when focusing on scientists. One of the most universal findings of our study is that rather than relying on recruiting as many entrepreneurial individuals as possible firms should create entrepreneurial teams, led by entrepreneurs but not composed entirely of them. Two clear rationales for this emerge from the conflicts between the roles and characteristics of researcher, manager and entrepreneur. Firstly, the propensity to be entrepreneurial is largely governed by character traits<sup>14</sup> and introverted scientists may not make good entrepreneurs. Furthermore, the process of taking a research idea through to new business creation is a complex one; it requires a business plan, knowledge of industry, marketing research and analysis, competitive analysis, financial projections, operations, management, R&D, critical risks analysis, and timetables. All of these skills are unlikely to be embodied in one individual and in a large company the development of a new business is rarely a one-man crusade. Secondly, a business full of entrepreneurs would be exceptionally hard to manage. If these assumptions are true then it is neither realistic nor desirable to have an R&D department full of entrepreneurs.

Our research did reveal such conflicts. The first to emerge related to the potential opposition between the prevailing extroverted characteristics of the entrepreneur and the prevailing introverted characteristics of the scientist. We were very aware initially of dealing with stereotypes but nevertheless our discussions with R&D managers provided substantial material to support the existence of a mismatch between these two roles. Entrepreneurs have been identified as having a risk taking propensity, a desire for autonomy, a need for achievement, goal orientation, and an internal locus of control.<sup>15</sup> They also have an instinctive ability to recognise opportunities with the potential for exploitation, alongside the ability to sell their ideas. Whilst some scientists have become successful entrepreneurs based on technical ability alone, the chances of commercial success are much greater if they are able to develop additional business management skills with which to exploit their expertise.<sup>16</sup> Several of our respondents felt that not all scientists possess the drive required for cut and thrust business activities or the extrovert character of an entrepreneur.

'The networking experience can be quite traumatic... .. it's a great challenge for us to be entrepreneurial because we [scientists] can be quite shy and reserved, we might prefer lab based work.' Dow Corning

Not only is the technical entrepreneur a rarity, as an individual who combines both technical and business ability with extroverted character traits, the skills for entrepreneurship are also hard to acquire. There was a general

consensus amongst respondents that because entrepreneurialism is governed largely by character traits it cannot be increased greatly through teaching. Although an individual may have potential that can be developed, the propensity to be entrepreneurial is predicted more by 'people's attitudes when they join [the company] than the training they are given after they've joined'.

With the significant 'have it, have not' aspect of entrepreneurship established it becomes clear that the recruitment of those who naturally possess entrepreneurial characteristics is a key factor in introducing entrepreneurship to the R&D function. In order to capture these individuals, the recruitment of R&D professionals has become increasingly sophisticated in all the firms in our sample. All of the respondents confirmed that recruitment now includes criteria beyond the necessary minimum technical skills required for a position. In addition to technical criteria, behavioural competences and character traits are increasingly considered when recruiting researchers enabling recruiters to identify candidates with entrepreneurial potential. Avecia places a high value on behavioural competencies.

'We have maybe 24 or 25 [behavioural] competencies that we recruit against. To give you a few examples we have results orientation, someone who's very focused on achieving goals rather than just enjoying the ride, critical thinking, and interpersonal awareness and interpersonal skills are also very important. We particularly focus on competencies we think are difficult to develop, because you can always train people up in areas which can be developed.'

In NKT all recruitment has a personality-testing component in the interview to ensure that new recruits have sufficient social skills. In addition to this, candidates for higher management positions face an even more rigorous test of their character, sharpness, and ability to recognise options and formulate solutions.

'We have developed our own CEO test and I would guess that 70% of the people we have tested, who we thought would be fantastic [based on technical skills and interview], have failed. We don't ask questions, you don't find anything out by asking questions. They are put in a [role play] situation where they have to act on common sense ...they cannot ask anybody and there is no right answer but afterwards we ask 'why didn't you do this?' 'why did you do that?'. We are trying to indicate that [the candidate] is not right in the head. Then you feel whether or not [the candidate] is solid.'

In addition to the potential mismatch between the characteristics of natural scientists and natural entrepreneurs, a second potential conflict- between being entrepreneurial and being managed- was also identified. In order to succeed, entrepreneurs often need to insist that they prevail; there is a tendency for them to become tyrannical and consequently addicted to winning arguments, even in cases where they prove to be wrong.<sup>17</sup> Entrepreneurs are characterised by their drive and ability to act spontaneously and exploit opportunity before others. On the one hand, entrepreneurial activities can be severely hindered by the bureaucracy of management systems. On the other, entrepreneurial activities, if performed, can cause major problems for managers who inevitably need to exert a degree of control on proceedings, especially on high cost R&D projects. The fine line that the corporate

entrepreneur treads within a company is aptly illustrated by the story recounted by one respondent; a senior, high ranking colleague, widely respected within the R&D community and successful with numerous spin-out companies, was 'encouraged to leave' after one too many clashes with the Board.

