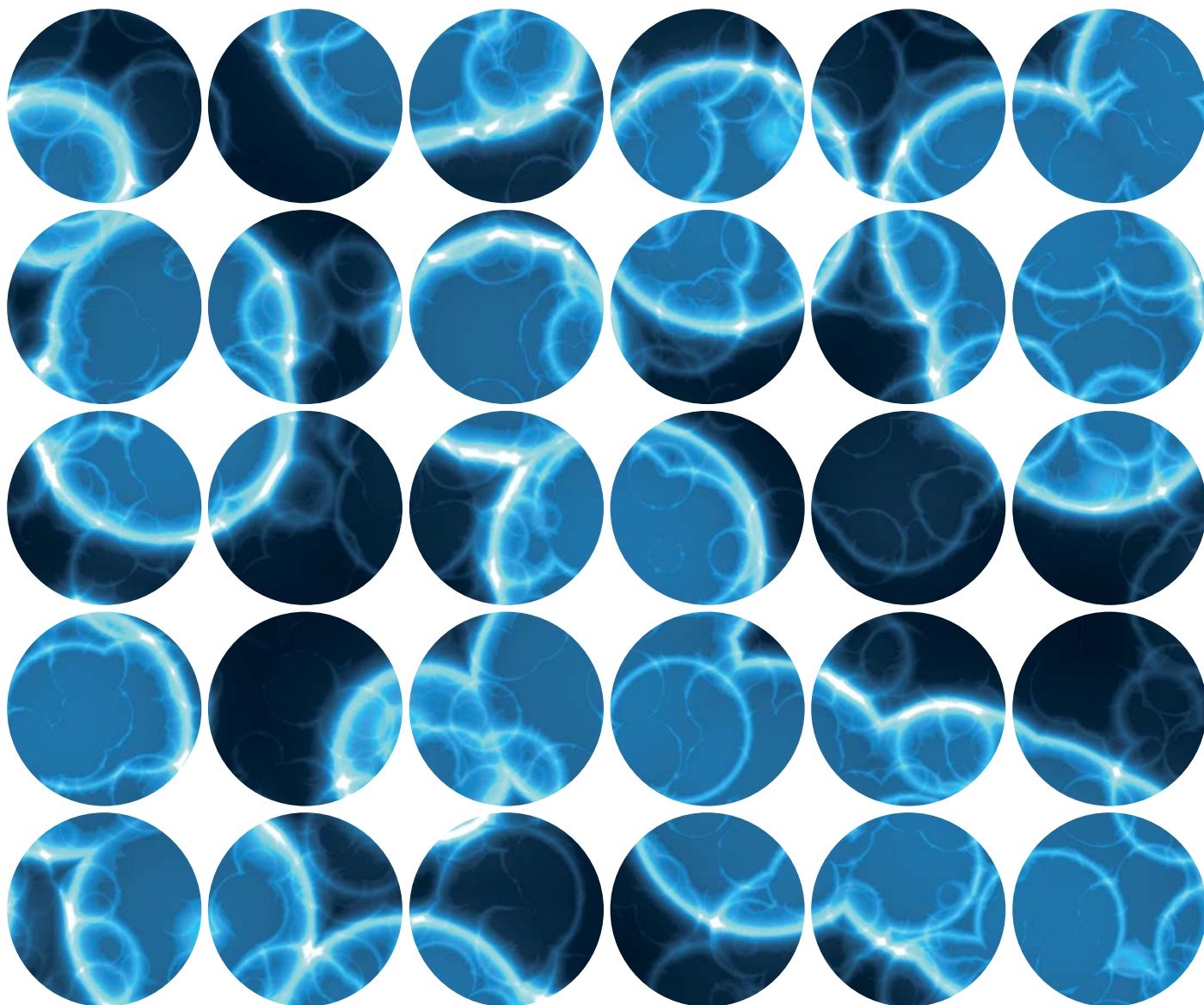
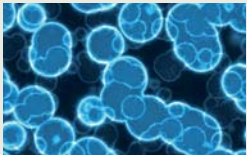


Reinventing biopharma: Strategies for an evolving marketplace

The innovation imperative in biopharma

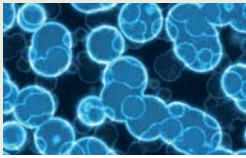
An Economist Intelligence Unit report
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Preface

The innovation imperative in biopharma is the first in a series of three reports by the Economist Intelligence Unit. It is part of the *Reinventing biopharma: Strategies for an evolving marketplace* programme, sponsored by Quintiles. The Economist Intelligence Unit conducted the survey and analysis and wrote the report. The findings and views expressed in this report do not necessarily reflect the views of the sponsor.

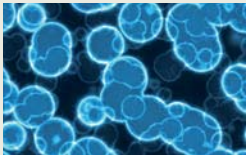
The author was Dr Paul Kielstra. The editors were James Watson and Rozina Ali, and Mike Kenny was responsible for layout.

June 2011

About the survey

The report is based on a survey of 282 senior executives from the life sciences industry, including respondents from pharmaceutical and biotech companies (39% and 21%, respectively), medical device manufacturers (22%) and service providers (14%), among others. Survey respondents are relatively senior, with 58% representing the C-suite or above. They are distributed

globally, with 32% based in the Asia-Pacific region, 31% in North America, 26% in Western Europe, and the balance from the rest of the world. Respondents hail from firms of all sizes: 43% represent companies with more than US\$1bn in annual revenue; 24% work for companies with more than US\$5bn. To complement the survey findings, eight in-depth interviews were conducted with senior industry executives and experts, along with extensive desk research.



Acknowledgments

The Economist Intelligence Unit would like to thank the following for their invaluable contribution to our research. Their insights enriched our analysis, but the Economist Intelligence Unit bears sole responsibility for the findings of this report.

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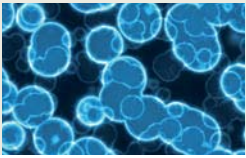
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Executive summary

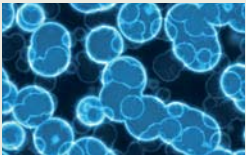
It's not easy being a life sciences firm today. Companies in the sector have seen rising research and development (R&D) costs, in exchange for flat, or even diminishing, innovation returns. Many are staring over the edge of a patent cliff, the loss of intellectual property protection on drugs that are currently bringing tens of billions of dollars in sales and that subsidise expensive R&D efforts. This concern is greatest for the biopharmaceutical sector, but other life sciences firms are suffering as well: medical device firms, for example, are also experiencing difficulties with their innovation programmes.

How severe is this problem? And what can be done to ease these pressures and reinvigorate innovation efforts within the life sciences industry? These are the questions that this Economist Intelligence Unit study examines, based on a wide-ranging survey and in-depth interviews with senior executives at global firms across the life sciences sector. Its key findings include:

“Right now the industry is very much driven by fear rather than by ambition.”

*Dr Wolfgang Soehngen,
CEO, Paion*

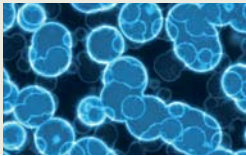
- **Executives in the industry are ambivalent about the quality of their existing innovation programmes.** Industry experts and other analysts have been harsh about the ability of the life sciences companies, especially biopharma, to innovate. Thomas Lönngren, former head of the European Medicines Agency, estimates that a staggering US\$60bn of the industry's US\$85bn annual global R&D spending is wasted. Surveyed executives are not as critical, but give a tepid endorsement of their own innovation programme. Less than one-half (47%) say that their R&D model is capable of meeting their company's needs, while a similar proportion of respondents (49%) rank their overall innovation strategy as just moderately effective at best. More worrying, just 42% say that this strategy is more than moderately successful at restocking the product pipeline as biopharma in particular goes over the patent cliff.
- **Companies often are not rising to the challenge.** Although almost every company is trying something to improve innovation, only 54% of respondents overall—including those who admit that their companies have poor or ineffective innovation strategies—say their companies consider change to innovation processes a leading priority. Moreover, for those who plan such changes, survival rather than growth may be the guiding rationale. “Right now the industry is very much driven by fear rather than by ambition,” says Dr Wolfgang Soehngen, CEO of Paion, a biopharmaceutical firm.



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- **Culture is the primary barrier to improved innovation among the most laggard firms.** The life sciences industry faces several impediments to innovation that are less common in other fields. The leading ones cited by survey respondents are costs (especially for smaller companies), R&D time scales and regulation. But among companies with the worst innovation record, cultural attachment to existing practices is cited as their leading problem. Dr Philip Gerbino, president of Philadelphia-based University of the Sciences, believes that improvement in how companies innovate “has been slow because there is a great amount of entropy in the ideology of what the industry must do with research programmes”.
- **Leading life sciences innovators create the right culture, are more engaged in open innovation and make better use of data.** The one in five companies surveyed who call their innovation programmes “very effective” typically produce about twice as many new products as others. They also act differently than the rest in several key ways. One is that they work hard to create the right environment, by finding appropriate ways to recognise and reward efforts, without penalising failure. A second is that they are more engaged in open innovation, with a more flexible perspective on intellectual property (IP), embracing a wider range of new ideas and ways to benefit from their discoveries. A third is that they make better use of data, both internally and externally, to support their efforts, thereby helping to improve research, development and use of existing IP.



Introduction: The innovation drought

“The past was more about bringing new technology to market. Today it is ‘how do we use that technology to deliver better care at lower prices?’”

