Making plans

This article discusses the way in which a number of factors are making the R&D planning process more complex. Drawing on the January 2008 representatives' round table, it outlines how companies are planning to enter new geographic markets, and collaborate more effectively at sector and European levels. It considers the value of engaging with the policy discussions that set the context for R&D, and how megatrends are changing research horizons. The article also looks at a new funding mechanism from the European Investment Bank, and considers one company's efforts to plan its personnel resources more effectively.

Planning is a basic part of R&D management, necessary to keep teams functioning effectively. But though planning is a year-in, year-out job, the process has to meet a constantly changing set of challenges. Well-made plans should help organise resources, turn strategy into implementation, and act as a two-way communications channel between senior management and those working at the lab bench or computer screen. But even the best plans are usually found wanting when tested by reality.

Making plans for China

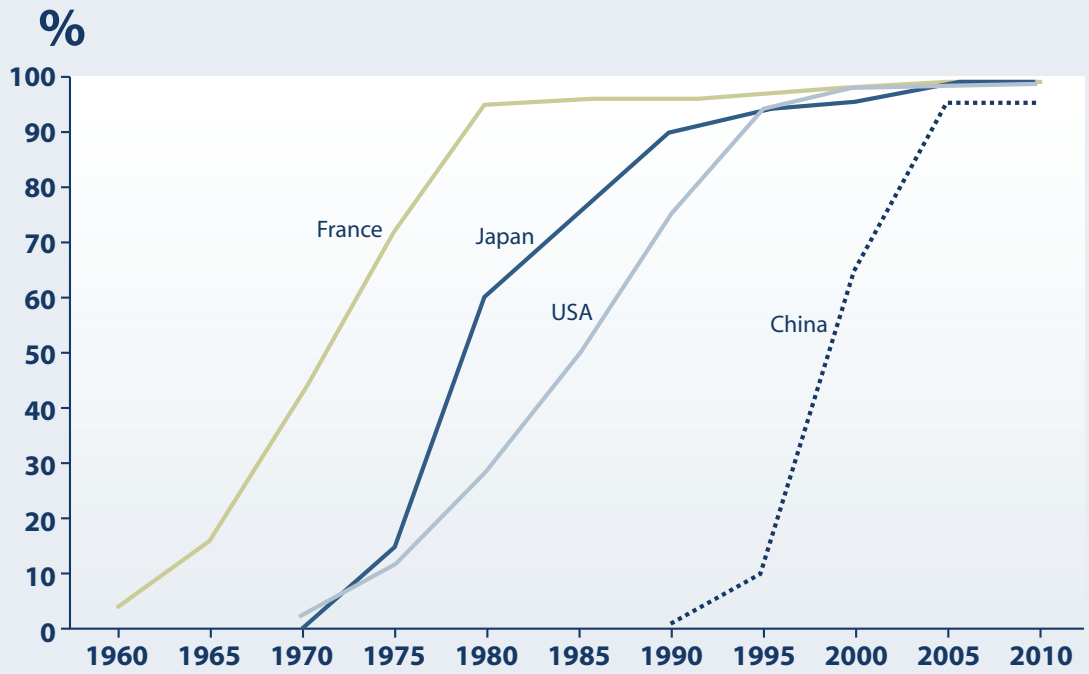
Dominique Neerinck, chief technology officer of steel wire and coatings company Bekaert told the annual meeting of EIRMA representatives in January 2008 about how its plans to enter the Chinese market also changed its approach to other markets.

Bekaert has 100 plants worldwide and 20,000 employees. It makes, among other things, tyre cords, shielding for electromagnetic interference, film coatings and champagne cork wire. Half of its sales are in the Americas, 30% in Europe and the rest in Asia and China, which are the growth areas. The company spends 3% of sales on R&D, or around 60m, with 70% of the work being done in one centre in Belgium and the rest within the business units.

"More than 80% of our R&D is done in Belgium, compared with 1% of our sales," said Neerinck. "This is not going to last."

Bekaert has been making tyre cord, the steel wire used to reinforce car and truck tyres, for 40 years and regarded it as a stable product until about 1995, when demand from China began to grow.

"In the last four or five years we have been confronted with an explosive growth in demand for tyre cord from China," said Neerinck. This is partly because China is building more roads, partly because it is increasing its car manufacturing capacity by one million cars each year, and partly because of the expansion of local tyre manufacturing companies, which are also entering export markets.