The role of the R&D entrepreneur therefore is finely balanced requiring constant and sensitive management. The type of managerial options that support and constrain entrepreneurs to the right degree will be discussed later in the paper. More immediately, the constraints that have been identified above- that not all scientists make natural entrepreneurs, and that those with entrepreneurial characteristics are more likely to clash with management- combine to create a robust rationale for entrepreneurial teams. When talking about increasing the entrepreneurial spirit of R&D we must step away from the tendency to say in general terms that 'researchers must be made more entrepreneurial'. Instead, entrepreneurial spirit can be generated by creating dynamic teams drawing together the scientific expertise of some with the entrepreneurial drive of others.

## **Entrepreneurial spirit through teams rather than individuals**

NKT, which is a noted practitioner of corporate entrepreneurship and has established stringent recruitment procedures including personality testing and role-play, recognises this need for flexibility. The interviewee admitted that it was sometimes deemed so important to gain access to specific scientific expertise that researchers were recruited against the will of Human Resources who were concerned with the lack of behavioural or social skills, let alone entrepreneurial skills.

'We also have quite often been in a situation where this person we know is odd, a nerd, or stupid, but we take the risk because we want this [specific] capability. And those in human resources say you are crazy. But we want those skills. Some one else can be sociable.' NKT

This approach recognises that although it is desirable to have a few extraordinary people whose role it is to champion and lead entrepreneurial teams, the key to an entrepreneurial R&D function is to have the correct mixture of scientific, business and entrepreneurial skills and to recognise in which task, be it pioneer or support, people will play their most effective role. R&D departments, even those with an entrepreneurial posture, can find a role for skilled researchers less inclined towards entrepreneurial activities. After all, despite the newly emerging entrepreneurial role for R&D, it does still have to provide the technology base for the company where incremental technological improvement is still important. A company should work like a well-oiled machine- all the parts must be there, but there is no need to duplicate one component more than necessary- not everybody needs to be an entrepreneur to create a system of corporate entrepreneurship. One respondent offered the metaphor of the Tour de France.

'You will never win the Tour de France if everyone is a Lance Armstrong on the team because then they will start to fight each other. So you have to have one or two Armstrongs, and then the supporters, the water carriers, those who have the bottles to give to the riders, and nothing comes up unless you have these people.' NKT

In this way, the company ensures that the right people are in the right place. Individuals identified as having entrepreneurial potential can be targeted for entrepreneurial activities, however, it may be a waste of time to enforce such behaviour on those that do not naturally possess it. Entrepreneurial teams ensure that everyone is allocated to their most effective role; entrepreneurs can lead, champion and drive the teams forward on entrepreneurial projects, business and marketing professionals can ensure that research has commercial potential, and researchers can apply their technical expertise.

### Business alignment

We have established that entrepreneurial activity is something difficult to impose on people and that R&D can drive corporate entrepreneurship via entrepreneurial teams, led by entrepreneurial individuals but not entirely composed of them. However, it is important to distinguish between the terms 'entrepreneurial' and 'business aligned' (see figure 3, below). Whilst not everyone has the propensity to be entrepreneurial, everyone can be aware of commercial issues through training and experience, and a researcher who is aware of the need for business alignment and is also suitably motivated on business issues is a very useful addition to an entrepreneurial R&D function; they may not necessarily have the necessary characteristics to push forwards radical ideas or to manage a spin-off, but the research they produce will at least be geared to create value for the company. Training, therefore, is a key requirement for creating an R&D department with entrepreneurial spirit.

**Figure 3:** Entrepreneur versus Business Aligned

	<b>Character Traits</b>	<b>Managerial Action</b>
<b>Entrepreneur</b>	Recognise opportunities / creative Generate options Excellent communicators Effective leaders of entrepreneurial teams.	Recruitment Sensitive management- let them strive for their goals but re-iterate the need for a degree of business alignment. Championing Intrapreneurs at grass roots can be protected 'below the radar'.
<b>Business Aligned</b>	Trained in business matters and aware of the corporate strategy and the need for research to be business aligned. Effective in entrepreneurial teams.	Training, Awards, Employee mobility. Need strong leadership from Intrapreneurs.