Dr Diego Olego, chief technology officer, Philips Healthcare

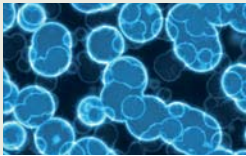
Life sciences companies need effective innovation strategies like never before. In the biopharmaceutical sector in particular, companies have reached the long-anticipated patent cliff, with seven of the world’s 15 top-selling drugs in 2009, that collectively account for nearly US\$50bn in sales, due to lose patent protection in 2011 and 2012. Other products that together also represent an aggregate market in the billions will be joining them. Generics makers are ready and waiting: most would agree with the 2010 Annual Report of Dr Reddy’s Laboratories, a pharmaceutical firm based in India, that the coming loss of patent protection will be “a major catalyst for the growth of generic pharmaceutical companies”, and many have products ready for sale as soon as the relevant IP protection disappears.

Companies across the life sciences sector will need to create new products to replace their soon to expire blockbusters. This is nothing new: in practice, because of the time still needed for development after a patent is filed, products typically enjoy only about a dozen years of protection on the market out of the complete patent length of 20 years. But innovation programmes are not delivering. Despite ever-increasing investment in R&D, the number of new molecular entities (NMEs, an active pharmacological ingredient that has never previously been marketed) gaining approval in the United States each year has remained stubbornly at around 20 for the last decade. Although the late 1990s saw a brief flurry of approvals, with the number in 1996 exceeding 50, this was an anomaly: 20 has been the longer-term average since the 1950s in the US. The European Medicines Agency (EMA), meanwhile, has seen the number of new product applications drop over the last four years from 59 to 34.

In other parts of life sciences, the situation is hardly better. According to the US Food and Drug Administration, American pre-market approvals for new medical devices, for example, have dropped from 53 in 2004 to 20 last year. This is not the whole picture. Dr Diego Olego, chief technology officer at Philips Healthcare, a medical devices company, points out that this sector has seen substantial innovation and improvement with existing devices that may not require new approvals. He adds, however, that changing health and economic conditions have meant that companies have had to adjust their innovation strategies. “The past was more about bringing new technology to market. Today it is ‘how do we use that technology to deliver better care at lower prices?’” But whatever the importance of such improvements, the decline in new devices suggests a decline in breakthrough use of new technology.

The longer-term picture is even more disheartening: the *Financial Times* reported earlier this year that productivity per dollar of R&D spend, when adjusted for inflation, has actually been declining logarithmically since the early part of the 1950s.¹ A 2009 study in *Nature Drug Discovery* showed similar

1. Andrew Jack, “Drugs: Supply running low”, *Financial Times*, February 9th, 2011.



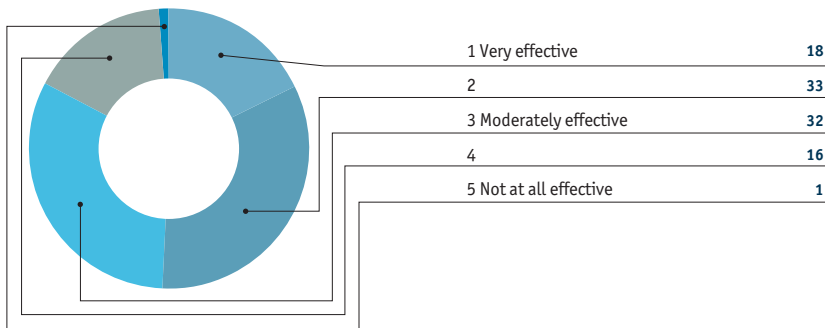
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data.² In fact, the latter study suggested that despite the industry’s efforts to improve innovation over several decades, there has been little change from the long-term average of about 20 drugs per year. It blamed the R&D model itself, which is typically heavily reliant on internal research programmes that do as much as possible in house. Some industry insiders agree. Dr Mervyn Turner, chief strategy officer of Merck, a pharmaceutical firm, notes: “For a long time, the industry felt that the old model was going to deliver. We kept expecting the arrival of a blockbuster drug. Over time, because the failure rate and cost of development were so high, it has really forced a recognition that [the current situation] represents something more fundamental than just another cycle.”

This Economist Intelligence Unit study examines the state of innovation in life sciences and the efforts that companies are making to improve. Given the industry’s situation, it is unsurprising that the companies surveyed show marked ambivalence about the quality of their innovation strategies. The findings make stark reading. Only 47% agree that their R&D model is adequate to meet their company’s

Chart 1. How effective is your organisation’s innovation strategy?
Please indicate on a scale of 1 to 5, where 1= Very effective and 5=Not at all effective.
(% respondents)



Source: Economist Intelligence Unit survey, April 2011.

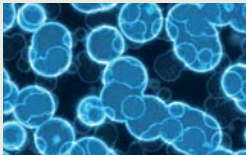
needs, with most of the rest uncertain. Just 42% think that their innovation strategy is more than only moderately successful at providing new, commercially viable products to replace those going off patent. Overall, about one-half (49%) rank their overall innovation strategy as moderately effective, at best.

Comments from outside the industry can be harsher still. Thomas Lönngren, when leaving as head of the EMA in late 2010, estimated that about US\$60bn of the US\$85bn spent annually in the biopharmaceutical industry globally on R&D “is wasted”. Executives are also feeling investor

pressure. Andrew Witty, CEO of GlaxoSmithKline, a research-based pharmaceutical company, has noted that “shareholders are not prepared to see more money invested in R&D without tangible success... [B]ased on a rational allocation of capital, R&D should now be consuming less.”³ Accordingly, many major companies surveyed for this report are cutting their spending on R&D. But simple cuts will not be enough. Executives need to consider how to reinvigorate their now much leaner innovation efforts.

2. Bernard Munos, “Lessons from 60 years of pharmaceutical innovation”, *Nature Drug Discovery*, December 2009.

3. The Economist Group, *The World in 2011* (2010), p.134.

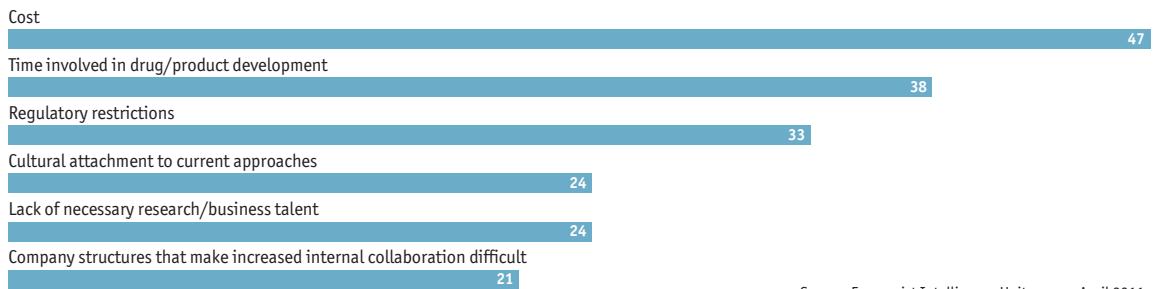


Stuck in old ways

The global biopharmaceutical industry faces several traditional difficulties in improving its innovation record. Those most often cited in the survey are cost (47% put it among the leading barriers), the time involved in product development (38%) and regulatory restrictions (33%).

Chart 2. **Top challenges to improving innovation record**

What are the biggest impediments to improving your company's product innovation? Select top three.
(% respondents)



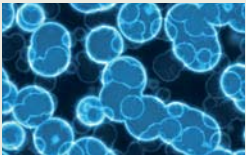
Source: Economist Intelligence Unit survey, April 2011.

“In any other industry you can measure [progress] using metrics, but you can’t really do that in this industry.”

*Peter Høngaard Andersen,
executive vice-president for
research, Lundbeck*

These are significant issues and should not be underrated. Dr Gerbino points out that innovation costs a lot of money: “Human nature has a way of underestimating costs. It is difficult to raise the money you need.” This is especially the case for smaller companies. Although cost is still the leading barrier for firms with annual revenue of US\$500m or above (38%), it was much more commonly cited by those earning below that figure (56%).

Meanwhile, long R&D time scales make changing innovation processes hard for two reasons. First, shifting processes could set back potential products that have already seen years of development. Second, the long time scales also mask whether any given change improves anything. Dr Kazunori Hirokawa, head of research & development at Daiichi Sankyo, a pharmaceutical company, explains: “In other industries, people can more easily see progress in product improvements, but in the case of innovation in this industry it takes 10 to 20 years to get a product on the market.” Peter Høngaard Andersen, executive vice-president for research at Lundbeck, a pharmaceutical company, agrees: “In any other industry you can measure using metrics, but you can’t really do that in this industry.” Instead, potential improvements need to be assessed against non-tangible criteria, such as measuring the inherent quality of innovation efforts before knowing whether they will pay off. “That is why we are all struggling to get this right,” says



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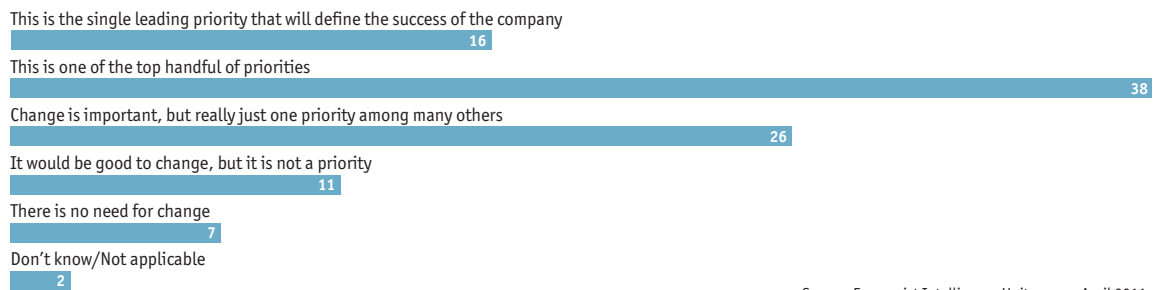
Mr Andersen. Others face the same issue: just 42% of respondents say that they have metrics to measure the effect of attempted innovation enhancements.

