

The biotechnology and pharmaceutical industries in the Munich Metropolitan Region (EMM)



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The Munich Metropolitan Region (EMM) is one of Germany's stand-out locations for the biotechnology and pharmaceutical industries. 15% of the country's biotech firms are headquartered in the EMM region, and 30% of Germany's development of biotechnological activities takes place here.

Following on from similar studies in 2005 and 2008, this is the third time that the Chamber of Commerce and Industry for Munich and Upper Bavaria, the City of Munich and BioM Biotech Cluster Development GmbH have joined forces to analyze the development of these industries, their success factors and the challenges they face in the future.

In 2013, the 377 biotech and pharmaceutical companies counted in the EMM region employed 23,000 people and generated sales of around EUR 8.5 billion. As such, they made a significant contribution to the region's economic output. The number of companies, sales revenue and the number of employees have all increased over the past five years. Companies in these industries are also very loyal to the EMM region: 82% said they were satisfied with their location; far fewer companies than in 2008 are planning to move operating activities abroad; and even those that are intend to do so only on a small scale.

The region has experienced turbulent years of late. Although biotechnology and pharmaceutical companies suffered less from the financial crisis in 2008/2009 than their peers in mechanical and automotive engineering, for example, they have instead been forced to respond to regulatory changes, healthcare reforms and legal provisions governing the licensing of generic products. Pharmaceutical firms have gained access to new developments and markets by stepping up mergers, acquisitions and collaborative development activities. Since 2008, seven companies in the Munich region alone have been taken over by international groups. The majority of young biotech companies have evolved into technology service providers for large pharmaceutical companies, making their knowledge and technology platforms available to the "big players" in the context of development partnerships.

Yet all these developments primarily concern individual companies rather than directly shaping the face of either industry in the region. What, then, are the factors that make the EMM region stand out as a biotech and pharmaceutical lighthouse? First and foremost, there are the eight research institutions that lay the scientific foundations, spin off start-ups and invite firms to cooperate with them. These institutions include two elite universities, three world-renowned Max Planck institutes and the German Research Center for Environmental Health. Building on this foundation, effective network management not only encourages collaboration between the business and scientific communities, but also supports the two sides as they do engage. Biotech companies in the EMM region are currently committed to no fewer than 261 collaborative development and distribution agreements with other companies; and around 60 of these partnerships were launched in 2013 alone. 40% of the region's biotechnology firms cooperate with Bavarian research organizations.

In 1996, scientists, biotech firms and pharmaceutical companies got together for the first time to map out a concept for the future of the region. For their efforts, they were singled out by the Federal Ministry of Education and Research (BMBF) as a model region. In 2010, Munich's university hospitals and its biotechnology and pharmaceutical industries together won the Federal Ministry of Education and Research's nationwide Leading-Edge Cluster competition with their m4 concept. As a result, the federal and regional governments and the industry itself have put together a project volume of EUR 90 million to advance the forward-looking discipline of "personalized medicine" in the EMM region.

Collaboration between companies, close proximity to high-quality research and a vibrant network are thus establishing the EMM region as an attractive venue for other companies too. Five biotech firms from the USA and two more from Japan have established a base in the Munich Metropolitan Region since 2008. They now constitute yet another building block in the international future of the EMM region as a biotechnology and pharmaceutical location.

Peter Driessen

Josef Schmid

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Facts and figures

Companies in the EMM region

The 377 companies that make up the biotechnology and pharmaceutical industries in the Munich Metropolitan Region (EMM) employ 23,000 people and generated sales revenue of around EUR 8.5 billion in 2013.

CORE DATA FOR THE MUNICH METROPOLITAN REGION IN 2013

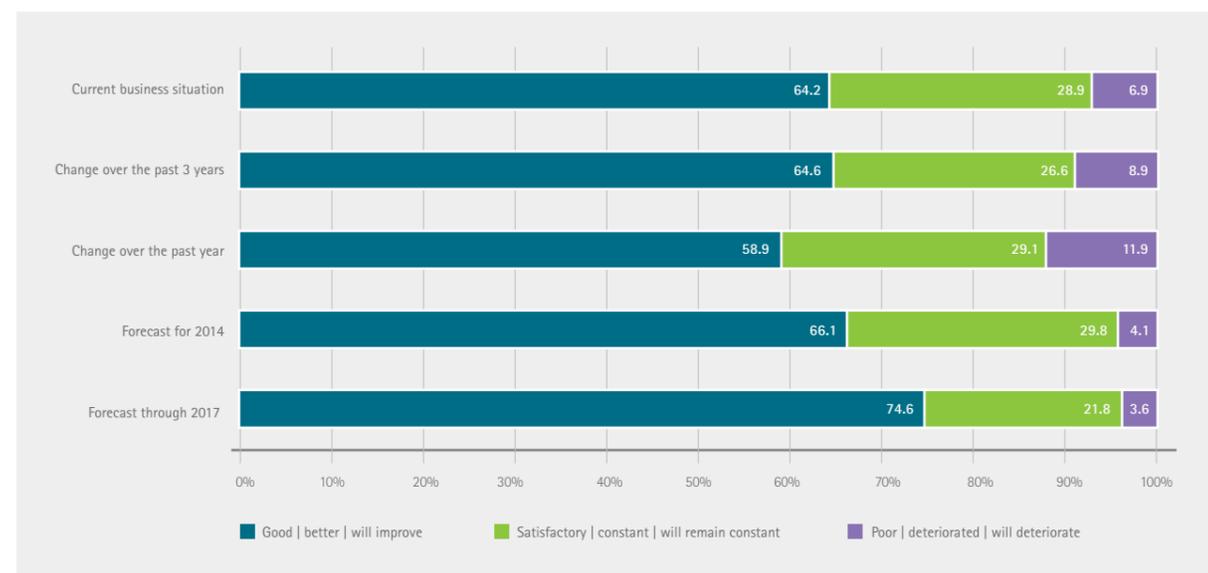
	No.	Employees	Sales (EUR m)
All companies	377	23,000	8,500
Biotech EMM	131	3,100	415
Biotech International	32	6,600	2,700
Pharmaceuticals	30	6,500	3,850
CROs	54	2,000	190
Others	130	4,700	1,340
Research organizations	8	ca. 10,000	k.A.
TOTAL		33,000	8,500