The goal is to create an organisation of individuals reflecting the familiar aphorism: 'T' shaped knowledge- they have depth of knowledge in one key area, which is supported by a breadth of knowledge in other scientific

disciplines and in business and market issues. A broad foundation of knowledge such as this enables individuals to recognise opportunities, in particular opportunities for cross-discipline projects, and assess their commercial potential. Several of our companies organised formal cross-business workshops on issues relating to corporate culture, business structure, markets and strategy. Our respondent from Siemens suggested that the most effective training for business alignment is on the job; researchers in the Siemens Corporate Technology department became keenly aware of the need for business alignment when the proportion of their funding coming directly from contracts with Siemens customers was increased from 1/3 to 2/3 between 1996 and 1999 (with a corresponding decrease in corporate funding). They were under added pressure due to the fact that business units were free to source their technology from outside the corporation. As a result of the changes researchers were suddenly required to approach businesses and sell their services. In effect, business alignment and customer satisfaction became the crux of their survival, a motivation that was just as effective as any formal training regime. Indeed, the changes are widely agreed to have improved technology transfer between corporate technology and the business units and corporate technology wins the vast majority of business unit contracts despite often being more expensive than alternate external sources.

## **R&D In Cross-Functional Networks**

In the previous section we noted that genuine technical entrepreneurs need to have a strong mix of technical and business skills alongside entrepreneurial characteristics and consequently are something of a rarity. We have also explored why it is neither possible nor desirable to have many of these individuals within the R&D function. Rather than through an R&D function full of entrepreneurs, entrepreneurial spirit can be created through entrepreneurial teams, led by entrepreneurs but composed mainly of business-aligned researchers.

However, to ensure that entrepreneurialism is diffused beyond R&D and throughout the organisation it is necessary to link business aligned researchers and individuals (often working in other functions) who have professional marketing and commercialisation skills. Entrepreneurial spirit in R&D is as much about connecting R&D to the rest of the organisation as it is about generating a function filled with entrepreneurial individuals.

The skills profile of R&D must be subject to a significant shift from pure technical expertise to more hybrid technical and commercial expertise. Organisational structures can ensure that the best scientific brains in the corporation are in close contact with the best business development and marketing brains in the corporation. Cross-functional collaboration drives corporate entrepreneurship by combining disparate but complementary skills in a dynamic group. Cross-functional teams also provide a structure to support early commercial

involvement in R&D projects. The benefits of this are two fold: Firstly, commercial people are generally closer to the customer and more aware of the market and business climate. Marketers have the responsibility for forecasting and creating new markets and then also for 'educating' these markets.<sup>18</sup> In this way they can add value to R&D projects by ensuring that work is business aligned and generate ideas by combining identified market needs and future market scenarios with the technological knowledge of the research staff. Indeed, their expertise can provide the 'bigger picture' and aid in identifying more fundamental 3rd horizon options that will support the company's future. Secondly, the early involvement of commercial people in R&D projects ensures that researchers do not feel that their projects are being hi-jacked when commercial people finally become involved or, perhaps worse, that good ideas are left on the shelf simply because of a lack of ownership.

Our companies were attempting to bridge the gap by various means. NKT had restructured its Research Group into a Research and Innovation Group by recruiting people with business, commercial and marketing backgrounds to work alongside scientists. This was a fairly small-scale operation with a total of about 15 people in the group. However, the concept can also work on a much larger scale. To marry research and commercial expertise DSM established a substantial new business group, the Venturing and Business Development Group, in 2001. Working in close collaboration with researchers and technicians they engage in business development projects, which eventually turn into internal start-ups. Furthermore they select external start-up companies to invest in via venturing (8, up to now). They have also spun out two start-ups, which were founded around non-core technologies.

The new division works very closely with R&D and is directly involved in co-steering corporate technological competencies. Many of the ideas for new R&D projects and new businesses come from the venturing and business development group.

'Our projects in many cases are started because we see a trend in the market and we see an opportunity and say, 'do we have everything in-house?'. If not, we have to develop this and we come up with a proposal and together with research we develop a project plan.' DSM

Although we promote the effectiveness of cross-functional collaboration we do not suggest that it is an easy task to establish cross-functional teams. The sometimes acrimonious dichotomy of hard and soft science means that the skills of one, which are equally important to entrepreneurialism in R&D, often get dismissed by the other.