Finally, the degree of regulation creates “a dynamic tension” with process innovation, according to Brian Daniels, senior vice-president for global development and medical affairs at Bristol Myers Squibb (BMS), a biopharmaceutical company. He adds, however, that companies will be rewarded by the market for being able to create products despite this challenge.

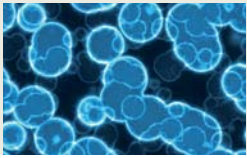
Too often, however, these entirely legitimate issues can be used as justifications not to change. They are “partially fact, partially an excuse”, argues Dr Soehngen. Professor John Kotter, Emeritus Konosuke Matsushita Professor of Leadership at Harvard Business School and an expert on organisational change, recalls that even 25 years ago R&D teams would insist that cost, regulations and especially long development times made the industry so different from others, and constrained it in what it did, that real process change was impossible.

The persistence of such attitudes helps to explain a puzzling lack of focus on innovation problems within the industry as it looks over the patent cliff. On the one hand, almost every company polled in our survey is taking some steps to improve its innovation strategy. In the last three years, for example, only 5% have done nothing to improve the efficiency of the product development process and only 6% have not tried to reach further outside the company’s current footprint—through mergers and acquisitions (M&A), partnership or globalisation. On the other hand, given the declining productivity of R&D, it is striking that plans to change the innovation process over the coming three years are a leading priority at only 54% of companies, and even for those who admit that their companies’ innovation strategies are poor or not at all effective the figure is just 53%.

Chart 3. Improving innovation process is not a top priority at almost half of companies
Which statement best describes your company’s plan to change its innovation processes in the next three years?
(% respondents)



Source: Economist Intelligence Unit survey, April 2011.



Shifting innovation strategies

The change that is occurring may even be happening by default at some companies. Consider where medical devices, generics or service companies have been getting their innovation ideas in the last three years. Those most directly involved in innovation at these companies—employees in clinical development—cite doctors/medical experts (59%), academic research (41%), and patients/patient groups (35%) as their leading sources. Those in the rest of the company, however, cite internal R&D (51%), existing IP (44%) and only then doctors (34%). In biopharma companies, employees involved in clinical development foresee a shift that is less clear to the rest of the company. They expect academic

BMS and Ipilimumab: Co-operation with academia and other companies yields success

A new metastatic melanoma product, ipilimumab (sold as Yervoy), from Bristol Myers Squibbs (BMS), has the potential to be a blockbuster. Malignant melanoma is increasing in frequency and this is the first new drug approved for the condition since 1998. Unlike previous treatments, it has been shown to increase life expectancy in patients by several months on average, and 28% are alive after two years, compared with just 14% using the previous treatment. Rather than the story of a single innovation, ipilimumab's development shows how co-operation can yield a series of innovations that are sometimes needed to create a new drug.

To begin with, the drug itself has a novel approach. Rather than target the disease directly, ipilimumab is a monoclonal antibody that disables certain proteins that inhibit the body's own immune system. In essence, it turns off the biological safeguards that prevent healthy people from developing autoimmune conditions. The immune system can then attack tumours much more aggressively. The big potential drawback is that this can leave patients open to a variety of other diseases. On the positive side, although ipilimumab has not been tested on other cancers, in theory it might work on some of these as well.

As with many biotechnology products, ipilimumab was not developed by a single company but relied on co-operation with academia and other companies. The original idea came from discoveries at the University of California at Berkeley in the late 1990s, which initially were too unusual to arouse major corporate interest. They were eventually taken further by Medarex, a biotechnology company. In 2004, Medarex and BMS agreed to partner on the drug's further development and testing. This relationship proved so valuable that BMS acquired Medarex in 2009.

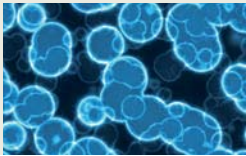
This was not simply a story of a large company buying up a

promising compound. In addition to providing substantial financial resources and the manufacturing and marketing experience that its partner lacked, BMS brought extensive knowledge of oncology and drug testing. For Brian Daniels, senior vice-president for global development and medical affairs at BMS, internal R&D strength is essential to effective collaboration in drug innovation. "You need to be able to ask if the molecule you are looking at externally has the potential," he says. "To answer that question, you need a large number of internal experts who understand drug discovery and development."

Further innovation proved necessary at the testing stage. Cancer immunotherapy is a relatively novel field and previous methods for evaluating oncology products were based on chemotherapy. But these did not fully address the new approach's biology and mechanisms, so BMS partnered with "key thought leaders to really advance the understanding of the relevant scientific endpoints," Dr Daniels says. This also created a more appropriate testing framework that can be applied to new immunotherapy trials. This involved co-operation with a number of leading research charities, international bodies and clinicians.

Finally, says Dr Daniels, BMS has customised its customer relations processes to address some of the issues relevant to the drug. These include its novelty, high price (the four-injection treatment costs US\$120,000) and side effects. "As soon as an order is placed," he says, "a variety of people—a reimbursement specialist, a melanoma sales specialist, and medical specialists—are made aware in order to give the patient important information about access and safe use. It is a real innovation in our customer model in a very specialised area." He adds that, although the model itself does not address the price, it seeks to make doctors and patients aware of BMS programmes for the uninsured and underinsured.

What BMS's experience highlights is that a single innovation is rarely enough for a big breakthrough. Instead, firms need to be prepared to innovate and co-operate in a variety of areas.



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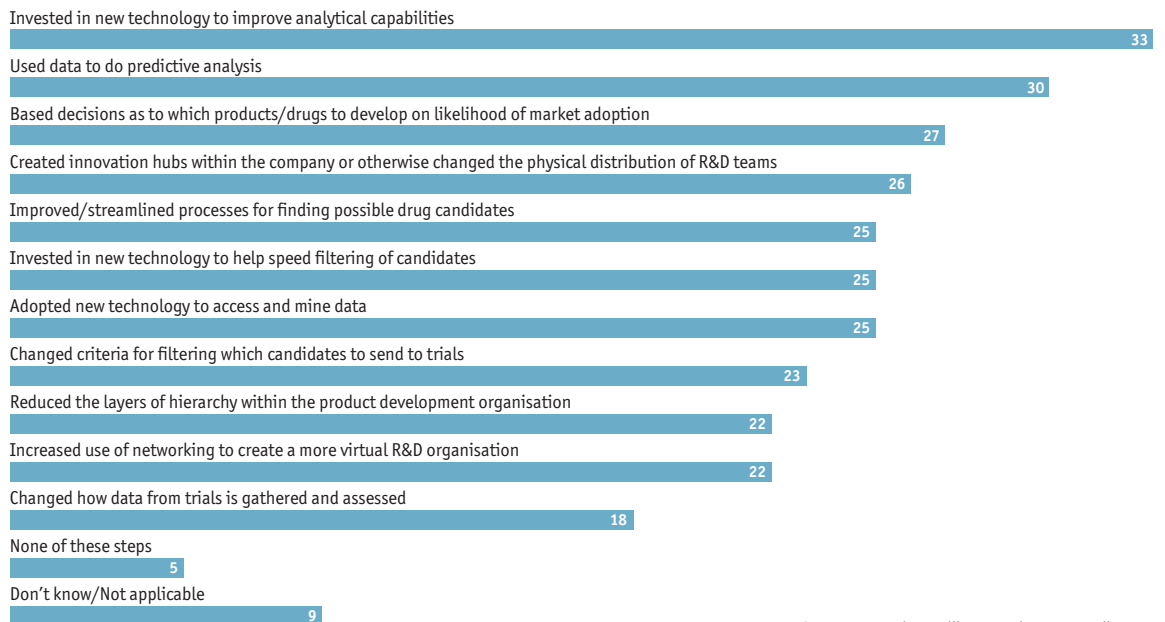
research to be the second most common source of ideas over the coming three years (cited by 38%), while other employees put much less stock in this source, in fifth place (24%).

It is unclear why this shift is not better understood within the wider company, but the experience of AstraZeneca is suggestive. Anders Ekblom, executive vice-president for global medicines development at AstraZeneca, a pharmaceutical firm that recently introduced a new innovation strategy, explains that the changes relating to its new strategy are well understood inside the organisation. He credits this to a substantial communication effort with the entire company and hundreds of interactions with management across the firm, before the strategy was launched. “In continued surveys we do internally, people get it,” he says. “They might not always like what we are doing, but they get it.” This suggests that the differences between clinical development and other respondents in this survey reflect shifts within R&D that are unannounced, or perhaps even unplanned, driven by necessity rather than as part of a comprehensive strategy.

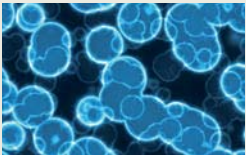
Finally, there is a challenge with the underlying driver of such improvement efforts. “Right now, the industry is very much driven by fear rather than by ambition,” says Dr Soehngen of the biopharmaceutical sector. While this can create activity, it does little to improve the underlying cultural assumptions about how innovation should be done. As Dr Gerbino puts it, change in how companies innovate “has been slow because there is a great amount of entropy in the ideology of what the industry must do with research programmes”. In other words, many executives remain unwilling or unable to conceive of innovation strategies that do not rely for the most part on internal R&D efforts, which has been the *de facto* model for at least 60 years.