- A total of 163 **BIOTECHNOLOGY COMPANIES** operated in the EMM region in 2013, 14 more (+10%) than in 2008. Of these companies, 131 are headquartered in the region (Biotech EMM), while 32 are subsidiaries of international groups (Biotech International). 44 new biotech firms have been launched in or moved to the region since 2008. Taken together, biotech companies generated sales totaling EUR 3.1 billion in 2013, an increase of 12% on 2008. Since 2008, the number of employees has also risen by around 20% to 9,700.

- The 30 **PHARMACEUTICAL COMPANIES** in the EMM region posted sales of EUR 3.8 billion in 2013, a gain of 3% since 2008. Most of these operations are the sales offices of international pharmaceutical groups that have set up their German headquarters here. 70% of them nevertheless also conduct research and development – primarily clinical trials in the context of international networks – in the EMM region.
- The EMM is home to 54 **CONTRACT RESEARCH ORGANIZATIONS (CROs)**. These external research facilities conduct and coordinate preclinical research and development work and clinical trials on behalf of large biotechnology and pharmaceutical firms. Sales revenue at these CROs rose by nearly 10% per annum from EUR 119 million in 2008 to a total of EUR 193 million in 2013 (+60% overall). The number of employees too rose by around 250 to 1,954 (+15%) between 2008 and 2013.
- 130 other **LIFE SCIENCE COMPANIES** can also be assigned to the EMM region's pharmaceutical and biotechnology sectors in the broadest sense. Generating sales of some EUR 1.3 billion, these firms have a good 4,700 people on their payroll and are an important economic factor in the region.

Overall, these companies are upbeat about their future prospects.

ASSESSMENT OF THE BUSINESS CLIMATE IN THE BIOTECH AND PHARMACEUTICAL INDUSTRY IN THE EMM REGION



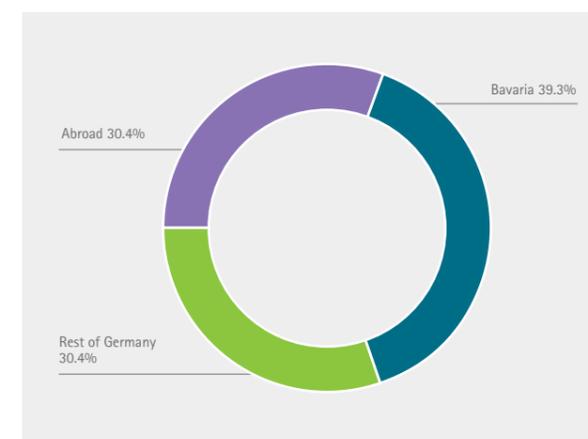
Success of the EMM model

The EMM region today occupies a leading position as a venue for biotechnology in Germany. Around 15% of German biotech companies (according to the OECD definition) are headquartered here (88 out of 570 companies). The EMM region thus hosts as many companies in this industry as the whole of Baden-Württemberg or the whole of North Rhine-Westphalia.

These companies cover a broad spectrum of technologies and scientific disciplines enables the region to master crises well while also quickly and successfully picking up on new trends.

An outstanding scientific and academic landscape – comprising two elite universities, three world-renowned Max Planck Institutes, the German Research Center for Environmental Health and an array of other institutes of higher education, complemented by a recognized and effective network management system that brings the business and scientific communities together – lays the foundation for economic success in this field. Close proximity to research organizations is thus cited by 84% of companies as a positive location factor. 40% of biotech companies here cooperate with Bavarian research institutions.

GEOGRAPHIC DISTRIBUTION OF COOPERATIVE VENTURES BETWEEN BIOTECH EMM COMPANIES AND RESEARCH INSTITUTIONS



"The academic research landscape is outstanding and bundles a lot of scientific talent in the region. However, financial support for research ideas is underdeveloped, which limits growth and the creation of jobs."

Jens Holstein
CFO Morphosys AG

Local and global challenges

82% of companies in the region are satisfied with their location and have no plans to move factories or units abroad. Good transportation links (68%) are one of the factors they are pleased with, although Martinsried is an exception in this regard: More than 40% of the firms based in Martinsried are very dissatisfied with transportation links here because of the lack of a subway station. Other critical issues include high rents and the high cost of living.

Despite positive development, biotechnology and pharmaceutical companies face major challenges and global competition. The USA in particular has, in recent years, accelerated licensing/approval procedures for innovative medication, as well as simplifying access to capital on the stock exchanges.