Several respondents highlighted these problems:

'I think [the scientists] consider that they are being a kind of teacher to the [business people], they have to explain why this, why that and for them it is hard to accept the value of the questions that are asked by business because they are different questions than the technical people would ask

themselves. They feel that it is always them who are delivering data to [the business people], and that the [business people] are just questioning, not delivering any results.' NKT

'I suspect the most difficult thing is making research people aware of business. They don't always want to be aware of business and sometimes are not actually very good at it. The link between R&D and practical application is very difficult because research workers can be a little bit arrogant and production people can be perhaps a little bit non-receptive because they have different demands on their time.' Imerys

Despite these difficulties, connecting R&D to other functions, and in particular connecting it to professional business development and marketing expertise, was the primary organisational priority of our firms. The promotion of staff mobility was an important organisational factor and widely believed to be instrumental in bridging the gap, and in some cases legacy of mistrust, between scientists and other business functions. It is achieved by companies in various ways; in large firms people can be moved between R&D and business functions within the corporation to avoid stagnation and in some of our companies the process was highly managed with Personal Development or Career Paths formally designed to include several parts of the company. Researchers at DSM have Personal Development Paths that are regularly reviewed. A move to the Venturing and Business Development Group is a highly popular choice for researchers, made more so by share option schemes on new projects they may become involved in. At Siemens high level managers in Corporate Technology can only be recruited once they have worked in at least two other business functions or business units in the corporation.

However, the degree to which mobility was encouraged varied across companies and it is necessary to balance the disadvantage of losing well-trained staff and the benefits of bringing in new talent and maintaining continuously evolving and dynamic groups.

'When you hire people you always lose half a year, at least, before you have people well trained and doing the right thing on the job'. DSM

Siemens looks to achieve an annual employee turnover rate of between 5-8% in their central research and technology facility. Researchers from the central facility are encouraged to move out to the operating units in order to hire young people and keep the average age between 35 and 38. Elsewhere, Imerys promotes an 'ideal profile' of 5 years in R&D and then movement out to production or sales. In decentralised R&D structures there was support for sideways, cross business mobility. Managers may be reluctant to release their best staff, who they will often claim to be indispensable, to other business units. However, at Siemens this is overcome by rewarding management decisions to facilitate mobility. At Haldor Topsoe, it was proposed that, although managers may be reluctant to lose good staff, the benefits of having an ambassador for your R&D group in another business goes some way to mitigating this especially in complex corporations where research may be conducted on a contract basis and business units may be competing with each other.

'I have the basic approach that people if they have a talent for doing other things than research, they should move to another part of the company after being here a few years. So when we have to cut down in R&D I say to the management group that the best way to cut down is to move the very best people to other divisions. So recently I have lost two of my best department managers, but I don't consider this to be a loss because now I have an ambassador for R&D in that division. So if you have to have the courage to say that if you lose your best people you have won and so far we have had no problem getting good people.' Haldor Topsoe

In smaller firms it is not always possible to maintain mobility within the firm. It may be beneficial to let them to leave the company but then maintain them as part of the wider network within which the company sits. NKT has just emerged from a period of prolific new business development and has a high spin-out and divestment rate. It encourages research staff to move into the new businesses, even those that will be divested, resulting in a research group employee turnover of between 25-30%.

'I think this is very valuable for an organisation like this because we always have to come up with new capabilities, for either existing companies or potential new companies. And this you cannot base on people who have, so to speak, delivered their capabilities to a new start-up. If the idea is that you should always be an organisation that is creating something new then I think that it is very important always to have access to new people. It is also for young people much more fun to be in a place with new people.' NKT

In this way they can also help to perpetuate a wider regional entrepreneurial system and also to develop a dense network of people beyond the boundaries of the firm.

## **Management Approaches to Support Entrepreneurial Spirit**

Because of the inherent uncertainty of entrepreneurial and innovative activities management cannot use traditional methods of organisational control such as outcome based objectives or strict procedural regulation. A balance needs to be found to ensure that entrepreneurs don't pursue maverick projects, but that entrepreneurial spirit is not quashed by overly bureaucratic management. If entrepreneurial spirit is to be harboured governance should not be prescriptive but guiding; managers must provide direction and support<sup>19</sup> and lead by example by taking an entrepreneurial posture.<sup>20</sup> Top management play a critical role in the generation of entrepreneurial spirit in R&D, both through the corporate culture and through the organisational and management processes they employ. The support role is critical. NKT felt strongly that the support culture it has established is one of its biggest assets.

'There's an extreme amount of attention to what's going on, a lot of follow up. But organising idea generation systems, having boxes where you can out in your ideas that in my opinion is the opposite of entrepreneurial. It's very much the culture. One of the big things we have accomplished, in my opinion, is to get the whole of [the corporation] to accept its role as a supporter and not just a controlling unit. I think we have managed to make [the corporation] a good nurse for supporting companies.' NKT

Furthermore, the development of new ideas and projects is dependent on responsive management. Researchers, and indeed other staff, need to know that if they come forward with an idea that there is a vehicle for assessing it and taking it forward.