Chart 4. No single strategy for improving innovation stands out

In the last three years, has your company taken any of the following steps to improve the efficiency of its product development process? Select all that apply.
(% respondents)



Source: Economist Intelligence Unit survey, April 2011.

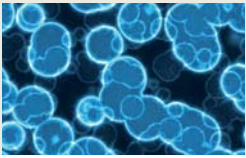


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A cultural shift, however, is an essential part of effective change. Dr Andersen reports that a few years ago, when Lundbeck consulted widely within the company about how it could improve its innovation strategy, the answer was clear: “culture was identified as the most important factor by a long way. It is probably the underlying foundation,” he says. Overall, survey respondents listed cultural attachment to the current approaches to innovation as the fourth-biggest barrier to improvement. But for those firms that admitted to being ineffective at innovation, it was the leading barrier (44%), whereas it was an issue for only 10% of the firms that were most effective.

Companies within the industry are experimenting with a large number of possible improvements to innovation, but none of these strategies is becoming widely popular. Nine different ideas have each been adopted at more than 20% of companies, but the most popular were only taken on by one-third of respondents (see Chart 4). These numbers will stay broadly the same over the coming three years, according to our survey. Nevertheless, rather than waiting for the best practices to slowly emerge, it is possible to draw lessons from what the most effective innovators are already doing today.



Lessons from the best innovators

Although the challenges to innovation that the industry faces are difficult, some companies are doing far better than others. Nearly one in five (18%) of respondents describe their innovation strategies as very effective. They have results to back up this self-assessment. In the last three years, despite typically being smaller than the average company in the survey, they produced an average of 7.2 new products or NMEs, compared with just 3.8 for the other companies.

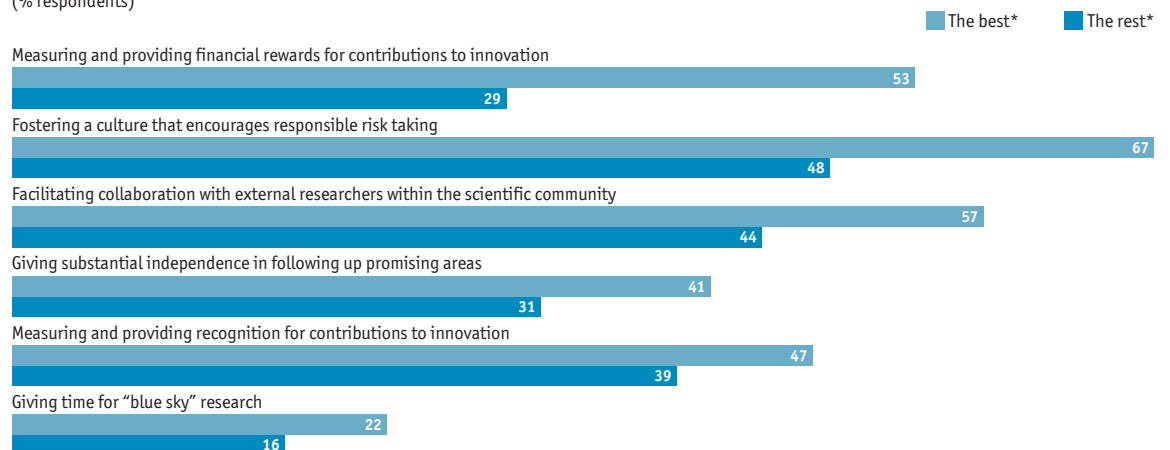
How can the experience of these firms help to improve innovation across the industry? Three key lessons can be drawn from their approach: first, they have developed an appropriate innovation environment; second, they have exploited innovation sources beyond their internal R&D; and third, they have made better use of available data.

1. Getting the environment right

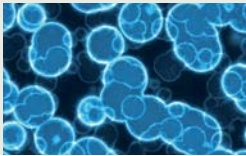
Certain impediments to innovation described above are simply a part of doing business in this sector. Governments and voters, for example, will always want strong regulation to ensure that products used in medical care meet certain standards.

Chart 5. **Leading innovators provide incentives**

Which of the following strategies does your organisation use to encourage research and innovation? Select all that apply. (% respondents)



* "The best" refers to companies whose innovation programmes are self-assessed as "very effective"; "The rest" refers to all other companies. Source: Economist Intelligence Unit survey, April 2011.



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The underlying attitudes and culture that hold back many companies, however, are not immovable barriers. Efforts here set apart leaders and laggards: two-thirds of effective innovators foster a culture that encourages responsible risk taking, compared with just 48% of others.

Freedom to think

Culture is a diffuse area, so it is helpful to look at what such efforts mean in practice. Dr Ekblom, like many other interviewees, stresses a company's attitude towards employees in enhancing innovation. "If you start with the process, you get it wrong. It is all about supporting the people." Particularly important here is the tone from the top. "You can't request innovation from your people and then treat them like military school students," explains Dr Soehngen. In Lundbeck's internal review of its innovation strategy, the firm found that "leaders had to understand that innovation comes from the individual who is working in the organisation, and that they should create space around people [to think]," says Dr Andersen. In return, individuals have the responsibility to engage in creative thinking.

Accordingly, leading innovators in our survey are typically more likely than others to give substantial independence to employees to follow up promising leads (41% to 31%). They are also more likely to give time for blue-sky thinking (22% to 16%). BMS goes a step further. In order to "free up our research scientists to do out of the box thinking," says Dr Daniels, the company instituted innovation awards, funding grants and time to pursue ideas of interest. The hope is that some of the results will be of direct use to the company. Dr Ekblom adds that even the nature of more structured work can have an effect. AstraZeneca organises research around disease areas, and one benefit is a "galvanisation of the mind", as he calls it. "People doing oncology are not thrilled by cardiovascular research," he adds.

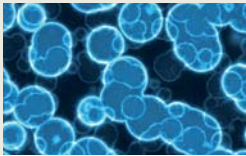
Rewards and incentives

Another fundamental part of creating a good innovation environment is the reward system. Here again, leading innovators act differently. First, far more leaders also provide financial rewards for such contributions (53% compared with 29%). Second, 47% of those with very effective innovation systems provide recognition for contributions to innovation, compared with just 39% of others.

To some degree, each of these strategies does the same thing: the money is a signal of appreciation as well as a reward in itself. Dr Andersen notes that, in his experience at Lundbeck, "it is clear that even though cash is appreciated, the most important part is recognition by colleagues. We introduced communication about success stories and about people who took a chance. It is an important part of an innovation culture." Philips Healthcare sees these rewards as part of a broader set of tools aimed at encouraging efforts. For example, the company has a technical innovation career ladder allowing people to achieve an employment grade in line with their contribution without having to manage large numbers of people. Dr Olego explains that creating the right environment requires "a whole package, not just one thing that motivates innovators".

Creating the right environment requires "a whole package, not just one thing that motivates innovators".

Diego Olego, chief technology officer, Philips Healthcare



Acceptance of failure

Innovation programmes that honour success must also address failure properly. This may not go as far as Rajan Tata, head of India-based Tata Group, in instituting an annual award for the best idea within the group that failed, but it does mean not punishing the inevitable setbacks that come when companies try to innovate. “If you want to have an entrepreneurial spirit, you need different values than a ‘no mistake’ philosophy,” says Dr Soehngen. “Fear hinders people from coming up with ideas.”

2. Looking beyond the internal R&D silo

An entrepreneurial culture, however, is only one part of the picture. As Dr Hirokawa puts it: “Both process and culture are important, and to be successful we can’t have one without the other.” One important process area is the search for new ideas.

Internal R&D remains by far the leading source of ideas for innovation for the sector as a whole (cited by 60%), and for pharma (73%) and biotech (71%) in particular. This is not inherently bad. A strong internal R&D function has been central to the success of many leading companies. Life sciences firms, however, have long understood the need for effective partnerships as well. In our survey, over one-half (54%) of companies have significantly increased the use of R&D partnerships and alliances in the last three years. But merely engaging in such arrangements does not inevitably mean effectiveness in using the resources of the outside world. Where innovation leaders and others differ is in being able to look beyond their own labs as well.

Open innovation

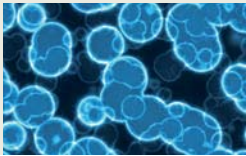
Although companies in the sector have engaged in partnerships for a long time, “there is a shift in recognising how we need to partner,” says Dr Uwe Schoenbeck, chief scientific officer for external R&D innovation at Pfizer, a pharmaceutical company. In general, partnerships with academia and companies have existed for a long time. “What we have found with cutting-edge innovation is to adjust business models to what makes sense in a given situation, making it much more collaborative and open spirited,” he adds.

In particular, leading innovators are much more likely to have embraced open innovation. The term has numerous definitions, but at a basic level involves two elements: first, searching for new ideas wherever they can be found, even licensing in useful ones where necessary; second, a willingness to share or license out IP that a company is not using. This is not a simple strategy for companies in the life sciences, dependent as they are on intellectual property: lack of certainty over IP rights and danger to existing IP are key risks cited by respondents.

Nevertheless, nearly two-thirds (63%) of those with effective innovation programmes say that they are successfully using open innovation, compared with just one-third (35%) of the rest of the survey. Similarly, more leaders have significantly increased their co-operation with non-commercial entities, such as academics and non-governmental organisations (NGOs), over the last three years, compared with others. With this also comes a shift in the nature of collaboration. Dr Hirokawa notes that, although Daiichi Sankyo has previously worked with well-known researchers, its new open innovation programme, TaNeDS, specifically provides opportunities for younger, talented ones.

“There is a shift in recognising how we need to partner.”