For these reasons

- The licensing terms for innovative, experimental pharmaceuticals need to be improved, especially with regard to the combination of molecular diagnostics and targeted therapy
- Companies should be given better opportunities to access clinical research and development in Munich's (Germany's) university medical landscape
- It is vital to improve financing options for young companies – above all for the protracted development of new medicines and diagnostic methods – for example by creating incentive structures to attract new venture funds to the region, and/or by providing tax breaks on R&D investments
- Creative, interdisciplinary collaboration between the biotechnology, medical engineering, information and communication technology industries must be reinforced
- Innovation workshops should be ramped up on a local level to facilitate early proof of concept and proof of market for project ideas within a supportive entrepreneurial framework.

ECONOMIC ENVIRONMENT AND REGULATORY CHANGES SINCE 2008

Financial crisis, euro crisis and resultant challenges

The last major study of the biotechnology and pharmaceutical industry in the Munich Metropolitan Region (EMM) was conducted at the end of 2008/in early 2009. Back then, 50% of the respondent companies in and around Munich expected their business situation to improve as early as 2009, while 73% anticipated improvements over the coming five years. At the time the survey was conducted, no one could have foreseen the dramatic developments that would follow the insolvency of US investment bank Lehman Brothers.

In a long-term study of its own (1), the German Association of Research-Based Pharmaceutical Companies (vfa) sees the **PHARMACEUTICAL INDUSTRY** as an anchor providing stability for the domestic economy. Unlike the manufacturing industry, pharmaceutical production barely fluctuated at all between 2009 and 2012, and indeed saw an increase in export business. Staffing figures headed in the other direction, however: In 2009, the German pharmaceutical industry axed a large number of jobs in response to both the global economic crisis and Germany's healthcare reform. When the healthcare reform took effect in 2007, pharmaceutical firms reduced their field service headcount. When the global economic crisis struck, they also scaled back investments and shed jobs in research and development. Although they have now been recruiting new staff again since 2011, a return to pre-crisis levels has not yet been achieved.

Once a year, Berlin-based agency BIOCOM gathers the data for the German **BIOTECHNOLOGY INDUSTRY** (2), on behalf of the Federal Ministry of Education and Research (BMBF). Analyzing 2008, the year in which the collapse of Lehman Brothers sparked off the crisis, the authors of the 2009 survey noted that the "crisis had not (yet) reached German biotechnology companies", and that the industry had remained stable in terms of the number of companies and employees, as well as in financing terms. The forecast turned out to be accurate, and Germany's biotech sector experienced continual growth in the years that followed.

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1 KEY DATA FOR THE BIOTECH INDUSTRY IN GERMANY

Key data for the company landscape	2007	2008	2009	2010	2011	2012	2013
No. of pure biotech companies	496	501	531	538	552	565	570
No. of other companies with operations in biotechnology	91	92	114	125	126	128	130
Employees (at pure biotech companies)	10,360	14,450	14,950	15,480	16,300	17,460	16,950
Employees (at other companies with operations in biotechnology)	15,210	15,520	16,650	17,000	17,570	17,760	18,450
Sales revenue (at pure biotech companies)	EUR 2.01 bn	EUR 2.19 bn	EUR 2.18 bn	EUR 2.37 bn	EUR 2.62 bn	EUR 2.90 bn	EUR 2.86 bn
R&D spending (at pure biotech companies)	EUR 1.05 bn	EUR 1.06 bn	EUR 1.05 bn	EUR 1.02 bn	EUR 0.975 bn	EUR 0.934 bn	EUR 0.899 bn

Source: biotechnologie.de

Changes in licensing and regulation

USA

When the human genome was decoded in 2001, the Food and Drug Administration (FDA), the USA's licensing body, acknowledged that the entire system of medical research and licensing was in need of fundamental reform. As early as 2002, the FDA incorporated the trend toward "personalized medicine" as a focus of its work, implementing relevant rules and procedural paths and restructuring its own organization (3). **The FDA has since continually adapted special fast-tracked, accelerated approval and breakthrough trajectories, for example, which are designed to promote innovation and seek to expedite screening and licensing procedures – given appropriate effectiveness and safety – in areas of disease that currently lack therapeutic options.** A good 40% of the 27 new medicines approved by the FDA in 2013 were fast-tracked (4).

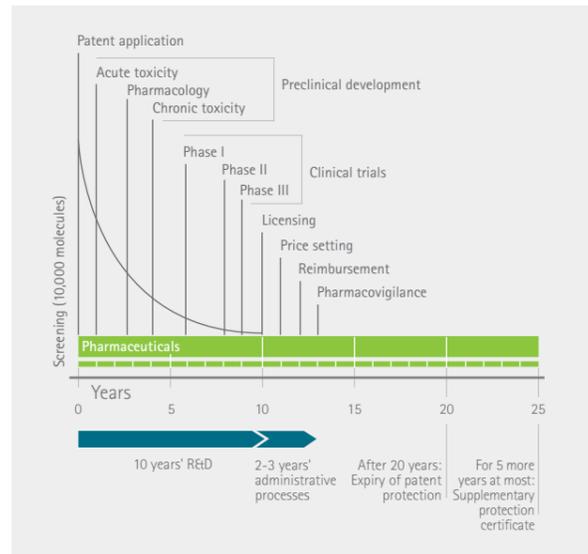
GERMANY

The entire healthcare industry operates in a very heavily regulated market environment. When medication is being developed, new products are subjected to a defined process involving clinical trials on multiple levels – a process that is strictly regulated and controlled before new drugs are approved by national and/or international authorities.