Source: Bekaert

The result is that demand for steel tyre cord in China has increased 36% a year for the past eight years. Demand has grown just 2% a year in the rest of the world.

"It is this explosive growth in demand which has triggered our innovation," said Neerinck. Bekaert now has local competitors in the Chinese tyre cord market, one of which started six years ago and is now the company's largest global competitor. But there's room for Bekaert to differentiate itself thanks to its experience: Chinese tyre companies don't make their own wire and want advice from experienced wire makers.

Bekaert has now started a Chinese R&D operation to serve the Chinese market by working out how to use Chinese steel, how to build cheaper plants to reduce investment costs, and how to cut energy consumption during the production process.

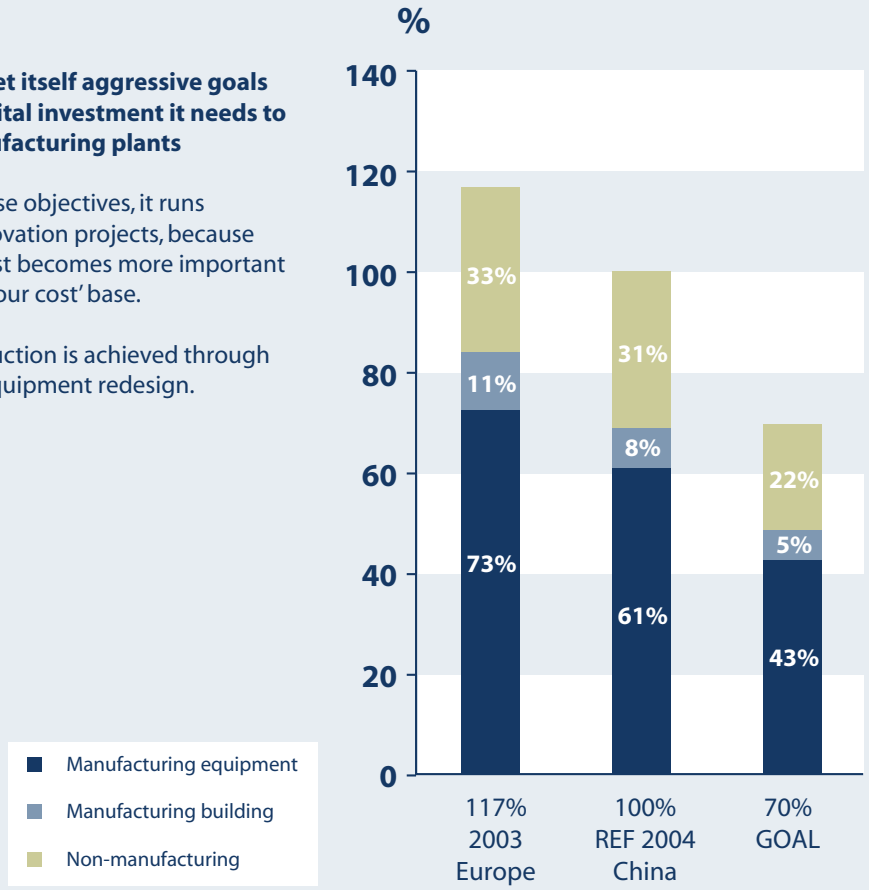
"We have 5000 people in China and we are paying more for energy than for people," said Neerinck.

Bekaert's Chinese R&D teams have started to focus on issues such as making production machines in China and re-engineering them to cost less. This has led to an overall 30 to 40% decrease in asset cost for a tyre cord production facility, at the cost of a 20% increase in total R&D.

Bekaert has set itself aggressive goals to cut the capital investment it needs to make in manufacturing plants

To achieve these objectives, it runs ambitious innovation projects, because investment cost becomes more important with a 'low labour cost' base.

Asset cost reduction is achieved through process and equipment redesign.



Source: Bekaert

"We had to do a fundamental review of the existing processes and equipment to address the Chinese market, and new opportunities in the home market," said Neerinck. "We have done our first international R&D in China, including co-operations with Chinese universities. We have had to review the whole R&D process to respond to the Chinese challenge. We could not be number one in the world if we were not number one in China."

Doing R&D locally has established Bekaert as a trusted partner, which is helping it enter Chinese markets for construction, textiles, environmentally friendly gas burners, window films, and sawing wires for solar cell manufacture.