Uwe Schoenbeck, chief scientific officer, external R&D innovation, Pfizer



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“The perceived need for blockbusters has killed a lot of promising compounds which could have been profitable products.”

*Henry Chesborough,
executive director, Garwood
Center for Corporate
Innovation*

Lundbeck has recently moved towards open innovation. The shift began with an intellectual change rather than a procedural one. Dr Andersen recalls that until recently the industry patented everything that it could. “Now more companies have started to understand the difference between freedom to operate and owning a given IP right,” he says. Understanding this can often be enough for a company to allow open innovation without unduly jeopardising IP rights. Lundbeck even has plans to build a website to attract academic groups interested in specific projects. It hopes to provide certain tools, such as cell lines, with no strings attached, but asks in return that the academics let them know about any interesting findings. “That has worked pretty well in some pilot projects we have run, but it is still early days,” says Dr Andersen.

Pfizer is also using this strategy. As an example, its Centers for Therapeutic Innovation (CTI) programme seeks to create partnerships with academic institutions that aim to translate basic science into medicines using an open innovation model. Dr Schoenbeck explains that such efforts are not about significant upfront investment, but about two-way sharing of research information and tools.

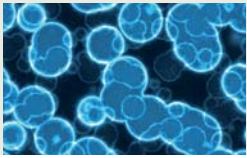
The company has created internal structures to help expand open innovation further. In particular, its external R&D innovation function has staff embedded in Pfizer’s global research units that focus on external opportunities. This is something that people with entirely internal responsibilities can find very difficult. By letting the company tap into these researchers’ networks, the company can use its size to great advantage in searching for new ideas. But Dr Schoenbeck warns that open innovation needs to complement internal research, not replace it, in order to succeed. Otherwise it could lead to internal resistance and even mistrust by external partners that do not know whether their contribution is being highly valued. Thus, the company seeks out partnerships desired by its research teams, where each side brings something the other cannot do on its own.

If anything, open innovation is even more important for medical devices companies than for biopharmaceutical ones. Philips Healthcare long ago opened its R&D campuses to host other companies and has many people embedded in research teams at other organisations’ clinical sites. Dr Olego explains that this is only a part of the net that device companies cast in searching for ideas. “The medical devices industry is an innovation industry,” he says, “but in itself might not have the muscle to push for the development of an enabling technology for a clinical solution from the ground up.” His company, for example, can make use of WiFi technology, advanced platforms developed for games consoles or cloud computing, even though the medical devices industry on its own would be unlikely to have had the market to create any one of these exclusively for healthcare applications and services.

Not only does open innovation provide better access to many sources of new ideas, it can unlock another problem of excessive focus on internal R&D, which Dr Soehngen calls “blockbuster mania”. Henry Chesborough, who coined the phrase “open innovation”, recently explained how these two are connected. “The perceived need for blockbusters,” he says, “has killed a lot of promising compounds which could have been profitable products.” The problem results from a need to pay for a research model that, by doing everything internally, leaves the company to bear all the costs of failed products. Only blockbusters can raise this kind of income. Open innovation, on the other hand, lets companies learn from the failures of others without needing to finance them, leaving open more room to pursue profitable, but not blockbuster, products.⁴

Finally, openness is about how a company innovates as much as about ideas for innovation. Dr Ekblom

4. Henry Chesborough, “Pharmaceutical Innovation Hits the Wall: How Open Innovation Can Help”, *Forbes*, April 25th 2011.



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reports that AstraZeneca's leadership teams "have a lot of out visits, in particular to companies outside pharma, in order to understand how people are doing this. We start asking people fundamental questions, like 'Why can Google be successful?' and 'What would that mean for us?'"

Maximising IP

Perhaps ironically, the bigger problem for life sciences companies looking to benefit from open innovation may not be looking outside for new ideas, but using the IP from their own research effectively. Companies involved in substantial research almost inevitably will develop IP that is not directly tied to what they are looking for. This might result, for example, in finding unexpected properties of certain compounds that make it suitable for uses other than the one for which it is being tested. Pfizer's realisation that its failed angina pill, sildenafil, could be used to treat erectile dysfunction led to the blockbuster drug Viagra. Nevertheless, when surveyed companies come up with IP that is not directly related to their development strategy, only 44% consistently make economic use of it, either by licensing out or through joint ventures.

Dr Gerbino explains that a regulatory system that requires such an intense focus—by setting increasingly stringent safety, efficacy and proof of value barriers—makes using unexpected discoveries very difficult. "[There is] probably stuff on industry shelves that would shock and amaze people, but right now you can't miss a minute in driving on to your focus," he says. Leading companies do about as well as all others in this regard, suggesting that it is an area where everyone must improve. Dr Andersen sees it as a major issue in the industry. One solution, he adds, is to try to separate data evaluation from development decision-making. This allows more time for the consideration of unexpected findings before choosing a course of action.

The use of market data

One particular type of data that life sciences companies have grown increasingly interested in is market data: 27% have moved towards basing decisions about product development more on the likelihood of market adoption and 30% expect to do so in the next three years. Overall, nearly six in ten firms believe that using data to model market trends would be of significant use in shaping innovation strategy. The reason is straightforward enough: "It is wonderful to bring drugs to market, but there has to be a market for those drugs," says Dr Philip Gerbino, president of the Philadelphia-based University of the Sciences.

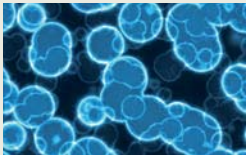
The issue, however, is not as simple as it seems. Brian Daniels, senior vice-president for global development and medical affairs at Bristol Myers Squibb, describes it as "a real hornet's nest". The biggest difficulty, he explains, is the inherent unpredictability of drug sales. The industry is rife with stories of dramatic overestimates, and underestimates, by companies. *Nature Drug Discovery* estimates

that market predictions are wrong about 80% of the time.⁶ In our survey, just 30% of respondents are confident that they use internal commercial data effectively in shaping R&D.

Despite these difficulties, our survey shows that an understanding of the market yields great rewards. Those companies that rate themselves above average on their ability to anticipate market demand for new products do better at development. Not only are they more likely to rank their innovation strategies as highly or very effective (64% compared with 42% for the rest of the survey), they also produce more commercially viable products (5.9 over the last three years on average compared with 3.4 for the rest). Even this group, however, has substantial room for improvement: just 44% say that they use their market data effectively with respect to R&D.

For further information on this issue, please see the Economist Intelligence Unit article, *How can a market perspective help biopharma R&D?*, which examines in greater detail how companies can benefit from such analysis.

6. Bernard Munos, "Lessons from 60 years of pharmaceutical innovation", *Nature Drug Discovery*, December 2009.



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“We are significantly better than five years ago. The whole area of bioinformatics has exploded.”

Brian Daniels, senior vice-president for global development and medical affairs, Bristol Myers Squibb.

The benefits can be surprising, and go far beyond the life sciences field. Amyris, a research and innovation firm, for example, is using the technology it developed to produce artemisinin, an anti-malaria drug, to produce precursors for biofuels. Similarly, Coca-Cola’s new Freestyle drink dispenser, which can mix up to 106 different beverages within the same size machine as a normal dispenser, uses technology developed for inserting exact microdoses of drugs into an intravenous drip. In both cases, open innovation is creating opportunities from which life sciences companies—and the public—would otherwise not benefit.

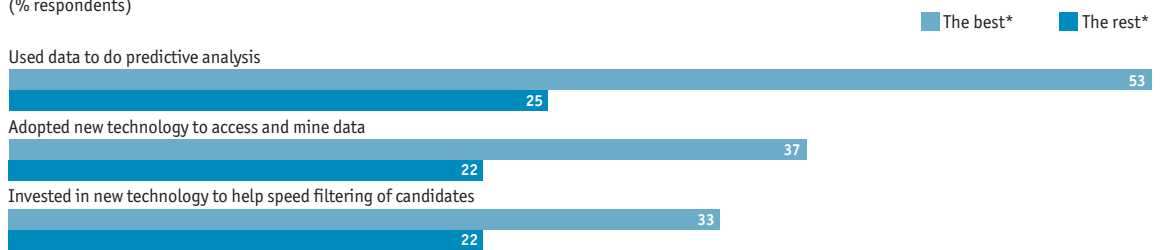
3. Harnessing available data

As Dr Ekblom puts it, “R&D is a data-driven activity”, so it is unsurprising that a third area where leading innovators differ from the pack is in their use of data. Over one-half (53%) of these firms, for example, have used data to do predictive analysis, compared with one in four (25%) among other companies. Success in this field begins with greater effort: in the last three years, 37% of leaders have adopted new technology to access and mine data and 33% have invested in technology to help speed the filtering of candidates, compared with 22% in each case for the rest (see Chart 6). Such effort yields results: 67% of innovation leaders say that they use internal company data to support innovation very well, compared with 25% of other firms; and 38% say the same about external data, compared with 17% among the others.

Chart 6. **Leading innovators are using data more effectively**

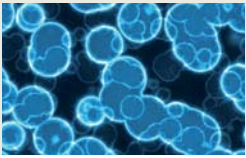
In the last three years, has your company taken any of the following steps to improve the efficiency of its product development process? Select all that apply.

(% respondents)



* “The best” refers to companies whose innovation programmes are self-assessed as “very effective”; “The rest” refers to all other companies. Source: Economist Intelligence Unit survey, April 2011.