Birkenshaw argues that setting appropriate 'boundaries' is one of the key pillars for creating an environment for corporate entrepreneurship.<sup>21</sup> Boundaries and broad targets should be well defined creating a culture where researchers know that their innovative and intrapreneurial activities will be supported within certain parameters. Conversely, goal achievement should be a 'high space' activity in which the individual is given significant autonomy in their activities'.<sup>22</sup> Several companies were attempting to demonstrate that their boundaries encompassed innovation and corporate entrepreneurship by creating company wide missions, from which the R&D targets are derived, for example, DSM has 'Vision 2005', Shell, 'Game Changer System', and Siemens 'Technopreneurship'. Although often lacking operational substance, if they are well promoted throughout the corporation, their potential for energising staff should not be underestimated. Indeed the Japanese approach to knowledge management, espoused by Ikujiro Nonaka and widely adopted by western scholars, is based upon the use of such metaphors.<sup>23</sup> Management processes are clearly of paramount importance, but the corporation can play an important role by endorsing entrepreneurial spirit at the very top.

*'People identify themselves with the concept, start to be believers, and behave like a champion.'*  
DSM

Goal achievement should be less tightly governed. Our respondent from Dow Corning promoted the benefits of 'working below the radar, below the risk. The risk is essentially passed onto the next level.' This is critical for creating the necessary environment for breakthrough research. The same degree of space was evident in other companies. Although stage gate was used in all of our companies to ensure that the right people were in the right place at the right time, it was used with a degree of caution. In particular, it was emphasised several times that stage gate should not be used pre-project or at the very early stages of a project.

*'You have to be deep down into development before you can use the stage gate model, for research I am not very in favour of that. In the research stage, the exploratory, the entrepreneurial stage, one must be careful not to have too stiff systems. You can easily find people that will ask you, 'do you have a project that we can criticise?', and that is not the right attitude.'* Haldor Topsoe

High space goal achievement can also be promoted by granting free time for researchers providing them with an autonomous workspace. Despite increasing pressure from more clearly defined project work it was still a well-established practice. The amount of free time varied from 10% to 40% and in some companies was not officially stated but was just part of the culture of the lab, one respondent suggested that 'if you have a good researcher, you can't stop them from doing that anyway'. Targets were generally not directed to the 'free time' and the criteria were generally to remain within the confines of the company's core competencies and to be working on something considered to be important for the next generation of technology. However, the degree of space given to researchers varied across companies and provides one effective measure of a company's entrepreneurial

posture. Our respondent from NKT reported that a researcher had been conducting research based on science outside the strictly defined competencies of the company.

‘In the lab here, one person is doing whatever he likes, and he has quite a lot of good ideas, proposals, but it is because he has already tried them all out in the lab, he sends in the proposal if it turns out it works in the lab! The management know he is doing it like this, but they close their eyes and then they hope that something pops up.’ NKT

## R&D Function as Driver of Corporate Entrepreneurship

Using responsive, high space management systems is a successful way of ensuring that the corporation has an entrepreneurial posture and creates the correct culture to promote entrepreneurial spirit amongst its researchers and employees. However, in order for R&D led entrepreneurship to drive corporate renewal in real quantifiable ways, it needs to be institutionalised and integrated into corporate strategy. Large-scale strategic entrepreneurial behaviour involves activities such as new business creation, corporate venturing, spinning-in and spinning-out. These require more substantial structural change, but if successful can renew the company, change the business and technology portfolio, exploit new external technologies and generate real cash value for the corporation. R&D can be at the centre of all these activities.

New business creation is a fundamental component of technology led corporate entrepreneurship and can be founded upon technology developed within the company’s own R&D facilities, or on technology from external sources. However, the seed stages of business development are very uncertain and they need to be protected from the strict results orientation of the corporate mainstream where entrepreneurial activities can still be stifled. Several companies have responded seriously to the challenge by developing support infrastructures for new business development. These come in the form of incubators and strategies for spinning-out new businesses. Siemens is pursuing a strategy that supports new business creation as a serious option when promising new technologies are identified and it is given substantial corporate resources.

‘We have two incubators, one in Munich and one close to Berkeley California. Both organisations try to get those technologies to the market that were developed internally but are no longer used by the operating units due to some business development. So if we have a very good technology and nobody in [the corporation] is committed to make use of that we are free to put that in a kind of venture funded company. In the last 3 or 4 years after the establishment of these incubators we have 8 to 10 businesses on the market even in these circumstances that are quite difficult, and they are quite, quite successful.’ Siemens

The strategy of new business development is proving so successful in this company that it even envisages a time when incubator successes would provide the funding for corporate R&D (in addition to contracts with businesses) eliminating the need for central funding.