In the past, the granting of an approval effectively signaled market entry and the launch of marketing activities which, in negotiations with health insurers, usually opened the door to reimbursement. In most cases, companies set their own prices, especially for new medicines.

Since healthcare costs have been spiraling for years, the government has, over the past 12 years, introduced many new laws and legal amendments in an attempt to rein in these costs.

2 PHASES OF THE PHARMACEUTICAL RESEARCH AND DEVELOPMENT PROCESS IN THE EU

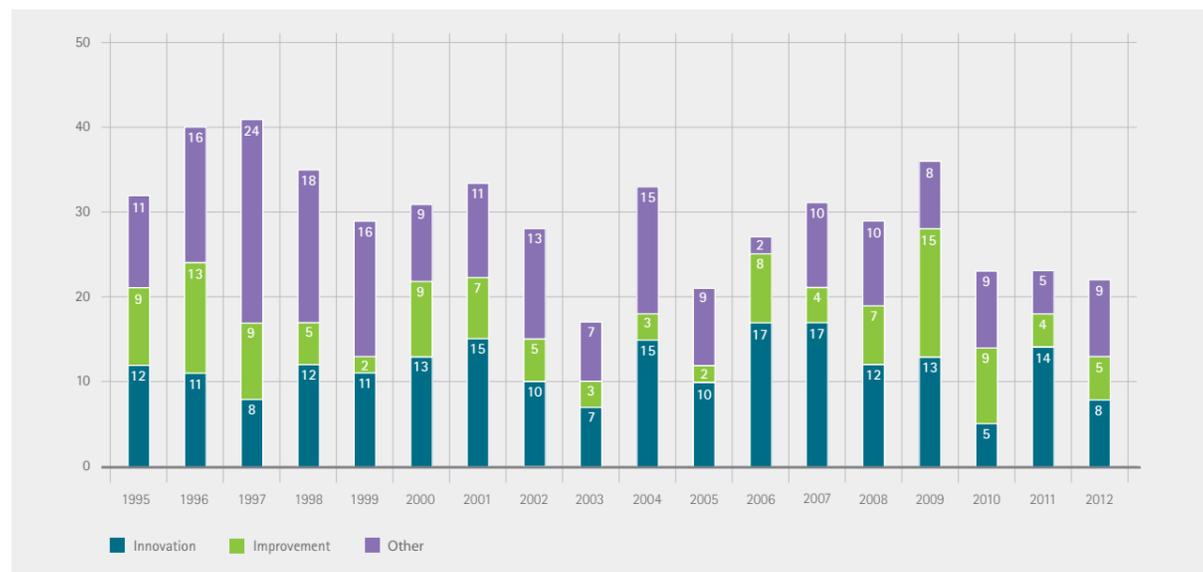


Enacted in 2010/2011, the German Pharmaceutical Market Reorganization Act (AMNOG) in particular was designed to cap the sharp increase in pharmaceutical costs, especially with regard to new drugs that are exempted from co-payment. The law now obliges pharmaceutical companies to have the value added by their newly approved and launched products screened at an early stage. If no added value compared to existing therapeutic standards can be proven, the drug is assigned to a co-payment group along with comparable active agents.

Since the development cycles for new pharmaceuticals can often extend over ten to 15 years, this change in the licensing methodology and the associated reimbursement system created a new hurdle that is neither predictable, nor can it be costed reliably. Furthermore, additional comparison criteria were added to what was already a complex and strictly regulated clinical development process.

Source: 2013 pharmaceutical data published by the German Pharmaceutical Industry Association (BPI); reproduced with kind permission

3 MARKET LAUNCH OF DRUGS WITH NEW ACTIVES AND THE NUMBER OF INNOVATIVE AND IMPROVED ACTIVES BETWEEN 1995 AND 2012



Source: Schwabe, Ulrich and Paffrath, Dieter (eds.) Arzneiverordnungs-Report 2013, Aktuelle Daten, Kosten, Trends und Kommentare ("Drug Prescription Report 2013, Current Data, Costs, Trends and Comments")

Biotechnology funding in the USA, Europe and Germany

PRACTICAL CONSEQUENCES

In practice, the new legal ruling has significant consequences. On the one hand, not all new drugs are automatically assumed to add value. The discounts negotiated as a result led to savings of around EUR 180 million in 2013 (5). On the other hand, a number of firms are now refusing to subject their new drugs to the AMNOG procedure and are simply not selling them in Germany. The impact on patients is the subject of heated debate among experts (6).

None of the parties to the licensing process disputes the fact that added value can be a useful criterion to describe and evaluate the degree of innovation in a new active agent. What is often debatable, however, is how added value can be sensibly measured. Other European countries have adopted comparable processes (such as the UK's NICE process).

Developers of drugs produced using biotechnology have only been operating in Germany since the end of the 1990s and have produced few approved medicinal products. Where they do meet with success, however, the drugs that German biotech firms are currently developing often provide an initial approach to treating conditions for which no other therapeutic options yet exist. By far the majority of these drug candidates have thus been designed and gone into development with a theoretical value added from the word go. As a result, the biotech companies behind them do not see AMNOG as a major obstacle. Industry associations such as BIO Deutschland nevertheless warn that drug companies are uncertain about market prospects in Germany, and that this could detract from their willingness to participate in joint development projects.