The uses of data in R&D are manifold and growing. Dr Daniels sees significant benefits on both the research and the development side. One example of the former, he says, is the standardisation of assay profiles of small molecules—the reports of the effects of these chemicals on human beings. These standardised data, combined with new technology, allow medicinal chemists to get almost real time feedback on the properties of designed molecules, a process that used to take weeks. On development, the analysis of real world data is making opportunities clearer. BMS began looking at anti-rejection drugs after an analysis of real world results made clear that although short-term rejection rates, where companies had previously focussed, were improving, long-term rates were static. “We are significantly better than five years ago,” says Dr Daniels. “The whole area of bioinformatics has exploded.”

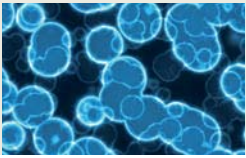


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Such analysis can also help companies to make better use of existing products. This is an area of weakness for the industry: a 2006 study by analysts from the MIT-Sloan School and Harvard Business School found that over one-half of new, off-label uses for existing drugs that were still under patent came from clinicians rather than drug companies or researchers.⁵ Leading innovators, however, are doing better than their peers in mining their own riches. A total of 61% of leaders listed existing IP as a leading source of new innovation, compared with just 31% of other businesses.

5. Harold J DeMonaco, Ayfer Ali and Eric von Hippel, "The Major Role of Clinicians in the Discovery of Off-Label Drug Therapies", *Pharmacotherapy* (2006), pp. 323-332.



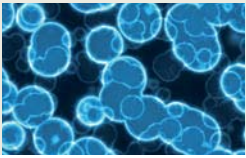
Conclusion: The industry can do better

For companies in the life sciences industry, improving their innovation record is essential. But high costs, complex regulations and long development time scales all conspire to make this task difficult. Larger companies in particular are addressing the first problem at least by announcing sometimes dramatic cuts in R&D spending.

The danger, however, is that executives might think of their current innovation problems as more of a cost issue than one of return on investment. Simply starving an ineffective system of funds is unlikely to increase its effectiveness. Instead, the reorganisations that come with consolidation need to be accompanied by more fundamental change. In order for this to occur, however, companies must give greater priority to rethinking innovation strategies, especially those that do not rank themselves highly as innovators. If not, all the talk of cultural shifts and improved entrepreneurship that frequently accompanies announcements of spending cuts risks being little more than empty words.

Fortunately, for those looking to improve, the habits of the most successful innovators provide important lessons that are not inherently expensive. They are more about changing attitudes and making better use of the company's assets—including its talent, knowledge and information. The leading lessons are:

- **Rethink your innovation environment:** A culture that motivates people is crucial even in a highly technical, scientific field. Companies must ensure that working conditions and reward structures truly encourage individuals to take the risks and put in the effort to innovate. At the very least, firms should recognise those who do well and not penalise failures if the risk was worthwhile. In Dr Soehngen's words, "You get what you ask for, but it may not be what you want." Therefore it pays to make sure all of the company's messages—explicit and implied—are saying the same thing.
- **Pursue more open partnerships:** Life sciences companies know that they need to partner, but how they partner is just as important. Leading companies are shifting towards more open innovation. This will require a changed mindset for companies that have thrived on a more closed-shop approach to product development in the past. In particular, although intellectual property will always be important, an excessive focus on this can hurt a company by impeding innovation. Moreover, it is important not to confuse open innovation with the straightforward outsourcing of research. Companies must also determine how to integrate external co-operation with internal R&D capacity in order to maximise the benefits of both.



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- **Exploit your IP fully:** Too many companies lack the processes to derive full benefit from their own research. They can improve their return on investment by looking outside the industry for applications of their discoveries. This is the flip side of open innovation. If a company has things that, in Dr Gerbino's words, "shock and amaze" and cannot exploit them directly, it only makes commercial sense to partner or license out.
- **Explore opportunities to make better use of your data:** The data tools available to assist R&D are improving rapidly. In such a situation, it takes focussed effort to review and reshape processes to integrate the new technology most effectively.

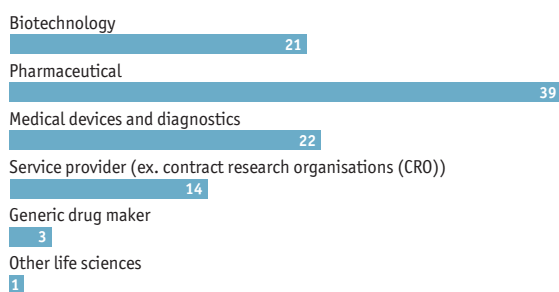
To meet the challenges mounting on every side, life sciences companies need to do far more than cut costs: they must reinvent how they innovate.

Appendix: Survey results

Percentages may not add to 100% owing to rounding or the ability of respondents to choose multiple responses.

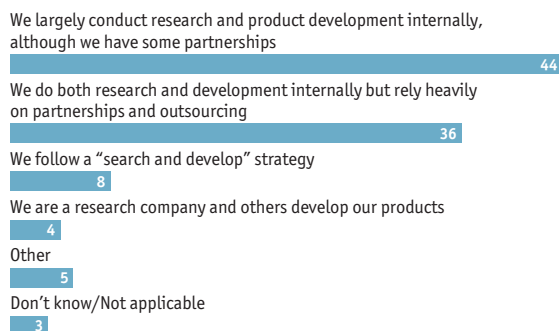
In which segment of the life sciences industry does your company primarily operate?

(% respondents)



How would you characterise your company's innovation strategy?

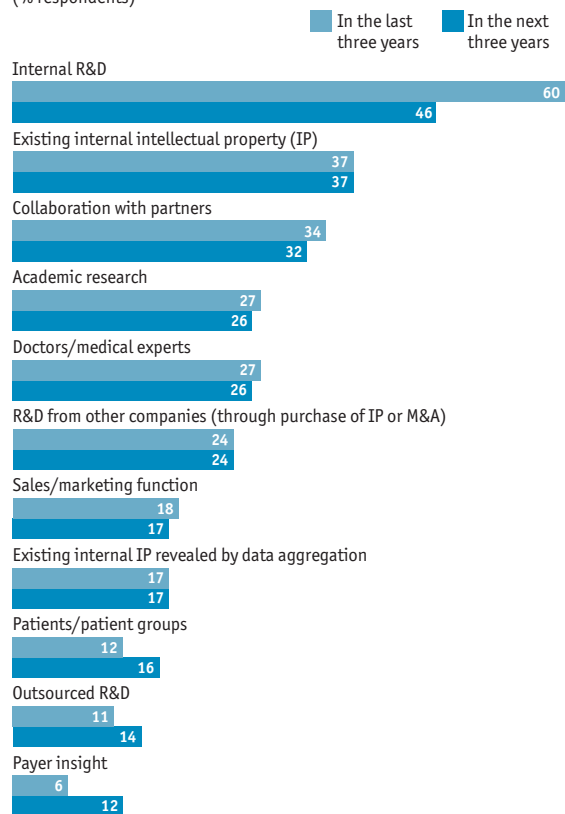
(% respondents)



What are the most significant sources of ideas that have led to new products or processes at your company in the last three years? Which, if any, do you think will become more important in the next three years?

Select up to three in each column.

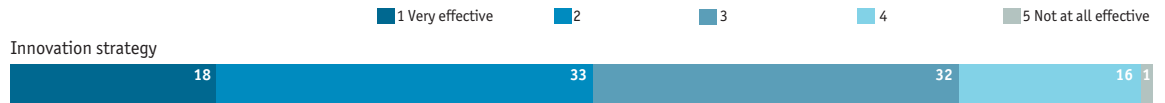
(% respondents)



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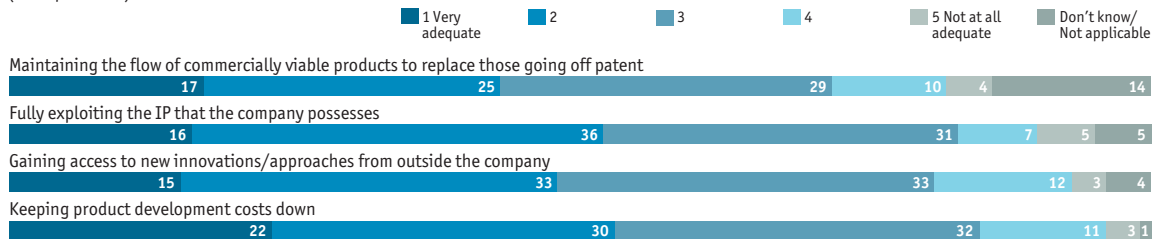
How effective is your organisation's innovation strategy?

Please indicate on a scale of 1 to 5, where 1= Very effective and 5=Not at all effective.
(% respondents)



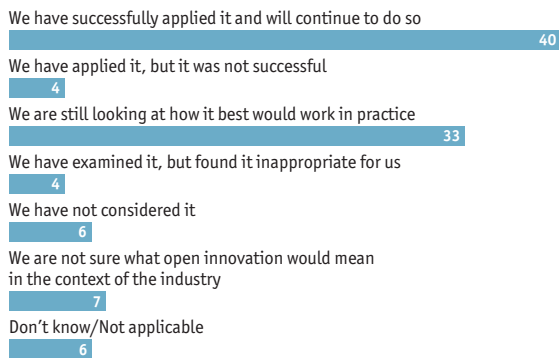
In your opinion, how adequate is your company's innovation strategy to do the following?

Please indicate on a scale of 1 to 5, where 1= Very adequate and 5=Not at all adequate.
(% respondents)



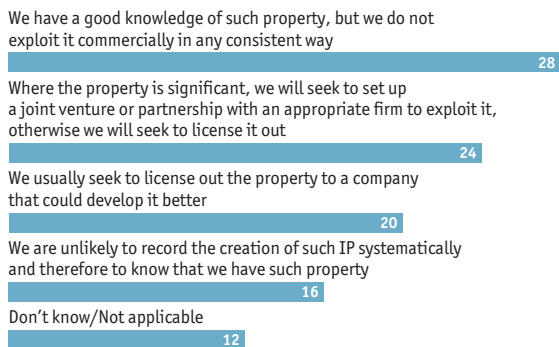
What is your company's attitude towards open innovation?