‘ Actually, we really think for the future of using these spin-off firms as probable sources of revenue for corporate technology within the company, it would help to reduce that one third of

money that we get from [the corporation] once we get money from our own companies outside when they are bought to the stock market. That is one of the visions behind that approach.' Siemens

This may be some time off as the incubators returned positive financial flows for the first time this year and Corporate Technology is still a cost centre. However, the revenues that they generate enable them to significantly reduce their burden on the corporation and donate sums of money that can buy them serious favour. Furthermore, the benefits of the incubators go beyond revenue and this was never intended to be their *raison d'être*. In Siemens there is a strong belief that incubators or business development spaces are essential for increasing the entrepreneurial spirit of R&D. If R&D staff are being told they have to become more entrepreneurial on one hand then it is crucial that they are given the space in which to do so on the other.

The Venturing and Business Development Group provides a champion and a haven for new business development in DSM. One of their strategies is to spin-out new businesses and maintain various degrees of investment in them according to their fit with corporate strategy. In this way the new business retains the feel of a small technology based start-up whilst benefiting from the expertise and resources of the parent company. When the technology is more established, the parent company can then make a decision about the degree of integration that should be established. It is an inherently flexible form of organisation because operational and equity linkages can be weakened or severed if the necessary complementarity is not achieved. Alternatively, the business can be retained as a periphery business or re-integrated into the main portfolio if at a later stage key complementarities are found.

New business development functions allow entrepreneurs to remain involved in the dynamic, exciting, entrepreneurial phase of new business development without them having to forfeit this as the business grows. There is perhaps an inherent conflict for the entrepreneur who succeeds and becomes the CEO of a company.

'My former boss founded many companies and is still involved in a few of them. One was built from 40 to 400 people under his guidance and then merged with a larger firm. He was on the Board. But then he said, 'these are not nice jobs, because they pay me to prevent risk'. But in the case of venturing and business development his salary is related to managing risk, not to prevent taking any risk.' *DSM*.

In addition to developing new business founded on research and technology developed in house, companies can increasingly exploit the proliferation of new technology sources in the external research and technology market through corporate venturing. Corporate venturing and spinning-in external technology has become a key technology acquisition strategy and it plays a key role in the search for new exploitable opportunities.

In addition to the process of developing new businesses, the practice of divesting new businesses is also a key activity of the corporate entrepreneur. Divestments, where firms relinquish all or most of their interests in a business are frequently perceived as indicative of a struggling firm: downsizing and losing dissatisfied employees to other projects. Many are a result of a sudden need to slim down activities. This was something that was keenly felt by NKT at the burst of the high tech bubble in 2001. NKT has been incredibly effective in creating a culture of corporate entrepreneurship and in hindsight feel that they started up too many new business ventures relative to the size of their modest 5000 employee group. However, the existence of a growing market for research and technology proved to offer a very lucrative escape route. Spinning-off activities proved to be an effective way of cashing in the value from businesses that they no longer felt were of central importance to the corporation.

*'Very recently we have just sold off our last activity, it was a very good story. We came out of all this hype with a lot of money, and we didn't spend it all, I think it has been a great event. What we did in this period [of prolific new business creation and spin-out] is still considered as being the Hans Christian Anderson story of Danish Business. If you talk of the sale of GIGA [to Intel] everyone in the business community knows of this.'* NKT

Finally, the ability to demonstrate value from the R&D department through licensing, spin-outs and divestments was held to be important for demonstrating value and perpetuating entrepreneurial spirit in R&D. Not least because such activities enable the R&D Director, or the Business Development Director to go to the board and demonstrate the value they are creating.

*'The advantage is that we are really allowed to spin-off. We can cash value created by us in time. To explain why we sell it, we tell them that, after checking and finding out that none of [our own] businesses wanted to have it, we succeeded in finding a very good foster parent who is willing to pay a large amount of money for it.'* DSM

Demonstrating value in this way is an effective method for promoting R&D within the wider corporation and so maintaining its status as a driver of the corporation, and corporate entrepreneurship.

## **Conclusions**

The call to increase the entrepreneurial spirit of R&D is one that is likely to get louder over coming years, addressing as it does two catalysts for change: the growing success of corporate entrepreneurship strategies providing the internal push and the emergence of a research and technology market providing the pull. We have shown that the positioning of R&D as the driver of corporate entrepreneurship represents a new central role for an increasingly embattled R&D. If it can deliver in this role R&D becomes the driver of corporate renewal, the bridge to the external R&D environment, and a source of quantifiable cash value.