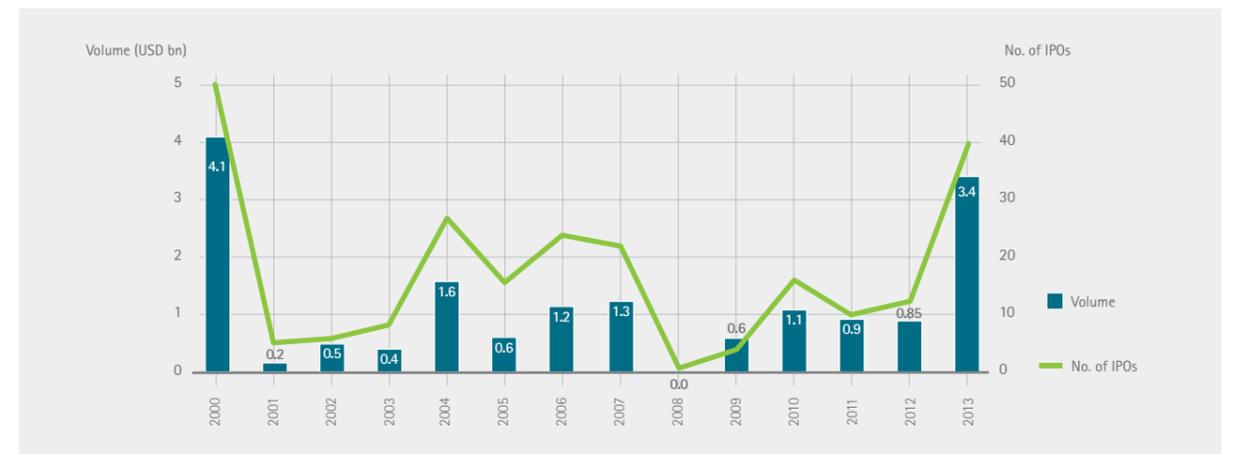
IN THE USA

The USA's deliberate policy of promoting innovation with its fast-tracked licensing process makes companies more willing to invest, as it gives them the prospect of faster success and a quick return on investment.

Long-standing US biotech firms have great confidence in their own capabilities. Many have already successfully placed drugs on the market and generate substantial revenue. They also operate among investors who already earn money with biotechnology and are willing to continue investing in new firms. This innovation-friendly climate led to a record number of initial public offerings (IPOs) in the USA in 2013, with no fewer than 40 biotech companies floating shares in return for more than USD 3 billion. In the process, investors also shouldered the risks inherent in very early development pipelines: **Only 13 of the newly floated companies have products that are either in the final clinical trial phase (phase 3) or are already approved. One IPO was even completed successfully with a pre-clinical candidate.**

On top of the opportunities that the stock market affords to companies in need of capital, venture capital (VC) funding too is much more widespread in the USA than in Germany. Private equity investors have channeled between USD 2 billion and USD 5 billion a year into biotech firms, although investors prefer to participate in more mature projects. **To make it easier for young companies to go public, the USA in 2012 simplified the licensing process and the ability to attract a larger number of shareholders in the early (pre-IPO) phase by ratifying the new Jumpstart Our Business Startups (JOBS) Act.** It will, however, be some years before the actual impact of the new law can be determined with any degree of certainty.

4 IPOs IN THE US BIOTECHNOLOGY SECTOR (7)



Sources: EY, Capital IQ, BioCentury and Venture Source

IN EUROPE

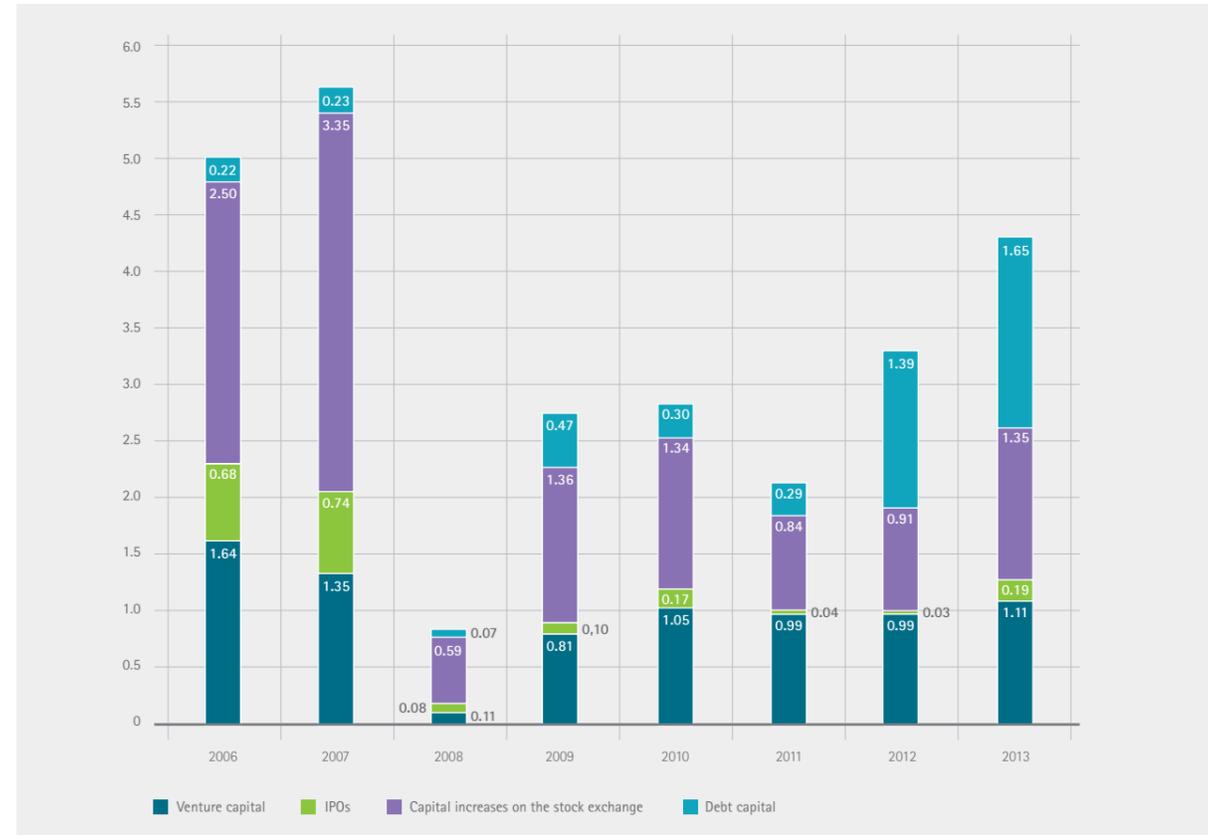
Europe hopes that the new stock market boom in the USA will continue, as Paris and London are already benefiting as the Americans lead the way. A number of IPOs have also recently been completed on European shores: British biotech firm Circassia, for example, netted the record sum of approx. USD 330 million on the London Stock Exchange in spring 2014.