(% respondents)



What does your company do with internally generated IP that is not aligned with the organisation's development strategy?

(% respondents)



What are the leading barriers to your company using or increasing the use of open innovation? Select top three.

(% respondents)

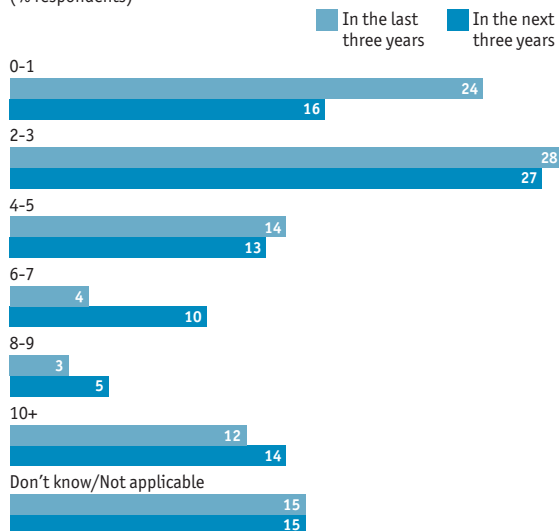


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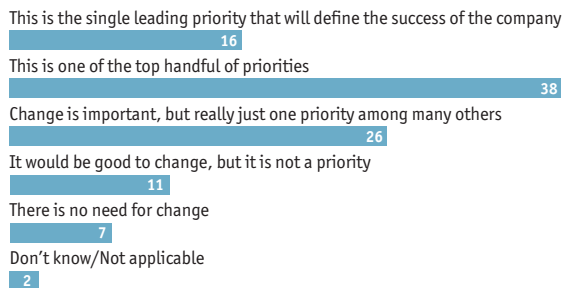
How many new devices or new molecular entities has your company brought to market in the last three years? How many do you expect to bring to market in the next three years?

(% respondents)



Which statement best describes your company's plan to change its innovation processes in the next three years?

(% respondents)



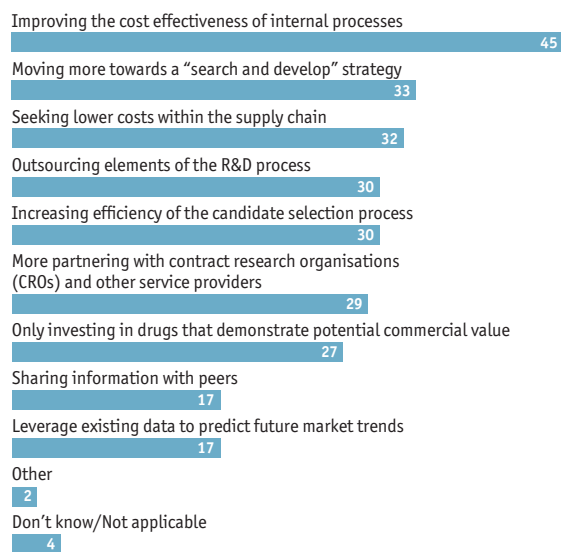
What are the biggest impediments to improving your company's product innovation? Select top three.

(% respondents)



In your opinion, what measures would provide your organisation the most benefit in reducing R&D costs? Select top three.

(% respondents)



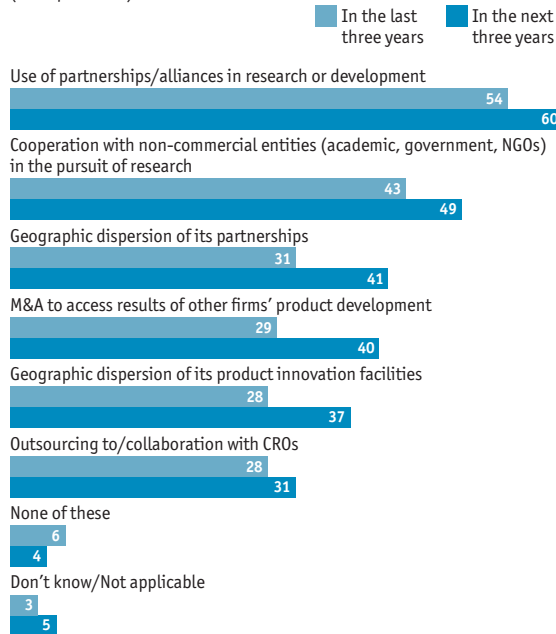
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Has your company significantly increased any of the following in the past three years? Is it likely to increase any significantly in the next three years?

Select all that apply.

(% respondents)



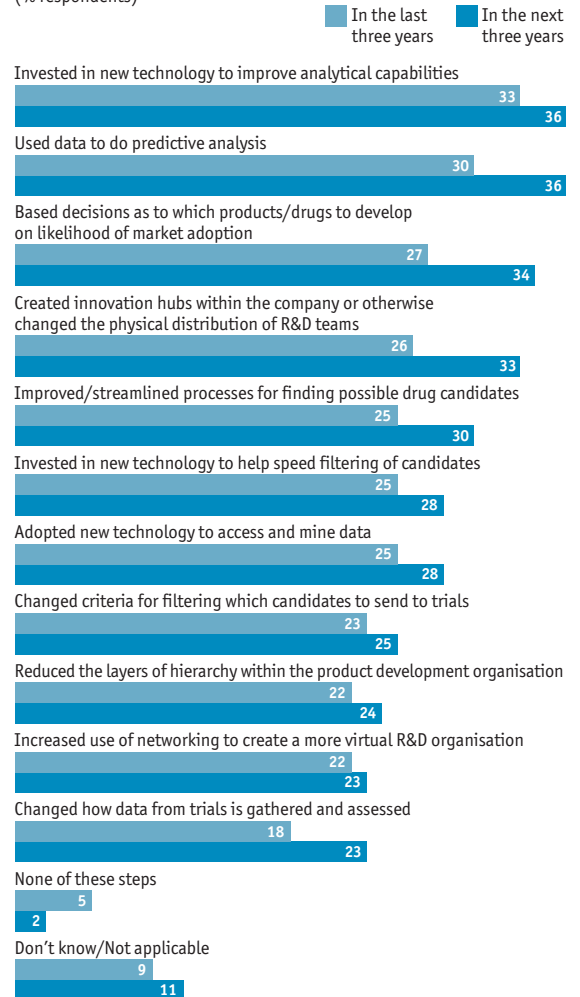
Which of the following strategies does your organisation use to encourage research and innovation? Select all that apply.

(% respondents)



In the last three years, has your company taken any of the following steps to improve the efficiency of its product development process? Which, if any, does it intend to take in the next three years? Select all that apply. Last three years

(% respondents)

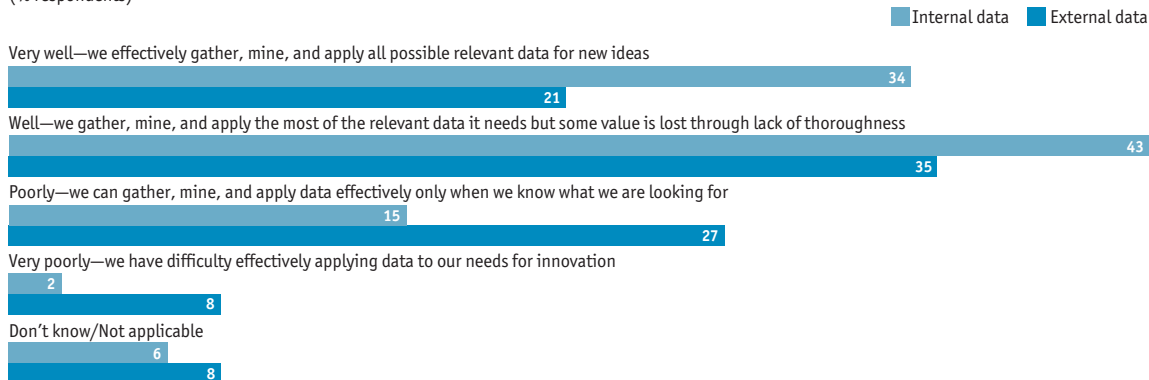


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How well is your company using data to support its product innovation? Internal and external data

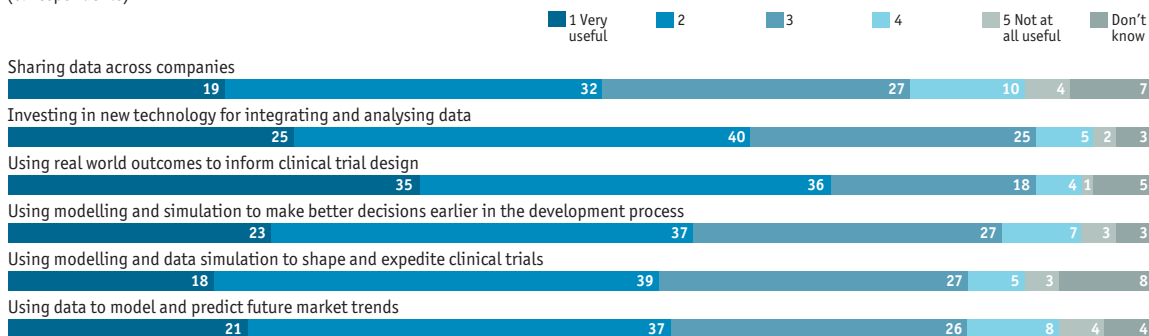
(% respondents)



In your opinion, how useful are the following to help companies shape innovation today?