More and more firms do indeed shout about their 'entrepreneurial spirit' and there are genuinely new or, at least re-emerging activities here; the promotion of R&D as the engine of corporate renewal through new business development and the evolution of R&D functions into cost neutral or profit centres represent step changes. However, entrepreneurial spirit seems to be a somewhat 'sexed-up' term that risks concealing the vital role of more mundane activities, such as the integration of R&D into wider corporate networks and the co-existence of technical and commercial expertise, in re-establishing the credibility of corporate R&D functions. Furthermore a general call to increase the entrepreneurial spirit of R&D may be misleading; we find that attempts to increase the entrepreneurial posture of all R&D employees are neither realistic nor desirable. Not all scientists will be good entrepreneurs, and entrepreneurs are hard to manage. Rather than relying on entrepreneurial individuals one of the key factors for generating technology led entrepreneurship is the creation of teams composed mainly of business aligned researchers but headed by entrepreneurial leaders.

Finally, the emergence of a research and technology market genuinely broadens the scope for R&D based entrepreneurial activity by enabling R&D functions to create value, through new business development, licensing and spinning-out, and to add value through corporate venturing and spinning-in. Such structures create the ideal environment for the entrepreneur, drive corporate renewal and generate revenue. R&D functions have been revitalised by the addition of business development activities and for companies wishing to institutionalise entrepreneurial activity the acquisition of business development skills in this way is essential; it provides both an avenue for value creation and an essential play ground for R&D entrepreneurs.

It is essential that the interactive nature of corporate entrepreneurship is understood; both individual entrepreneurship and the structures to support institutionalised entrepreneurial activity are needed to maximise the role of R&D in corporate renewal. A failing in the performance of one can debilitate the efforts of the other: an R&D function that makes every effort to establish an entrepreneurial strategy will fail if it has no entrepreneurs, and similarly, if a potential entrepreneur feels that the culture within the organisation does not support their efforts, entrepreneurial activity will probably not occur. Companies should strive to create an entrepreneurial machine that translates the creativity of individuals into corporate renewal by supporting cross-functional teams and institutionalised entrepreneurial activities. Firms attempting to increase the entrepreneurial spirit of R&D will undoubtedly face challenges but we have shown that they can be overcome through careful recruitment, training, employee development, and structuring. If they succeed the rewards are great: a chance to re-establish R&D at the heart of the organisation.