"China turned a maturing product into a growth product, but this required breakthrough process innovation efforts," said Neerinck. These were driven by the local opportunity, but have improved global competitiveness. "We managed to generate a 40% increase in process effectiveness, 70% of it through incremental innovation and 30% of it through breakthrough innovation."

Bekaert went back to basics to serve the Chinese market and boosted the rest of its business by doing so. But this is a dangerous path for Bekaert to remain on.

"For the Chinese investment we've had to refocus on our core competencies," said Neerinck, "but if we do that for too long we will be dead in 20 years. So the challenge is to go back to the board for new venture money as well."

Venturing jointly

Bekaert's Chinese venture has involved a number of the kind of small partnerships that are a key part of the shift to open innovation. Open innovation is also being used to form much wider industrial groupings with the scale to compete globally. Sometimes, though, the motivation for forming these groups is just to get noticed.

Paul-Joël Derian, group vice president, R&D at Rhodia, a €5bn speciality chemicals company, told the January conference that despite the fact that the chemicals industry is probably the second largest industry in Europe, it was largely unrepresented in the Sixth Framework Programme (FP6) and in the draft outlines of the Seventh Framework Programme (FP7).

The industry felt it had to remedy this situation and got together to develop a vision, propose a strategy research agenda and define two European technology platforms.

"The initial goal was to have an impact on FP7, and eventually chemistry was reintroduced to the programme as a technology platform," said Derian.

The first of the platforms is SusChem an effort to create a more sustainable form of chemistry that will also boost the status of chemistry, biotechnology and chemical engineering R&D and innovation in Europe. The second platform is Axelera, an effort to link the chemical industry and the environmental industry to create an environmentally friendly approach to chemistry that takes into account eco-design.

"What is interesting to see is that these kinds of initiatives can bridge between large and small companies," said Derian. "There are many chemistry clusters world-wide but this is the only one linking chemistry to the environment."

Derian listed a number of motivations for becoming involved in such projects, and some of the longer-term goals.

"There are some subsidies available," he said, "and involvement has also brought pride and ambition to our team at a difficult time. It has also helped academics move from curiosity-driven research to more goal-oriented research."

Over the medium term, the effort to get the two platforms accepted as part of FP7 has boosted the acceptance of open innovation in the industry as a useful way of creating worthwhile innovation projects based on mutual trust and a shared vision among partners of different size and cultures. Over the longer term the work will boost the perception of the chemical industry as being a key innovation force in Europe, and may even have secured its future here.

Chasing scale

The European electronics industry is also chasing scale, most notably through the €2.7bn ARTEMIS joint technology initiative, in which Andrea Cuomo, corporate vice president of ST Microelectronics, has been taking a keen interest.

ST had sales of €10bn in 2006, has 10,000 R&D employees and files 700 patents a year. It spends 17% of its turnover on R&D, or about €1bn, in Europe. Cuomo says companies such as Bosch, Daimler, Nokia and others spend similar amounts.

"The idea is to rationalise and reduce overlap," he said.

ARTEMIS (for Advanced Research and Technology for EMbedded Intelligence and Systems) is a European technology platform on embedded systems, the hidden electronic systems that are vital to innovation in major industries and so key to keeping jobs in Europe. It is backed by 10 of the top 25 EU companies in terms of global R&D, along with academia, small business federations, MEDEA+ and various other organisations. In all, 24 countries plus the Commission have helped formulate the platform, which is organised as a joint technology initiative.

"The joint undertaking is a new way to unite public and private resources to set up a broad European scale programme," said Cuomo.

He says it combines the best of the Framework Programme (FP) and EUREKA models, with a straightforward project proposal and approval flow similar to that of EUREKA, coupled with a certainty of funding similar to that of the Framework programmes. It will also get protected budgets from the member states, and benefit from synchronised funding decisions and the established procedures and contract arrangements developed in other initiatives.

The ARTEMIS project's goal is to make it possible to design embedded system of twice the complexity of today's systems, with 20% less effort. The agenda calls for much more reusability of embedded systems devices between sectors such as the automotive industry, aerospace and manufacturing. It also hopes that twice as many European small and medium-sized enterprises (SMEs) will become engaged in the embedded systems supply chain.