Rate on a scale of 1 to 5, where 1= Very useful and 5=Not at all useful.

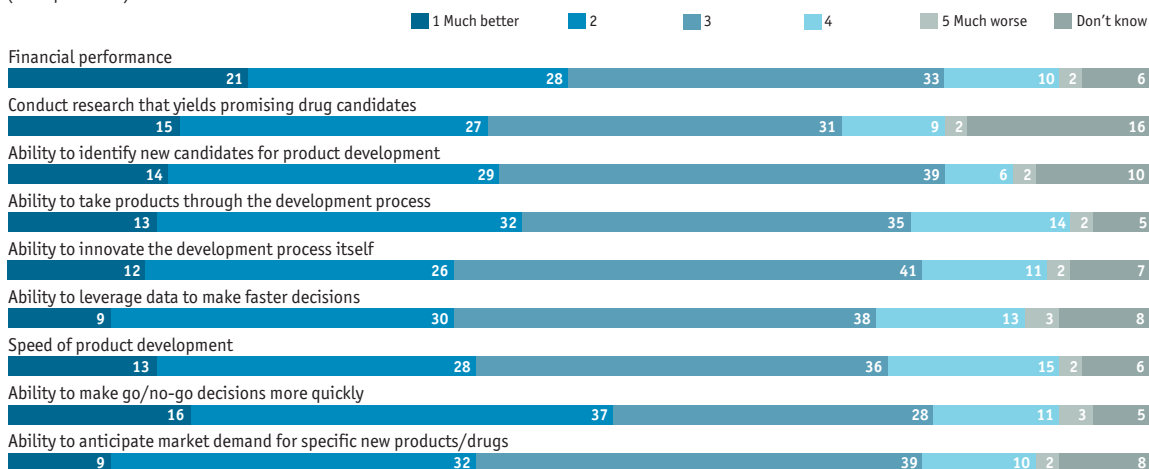
(% respondents)



Compared to its peers, how would you rate your organisation in the following areas?

Answer on a scale of 1 to 5, where 1=Much better, 3= About the same, and 5=Much worse.

(% respondents)



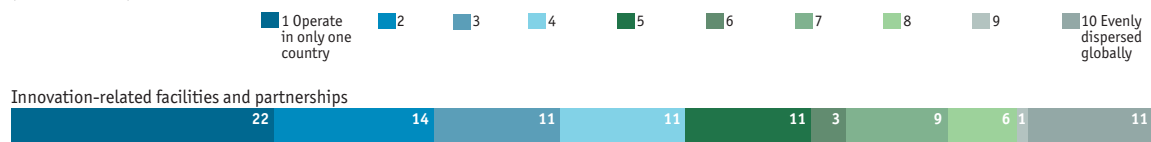
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How geographically dispersed are your innovation-related facilities and partnerships?

Please indicate on a scale of 1 to 10, where 1=Operate in only 1 country and 10=Evenly dispersed globally.

(% respondents)



What challenges, if any, has your organisation faced because of the geographic dispersion of its innovation-related facilities and partnerships? Select all that apply.

(% respondents)



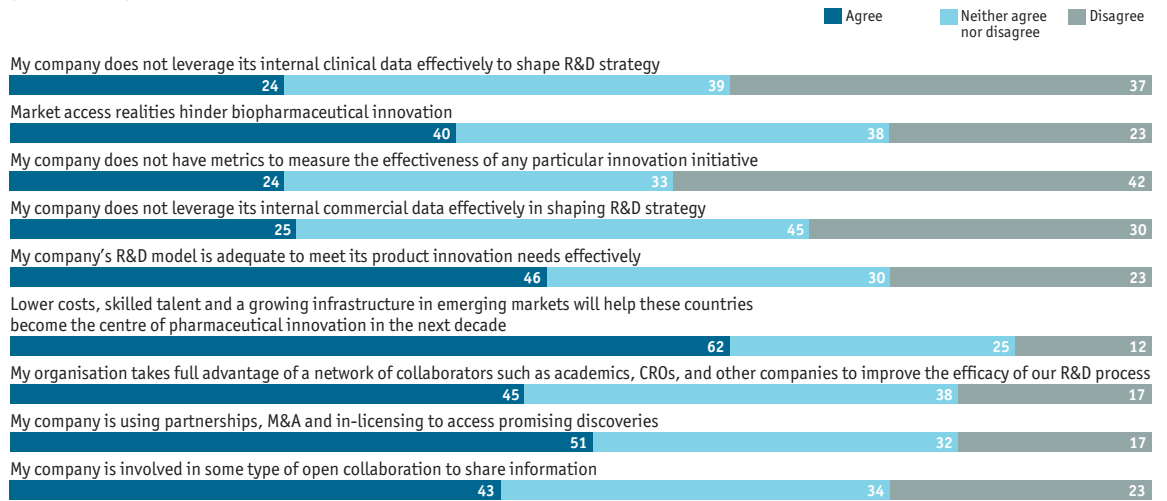
If your organisation's operations have become more widely dispersed geographically in the last three years, which, if any, of the following benefits has your company actually realised? Select all that apply.

(% respondents)

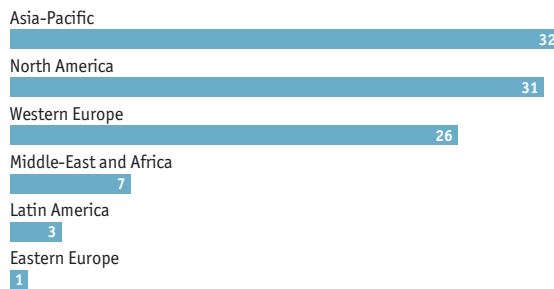


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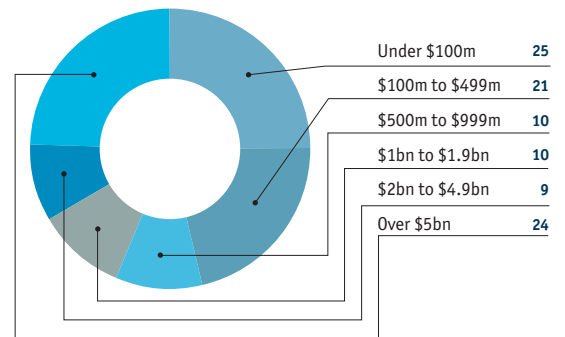
Do you agree or disagree with the following statements?
(% respondents)



In which region are you personally based?
(% respondents)



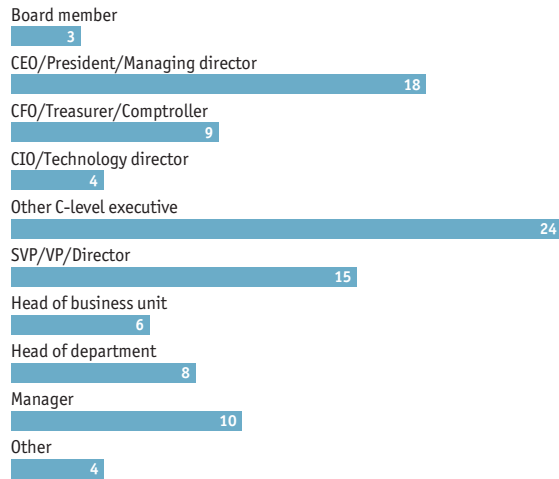
What are your company's annual global revenues in US dollars?
(% respondents)



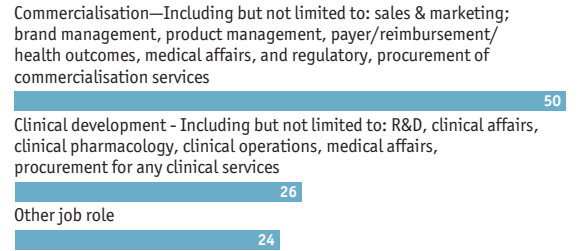
**Reinventing biopharma:
Strategies for an evolving marketplace**

The innovation imperative in biopharma

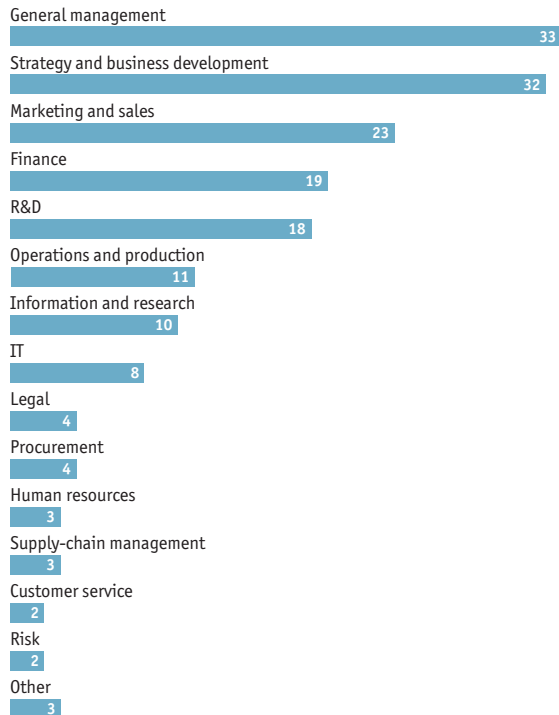
Which of the following best describes your job title?
(% respondents)



Which of the following best describes your primary job role?
(% respondents)



What are your main functional roles? Select up to three.
(% respondents)



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