After cooling noticeably in the wake of the global economic crisis in 2008, overall financing in the European biotechnology sector is showing a positive trend and hit a new peak of more than EUR 4 billion in 2013 (7). Apart from IPOs, capital increases on the stock exchange and debt capital financing arrangements drove this significant year-on-year gain of nearly 30% relative to 2012. By contrast, venture capital backing rose by only about ten percentage points. The VC volume thus remains static at around the EUR 1 billion mark, still roughly 30% down on the figure recorded in 2008 (7).

"Early-phase financing is a topic that is now being well-served in Germany. The bottleneck has been pushed back into later funding phases, when companies want to stump up EUR 5-10 million or more. Structurally, the venture capital model doesn't work well for pharmaceutical and biotech business models."

Dr. Marion Jung
CEO Chromotek GmbH

5 POSITIVE TREND IN FINANCING IN EUROPE (IN EUR BN)



Sources: EY, Capital IQ, BioCentury and Venture Source

IN GERMANY

In Germany, the financial crisis precipitated a sharp decline in funding for biotech companies. Whereas venture capital funding increased year on year in 2013 in virtually all the European countries analyzed – especially in Denmark, Ireland, Austria, France and Switzerland – both Germany and the Netherlands fell below the figures posted for 2012. European money is definitely seeking investment opportunities in biotechnology. As a result, several new, large-scale funds were created in Europe (albeit not in Germany). Examples include the funds launched by Edmund de Rothschild Investment Partners (USD 250 million), Abingworth Management (GBP 225 million) and Gilde Healthcare Partners (EUR 145 million) (7). Many of these funds pursue mixed investment strategies that embrace biotechnology, medical engineering, e-health, m-health and other branches of the life sciences.

In 2008 and 2009, venture capital funding halved from EUR 297 million (2007) to EUR 142 million (2009). The crisis seemed to have been weathered in 2010, and external funding for biotech firms fleetingly touched an unprecedented peak of EUR 700 million. Only a handful of companies benefited, however. A few of the 15 or so biotech companies whose shares were publicly traded at the time snapped up nearly half of this amount with a small number of very large capital measures. Essentially, two private investors – the family offices of Dietmar Hopp (SAP) and the Strüngmann brothers (Hexal) – contributed EUR 320 million.

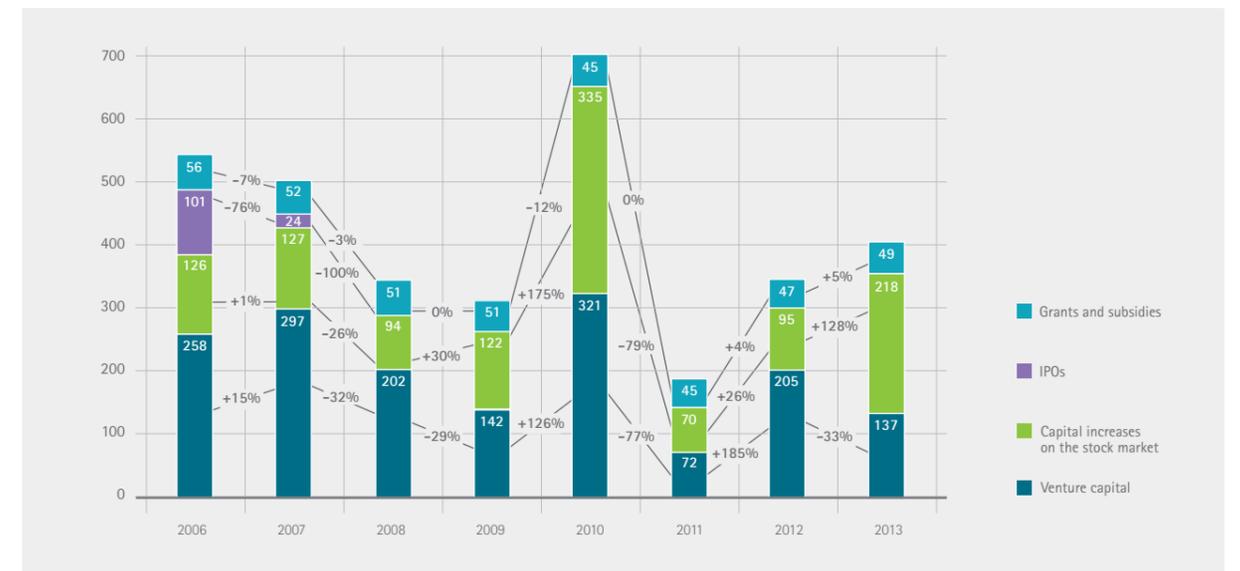
After a record-breaking 2010, 2011 saw an exceptionally pronounced slump in funding for biotech firms. The total annual financing volume has since been growing again. Yet once again, only a handful of companies received funding in 2012. Since 2008, not a single biotechnology company has ventured to launch an IPO on a German stock exchange. Meanwhile, acquisitions of isolated German biotech firms have generated record proceeds approaching EUR 1 billion.