"The idea was to start thinking as a whole rather than as a bunch of individual regions, combining the best of the Eureka and European Commission Framework Programmes and providing some certainty of funding," said Cuomo.

Other regions are doing similar things, he said. Europe has a federated approach, Korea has a top-down approach and although Japan hasn't yet announced what it is doing, a large amount of money is expected to be involved.

"We're trying to avoid research duplication and to define the holes in the research web," added Cuomo.

Building for the long term

Europe hosts one project whose timescale is far longer than that of individual technology platforms. The ITER fusion reactor project is underpinned by a 35-year commitment from the international community.

The project is a collaboration between the EU, India, Japan, China, Russia, Korea and the US. It will cost about €5bn to build over 10 years and €5bn to operate and then dismantle safely over the following 25 years.

The Commission sees the project as one way to bring the public and private sector together at the European level, to provide the rich set of input technologies such a complex undertaking needs. Heinrick Hick of DG R&D at the European Commission said that industry's view of fusion research before the launch of the ITER project was that it was too far from the market to get involved with, had major technological obstacles, and was really a public project. Collaboration opportunities were limited by stop/go funding cycles and the sense that the project would only want very low volumes of many of the parts it bought.

Hick argued that the long-term nature of the ITER project would overcome many of these objections. Being involved with ITER would enable companies to tap into the vast research capacities of 27 European laboratories associated with the project, as well as those from outside the country and at other companies.

ITER will also act as a long-term reference for energy research, with global exposure and a public funding commitment. A tailor-made IP framework will enable commercialisation projects. There are likely to be opportunities for joint ventures between businesses, and between industry and the public sector. The project may also help tackle key challenges in the European energy innovation system, such as the geographical and organisational boundaries within and between private and public research.

Taking part

So what are the advantages of getting involved with these large European projects? Cuomo highlighted the drawback of not doing so: "It's an issue of making sure that the ecosystem works, because if you're not part of an ecosystem you will not have a chance."

Derian said such projects help businesses refocus on the long term, as well as giving them the opportunity to benchmark their internal efforts against the rest of the players in the ecosystem. Involvement also brings respect.

"The few million euros [you get as a grant] mean you also get internal money. It also means that you look totally different [to internal colleagues] if you're a leader of one of these programmes."

Cuomo pointed out how important such large projects had been to his industry in the past, and could be in the future.

"China will drive the development of fifth-generation mobile communications systems because of its 600 million to 700 million user base," he said. "If we can get our act together in Europe we may have a chance to play in that market. If we don't, we won't."

But he admits it won't be easy: "Is this simple? No way. Are we used to working this way? No. The GSM mobile phone standard [which is widely referenced as one of the best examples of Europe's collaborative and standards-based approach] was eventually developed by around five people."

But he believes the approach is vital to Europe's future technological competitiveness: "The idea behind trying to do these platforms is really because each of the national industries is sub-critical."

Philippe Queille, deputy director of R&D for Air Liquide, pointed out that getting involved in joint policy initiatives and European platforms could be important for understanding a market or an issue.

"There is also a question of how you organise for involvement in multiple committees and bodies," he added. "Either you don't engage or you split the load between the business and the R&D functions."

Policy issues

Michael Harris, senior research fellow of UK thinktank NESTA took the issue of engaging with policy a step further in his presentation of the organisation's research into hidden innovation in the UK.

The report argues that there are four types of hidden innovation. These are: innovations that aren't counted in the R&D intensity figures, such as those that happen in industries such as oil exploration; organisational innovations; new combinations of existing innovations, such as the development of Internet banking; and very localised innovations, such as those that happen on a building site.

"We found that these forms of innovation were very collaborative, linking many disciplines and going beyond traditional R&D to involve other approaches as well," Harris said. "This form of innovation is also very global and uses technology as an enabler rather than as the leading innovation. These forms of innovation are not usually reflected in policy and we wondered how policy should change to reflect that.

"A lot of our assumptions in policy making about innovation are collapsing," he added. "We have a model which is 50 or 100 years old."

Harris recommends more dialogue between different forms of innovators, and that policymakers should consider how they can support companies in their efforts to collaborate with users.

"One of the arguments we make most strongly to UK policymakers is to get them to understand how innovation works in the sector they are responsible for. There don't seem to be mechanisms for practitioners to inform policymakers of what makes innovation flow," he said.