## Notes

- <sup>1</sup> This study was supported by a grant from the European Industrial Research Management Association through the Hendrik Casimir Award (EIRMA) and the paper is based upon a presentation given to the EIRMA Annual Conference 'Increasing the Entrepreneurial Spirit of R&D' on 28th May 2004. The author is grateful to the EIRMA secretariat and, in particular, to Andrew Dearing for his comments and helpful advice throughout this project. The author also wishes to thank Professor Luke Georghiou of Manchester Business School whose comments and advice have helped to shape this paper.
- <sup>2</sup> Due to its uncertain nature the kind of basic research investments commonly made in corporate R&D are frequently the first to be cut in times of tightening margins. As one interviewee in Whittington's case study of centralised in-house R&D functions said 'the easiest way to make a profit is to stop doing long term R&D.' R. Whittington, "The Changing Structures of R&D: from centralization to fragmentation," in R. Loveridge and M. Pitt, eds, *The Strategic Management of Technological Innovation*, eds., (Chichester, Wiley, 1990).
- <sup>3</sup> In response to slow progress towards the Lisbon Target there have been calls to develop an enterprise culture in R&D. See Communication from the Commission, "Innovation Policy: the Union's approach in the context of the Lisbon Strategy," COM (2003) 112, Brussels, 11.3.2003.
- <sup>4</sup> Several studies now exist that support the positive relationship between corporate entrepreneurship and corporate performance. See C.J. Goosen, T.J. de Coning, and E. Smit, "Corporate Entrepreneurship and Financial Performance: the role of management," *South African Journal of Business Management*, 33/4 (2002): 21-27; J. Covin, and D. Slevin, "A Conceptual Model of Entrepreneurship as Firm Behaviour," *Entrepreneurship Theory and Practice*, 16/1 (1991): 7-19; and S. Zahra, and J. Covin, "Contextual Influences on the Corporate Entrepreneurship Performance Relationship: a longitudinal analysis," *Journal of Business Venturing*, 10 (1995): 43-58.
- <sup>5</sup> This takes us away from the traditional image of the entrepreneur as an individual spearheading his own organisation. However, corporate entrepreneurship may indeed be an increasingly appealing prospect for the technical entrepreneur who is traditionally assumed to prefer operating beyond the constraints of the corporation. Being entrepreneurial within a corporation avoids many of the pitfalls of the loan entrepreneur such as lack of technical resources, lack of finance, and lack of management skills and team leadership, which can all act as a bottleneck to growth.
- <sup>6</sup> R.D Russel, "Developing a process model of intrapreneurial systems: a cognitive mapping approach," *Entrepreneurship Theory and Practice*, (Spring 1999): 65-84.
- <sup>7</sup> Although most companies have settled for a hybrid organisation with both central and decentralised R&D activities, the corporate R&D function is under increasing scrutiny. An EIRMA survey of R&D practices in its member firms found a sea change index (the number of respondents reporting increasing trends - the number of respondents reporting decreasing trends / the total number of respondents) of 44% expecting more use of active performance benchmarks for corporate R&D in the future, and of 32% expecting more active monitoring of R&D decisions. A summary of the report can be found at [www.eirma.org/f3/showthread.php?t=80](http://www.eirma.org/f3/showthread.php?t=80).
- <sup>8</sup> EIRMA is the European sister organisation of the Industrial Research Institute and has some 155 member companies based throughout Europe. Its website can be found at [www.eirma.org](http://www.eirma.org)
- <sup>9</sup> In particular, the interactive nature of key corporate entrepreneurship facilitating conditions such as organisational characteristics, individual characteristics, external catalysts and resource availability are discussed in J.S. Hornsby, D.W. Naffziger, D.F. Kuratko, and R.V. Montagno, "An Interactive Model of the Corporate Entrepreneurship Process," *Entrepreneurship Theory and Practice*, 17/2 (Winter 1993): 29-38.
- <sup>10</sup> R. Coombs and L. Georghiou have created the term New Industrial Ecology to represent more open and distributed innovation systems where technology is developed across multiple institutions and located in a research and technology market, which is fuelled by new technology based firms, contract research organisations, and venture and corporate venture capital. See R. Coombs and L. Georghiou, "The New Industrial Ecology," *Science*, 296 (April 2002).
- <sup>11</sup> In J.M. Stopford, and W.F. Baden-Fuller, "Creating corporate entrepreneurship," *Strategic Management Journal*, 15/7 (1994): 521-536, Stopford and Baden-Fuller similarly recognise the interactive nature of a successful corporate entrepreneurship model. They identify three stages in the corporate entrepreneurship process; individual entrepreneurship, the process of corporate renewal, and frame-breaking change. They argue that these are sequential, and that entrepreneurial characteristics become more diffuse throughout the firm with each stage.
- <sup>12</sup> The interactive nature of key corporate entrepreneurship facilitating conditions such as organisational characteristics, individual characteristics, external catalysts and resource availability has been noted by Hornsby, Naffziger, Kuratko, and Montagno, op. cit.

- <sup>13</sup> The ivory tower represents the so-called 1st generation of R&D which conformed to the linear model of innovation and where basic research was conducted in autonomous laboratories relatively unscathed by corporate targets or strategy. See P. Roussel, K. Saad and T. Erickson, "Third Generation R&D: managing the link to strategy," (Harvard Business School Press, Boston, 1991), for a discussion of 1st, 2nd and 3rd generations of R&D management.
- <sup>14</sup> Hornsby, Naffziger, Kuratko, and Montagno, op. cit.
- <sup>15</sup> Ibid.
- <sup>16</sup> R.P. Oakey, "Technical entrepreneurship in high technology small firms: some observations on the implications for management," *Technovation*, 23 (2003): 679-688.
- <sup>17</sup> Ibid.
- <sup>18</sup> Ibid.
- <sup>19</sup> R.D. Russell, "Developing a Process Model of Intrapreneurial Systems: a cognitive mapping approach," *Entrepreneurship Theory and Practice*, 23/3 (Spring 1999): 65-84.
- <sup>20</sup> Covin and Slevin, op. cit.
- <sup>21</sup> J. Birkenshaw, "The paradox of corporate entrepreneurship," *Strategy+Business*, (Spring 2003), available at [www.strategy-business.com/press/article/8276?pg=all&tid=230](http://www.strategy-business.com/press/article/8276?pg=all&tid=230)
- <sup>22</sup> Ibid.
- <sup>23</sup> I. Nonaka, "The Knowledge Creating Company," *Harvard Business Review*, 69/6 (November-December, 1991): 96-105.