Measured against its share of the total European population (more than 16%), Germany's biotech sector has for years remained underweight at only about 10% of the total volume of European financing.

"Internationally, the climate is very healthy, as the door is wide open to biotech IPOs in the USA and many firms have been able to publish promising data about their drug candidates. On a national and local level, the business climate is more subdued, because the financing situation is complicated. Financial incentive systems for the industry would be helpful on this score."

Jens Holstein
CFO Morphosys AG

6 SOURCES OF FUNDING FOR GERMAN BIOTECH FIRMS



Source: biotechnologie.de



INDUSTRY TRENDS AT THE GLOBAL AND EUROPEAN LEVELS

New business strategies

The USA still sets the standard for the biotechnology and pharmaceutical industries worldwide. Generic drugs and the continuing rise in development costs are putting the pharmaceutical sector in particular under pressure. It will be a few years before biotech companies begin to feel the same effects. That said, mergers and development partnerships are making it increasingly difficult to draw a clear line between pharmaceuticals and biotechnology. Even in Germany, approved biotechnological drugs are not always developed exclusively by biotech firms, but also by the heavyweight pharmaceutical incumbents.

The aggressive deployment of inexpensive generics has placed a heavy strain on the pharmaceutical sector in recent years, with the industry losing around 20% of its market capitalization in the first decade of the new millennium. The reason? Patent protection expired for drugs with annual sales totaling nearly USD 200 billion, which were then substituted by cheaper generic versions. The well-funded pharmaceutical industry had to plug the gaps in its pipeline by acquiring innovative biotechnology firms. Since 2002, the big pharmaceutical corporations have thus bought large and small biotech players with a total market capitalization in excess of USD 150 billion. The first fruits of this strategy began to show in 2012, since when drug companies' market valuations have been recovering. While the big players shopped around for innovation, the biotechnology industry persevered with its path of innovative, value-added growth, driving a continual increase in the industry index. In the first quarter of 2014, aggregate market capitalization in the biotech industry surpassed USD 700 billion – more than twice the figure reported in 2001! Since 2011, over 100 new products have been approved for diseases that, hitherto, were difficult or impossible to treat. These drugs are now treating hepatitis C, multiple sclerosis and cancer, for example, and are generating sales revenue in the billions. The sector is expected to grow by an estimated 20% per annum through 2017." (8)

Excerpt from the latest industry analysis published by the Medical Biohealth Trend fund.

PHARMACEUTICAL INDUSTRY

MERGERS IN THE PHARMACEUTICAL INDUSTRY: REVENUE AND NEW MARKETS BEING ACQUIRED

Between 2010 and 2013, the cost of developing a new drug increased by an average annual rate of around 18% (4). At the present time, pharmaceutical companies work on the assumption of development costs of approximately USD 1.3 billion per drug. At the same time, efforts to curb costs in healthcare are forcing them to scale back their expectations of a return on investment. Asia and other emerging markets are today the principal growth markets for the sale of medicinal drugs, while markets in Western countries in particular shrank in the year from 2012 to 2013 and are forecast to experience only modest, below-average growth in the future (4).

The drug companies are responding to growing cost pressure by acquiring their competitors' development pipelines and products that are already on the market. Other purchases are intended to provide access to new markets – in emerging countries, for example, but also in other lines of business such as generics and biosimilars.

On average, patent protection for a medicine expires 20 years after the patent was initially granted. Generics appear on the market immediately at this point, causing the original manufacturer's revenue to collapse in a matter of weeks. When Pfizer's patent for the cholesterol-reducing drug Lipitor expired in 2011/2012, the company saw revenue of over USD 10 billion plunge by more than 50% in the space of a few weeks. A year later, the figure was just 10% or so (9). Pfizer has developed multiple strategies to cushion the inevitable blow of imploding sales, launching its own generic version of the drug via a subsidiary while also holding interests in other manufacturers of comparable generics.

Since 2009, some 500 pharmaceutical companies have merged every year (563 in 2009, 548 in 2010, 504 in 2011 and 456 in 2012). The average annual transaction volume stands at roughly USD 50 billion. In Germany, Israel's Teva Group paid around EUR 4 billion for Ratiopharm in 2010, while Sanofi bought Genzyme for USD 20 billion a year later. Large-scale mergers tend to be rare, but are still the growth option of choice for a number of firms (Pfizer, Merck, Valeant).