Andrew Dearing, secretary general of EIRMA, made the point that investment in public R&D is an input. Investment in private R&D is an output that depends on how government policies support a particular sector. Engaging with policymakers can be hard work, but it shapes the context within which businesses operate: influencing policy is the organisational equivalent of a researcher discovering a way to adjust gravity, change the speed of light or turn down the charge on an electron.

Financing opportunities

The planning issue is also affected by the ability to find and structure funding. Where once the term 'financial engineering' seemed like nonsense, now it reflects a sophisticated discipline that can channel capital to needy projects in an efficient way.

Gunnar Muent, head of the RDI division of the European Investment Bank told the conference about how his bank is being used to support European policy objectives.

It has €300bn on its balance sheet and lent around €46bn in 2007. Its objectives are to increase convergence, improve the lot of SMEs, encourage sustainable environment and energy, and support innovation and trans-European networks.

When the Bank was founded it lent to companies with high credit ratings, which were usually large or medium-sized European corporations. But it found that most of the R&D that it wanted to support was being done by companies without ratings.

Muent said that R&D and innovation were the riskiest things that a company did, since they had a high failure rate and uncertain future revenues. R&D is also funded from cashflow, the most expensive form of funding.

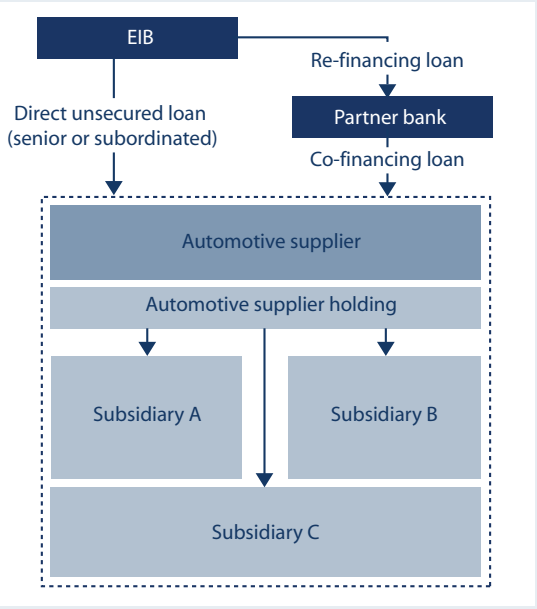
"So you have to fund the business's riskiest activities with the riskiest form of funds," he said. The EIB's response has been to try and cut the cost of funding R&D by providing a way for companies to outsource some of the risk and part of financial rewards, while maintaining their corporate assets and flexibility.

The EIB's risk-sharing finance facility is a $2bn pot of money that is set aside to make up the bank's losses from bad loans. Since it hopes to invest well in companies that will largely succeed, the loan funds on offer could be up to $10bn.

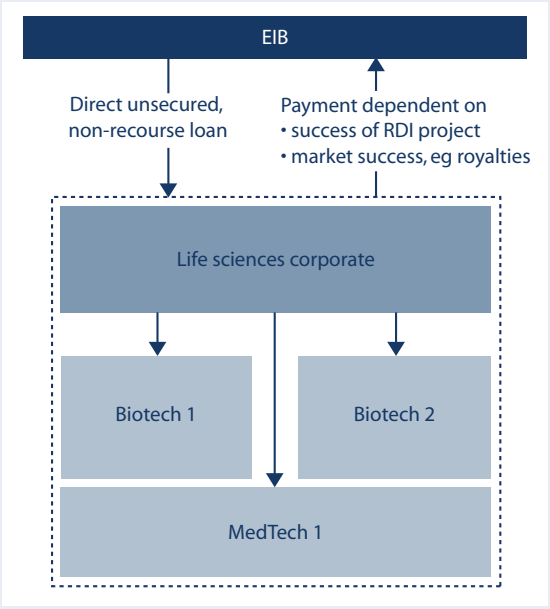
"It's a loan, not a grant," said Muent. "We have to be repaid with principal and interest, but the EIB funding is cheaper than commercial lending. The idea is that we take on our books risks that are not normally taken on by the banks."

The bank will loan up to half of a company's combined capital expenditure and R&D spend over three to five years, in two ways. It will fund corporate investments, such as organisational innovations, as well as project work. The bank will lend directly or to a company's usual bank, and will act as a subordinate lender to another bank, which helps when a company has already taken full advantage of its secure lending facilities.

The corporate financing model – as applied to an automotive manufacturer



The project financing model – as applied to a life sciences project company



Source: EIB

Since June 2007 the EIB has lent at least €880m to SMEs and mid-sized companies. Muent says two models have worked: corporate financing of SMEs and mid-sized companies; and risk-sharing project financing with larger companies.

The approach has its problems. Confidentiality is always an issue for companies seeking alternative sources of funding. The EIB has to be confident that R&D projects will be properly ring fenced, so their loans don't leak away into other parts of the business; and it is still working on striking the right balance between risk and reward.

Muent said the factors that help the bank make a loan are approaches from companies with mature projects that are close to commercialisation, a market track-record, and some sort of relationship with a European policy direction.

"We are not trying to offer cheaper financing, we're offering financing the local banks are not willing to provide," he said. He accepts that the loan facility is sometimes abused by companies that just want cheap money, but believes it provides a net benefit for Europe.

"To a certain extent we are used as a source of cheaper funding. But we are sure we have an overall positive effect," he said.

Providing staff

One of the most difficult parts of the planning function is managing the availability of qualified people who can progress a developing research agenda.

Queille at Air Liquide explained how his company approaches the issue. He said the company had split its planning horizons between projects that run for up to five years, and projects that run for 10 years or more. This reflects the fact that work on the hydrogen economy, for example, may not bear fruit for 20 years or more, while other projects may deliver a return much more quickly.

Queille said that in a decentralised organisation like Air Liquide a technology may need to be transferred from R&D to development many times, and at many different times. The personnel planning challenge is to keep the skills necessary to do that transfer within the organisation.

The company's response has been to develop stronger business lines with mid-term objectives, which help the organisation balance technology skills between its sectors. It is also turning its investment committees, which have traditionally exercised strong control over spending, into resource and investment committees, charged with ensuring that the right people are available to progress projects.

Air Liquide has defined 14 technology platforms across both its corporate and business unit R&D. Each platform has a domain manager who helps define the skills the organisation needs to progress its work.

The company introduced a technical career ladder about five years ago to help it understand and manage its access to skills. The ladder applies to a population of around 1000 people, who are reviewed every 18 months on the basis of their technical ability, diversity and location. This helps the company do a gap analysis that shows where the company needs to strengthen its skills.

A global coaching programme, in which individuals are seconded to other groups with the company, at the receiving group's expense, for periods of between a week and six months, helps share knowledge and skills. The programme has been running for two years and has done about 30 short-term engagements so far.

"We're now trying to encourage more geographies to improve their skills bases this way," said Queille. "We're also doing more partnerships, with more than 100 academic and more than 100 industrial partners so far.

"We've found that in the context of open innovation it's very, very important to have people who can develop a partnership very, very quickly. So you have to find the people who are good at that – it's a matter of face [the power of personal relationships]."

Planning for megatrends

The context for research is being shaped by global megatrends, such as climate change, the desire for energy security, water scarcity, and increasing populations.

Jan van der Eijk, chief technology officer at Shell, pointed out that the oil and gas landscape had changed over the past 40 years. Back in the 1960s, the big integrated companies produced most of the energy and did most of the energy R&D.

"Now both percentages are coming down, and these companies no longer have the dominant positions," he said, "so they need to focus on areas where a company can win and not try to do everything."

van der Eijk said there were several drivers for this change, including rising energy demand and the inability of oil and gas production to keep up; the issue of climate change; and the management of carbon dioxide.

He said a number of technologies were likely to have a large impact on the industry, such as the use of biotechnology to develop microbes that can digest heavy oil into methane, and the impact of high-performance computing on plant optimisation and the ability to work virtually. Nanotechnology is already at work in catalysis and coatings, as well as in the development of new batteries, which will change the transport sector.

"We'll also see new companies in new and existing sectors, such as the microelectronics companies entering photovoltaics, agriculture focusing on biomass for fuel, and engineering companies turning their attentions to wind, air and tidal turbines. Some of these new companies will be driven by the venture capital industry.

"All these forces are creating preconditions for a revolution in the energy companies. One of the big questions is how we position ourselves to take advantage."

Shell's planning process is likely to be affected by environmental concerns about accessing new deposits in frontier locations. Attempts to use contaminated gas or oil shales will bring concerns about issues such as carbon capture and storage, and the use of scarce metals to reduce environmental impacts.

In some areas Shell will research in a proprietary way, whereas in others the work can be done through collaboration. Some research crosses boundaries between Shell companies, so van der Eijk needs to understand how to avoid losing value at the intersections between silos, probably by establishing a 'community of practitioners', rather than by trying to recreate a corporate R&D group.

"I don't believe in it and it wouldn't do my career much good," he said.

"To do this well we have to be well integrated, good at working with third parties and good at mobilising technologies."

Engaging in some of these alternative energy projects also poses some fundamental challenges to Shell.

"Working in solar energy takes you to the question of whether to be in energy or in the oil and gas sector," said van der Eijk. "It's a question of how strongly you want to bank on this. Companies could easily spend all their money on it."

Changing consumer demand is another issue, as demonstrated by the uptake of hybrid vehicles.

"The biggest unknown is to what extent consumers, such as people, cities and governments are going to drive demand," van der Eijk said. "If you look at the justifiable desire of those in the developing world for energy, we will have to take all possible avenues to meet that demand. There is no silver bullet out there. We need more of all these things: nuclear, biofuels, carbon capture and storage, and so on."

Jean-François Minster, senior vice president, scientific development at Total, pointed out that rising energy demand from the developing world would also mean more use of less efficient forms of energy, because of the increasing consumption of electricity.

Efforts to reduce carbon dioxide emissions will demand huge investments, using approaches that will vary by geography and politics.

"For Total, R&D spend has increased 10% per year for the past five years," said Minster. "The core challenges include trying to broaden our competencies, tools and partnerships; and the need to manage R&D ahead of the business strategy among the burgeoning technologies."

For example, Total has been involved in photovoltaics since 1983, working at the highest value-added end, but photovoltaics are still too expensive per Watt generated.

"So we need to make the whole value chain cheaper by understanding the technologies at all stages in the chain," said Minster. "This is why we need to understand many technologies and we do this through partnering, for example with universities.

"Our R&D strategy is built on cross connections across the business, yet it is getting too conservative. So we are trying to identify a portfolio of 12 key transverse technologies for the R&D group [to focus on] in the next 10 years."

These could stem from a portfolio of emerging technologies, demands for new competencies within the business, and as a consequence of medium and long-term business drivers defined with strategy groups.

"This could drive a re-concentration of R&D at the corporate centre, versus trying to develop [those transverse technologies] across the business units and other R&D groups," said Minster.

Planning to plan

The planning process is becoming more complex as competition for talent and resources increases within and between companies and geographies.

External pressures such as climate change and energy security are having an impact on planning, forcing companies to develop a longer term outlook as well as making public policy issues a bigger part of the process. Financing is becoming more flexible, creating opportunities as well as risks. Increasing complexity presents a great challenge to R&D planning. The conventional linear R&D process is no longer adequate and needs to be transformed into a networked effort, taking into account competing and sometimes conflicting issues.

Planning is about tackling uncertainty and needs to be flexible: the days of just working out 'Who does what with whom by when' are long gone. Companies need both their immediate plans, and longer-term visions that will motivate an organisation and help bridge the gap between strategy and the day-to-day planning process.

Links

Bekaert
http://www.bekaert.com

January 2008 representatives' round table
http://www.eirma.org/f3/showthread.php?t=7568

Rhodia
http://www.rhodia.com

Sixth Framework Programme
http://cordis.europa.eu/fp6

Seventh Framework Programme
http://cordis.europa.eu/fp7

SusChem
http://www.suschem.org

Axelera
http://www.axelera.org/srt/axelera_en/home

ARTEMIS
http://www.artemis-office.org

ST Microelectronics
http://www.st.com/stonline/

ITER fusion reactor project
http://www.iter.org/

Air Liquide
http://www.airliquide.com/

NESTA
http://www.nesta.org.uk/

Hidden innovation report
http://www.nesta.org.uk/informing/policy_and_research/highlights/hidden_innovation.aspx

European Investment Bank
http://www.eib.org/

Jan van der Eijk, chief technology officer at Shell
http://www.shell.com/home/content/aboutshell-en/swol/july_sept_2007/q_a_janvandereijk_swol_12072007.html

Jean-François Minster, senior vice president, scientific development at Total
http://www.total.com/en/finance/fi_press_releases/fpr_2006/060906-jf-minster-scientific-dev_10460.htm