PATENTS NO LONGER PROVIDE ADEQUATE INSURANCE

In the international arena, recent court decisions in India and China have presented companies with entirely new challenges: In 2013, India's Supreme Court declared a Novartis patent for the drug Glivec to be null and void, expressly in order to enable the country's generic industry to copy the product and make it available quickly and inexpensively on the Indian market. Also in 2013, China's government-run patent office likewise declared patent protection for the Viread drug from US company Gilead to be invalid – four years before the patent was actually due to expire. Here again, the focus was on strong demand for supply of the medicinal product to several millions of sufferers nationwide.

DEVELOPMENT PARTNERSHIPS FOR ROBUST PHARMACEUTICAL RESEARCH PIPELINES

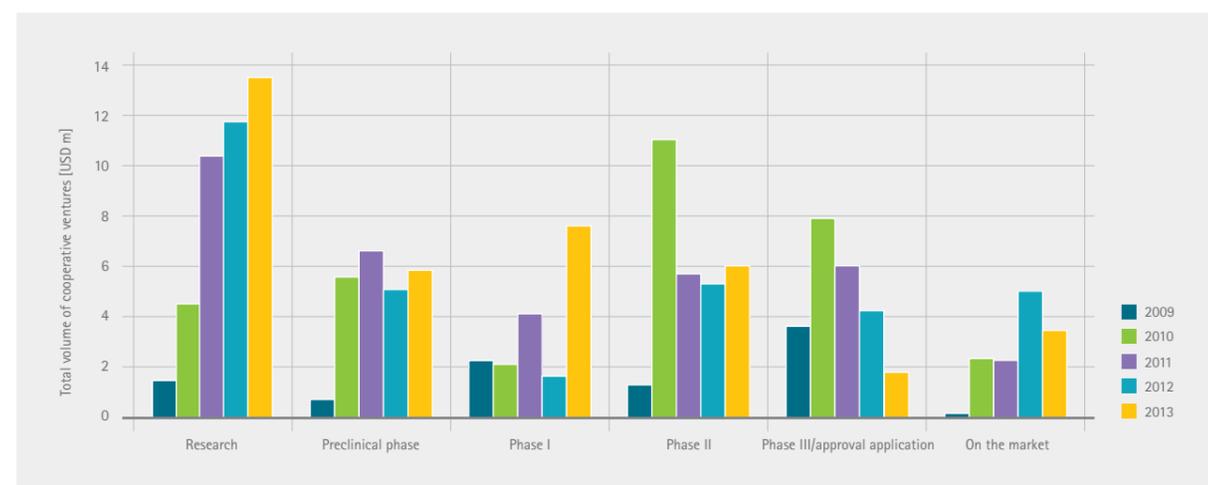
Given the high cost of research and development, however, large pharmaceutical groups are also coming under pressure from shareholders to critically review their in-house R&D departments, reorganize and/or focus their research areas and use the money they save to buy external development candidates or drugs that are already approved. Both in the USA and around the globe, R&D spending in the pharmaceutical industry is stagnating: In the period from 2010 through 2013, the global R&D spend stood at approx. USD 200 billion, while US life science companies channeled around USD 90 billion into R&D (4). In return, more than 60% of the development candidates that have reached very advanced clinical trial phases at the world's top 12 Big Pharma players originate from purchased companies, co-development partnerships or licensing agreements (4). **The open innovation wave is benefiting companies that can demon-**

strate promising and advanced drug candidates or have developed a technology platform with which a large number of attractive candidates can be identified and evaluated.

Partnerships are being forged in ever earlier phases of research and development. For example, the number of collaborative research ventures in which a drug candidate has not yet passed preclinical or clinical trials but is still in the research phase has been increasing since 2011. Accordingly, the prices for development partnerships in the preclinical phase or phase I of clinical development have shot up by 200-300% since 2009 (4).

As they search for ever earlier projects, drug companies are increasingly also cooperating with excellent clinical research establishments in order to improve their own research pipelines. In the process, they are investing in collaborative innovation programs at selected venues such as San Francisco, Boston/Harvard, San Diego and Cambridge/Oxford, as well as Munich, Heidelberg and Berlin. GE Healthcare, for example, has set up research centers close to universities around the globe, one of which is near the TUM in Garching. AstraZeneca has opened a similar facility in Cambridge/Oxford, UK, while Johnson & Johnson operate several incubators worldwide. In May 2014, Bayer opened a start-up laboratory in Berlin and Sanofi signed up for a collaborative research venture with the Munich-based Ludwig Maximilians Universität (LMU). A number of biotech companies are committing to similar cooperative ventures: Hamburg's Evotec operates a branch office in Martinsried and works together with a number of leading US universities (Yale, Harvard).

7 COOPERATIVE VENTURES AT DIFFERENT DRUG DEVELOPMENT PHASES



Source: Burrill & Company

BIOTECHNOLOGY INDUSTRY

GLOBALIZATION AND MERGERS

The biotechnology industry has likewise witnessed significant mergers in recent years. Roche purchased the remaining (44%) stake in Genentech in 2009, snapping up what, at the time, was the biggest and most successful biotech firm in the world for USD 47 billion.

Some biotech companies in the USA, such as Amgen and Gilead, are joining the ranks of the top 20 pharmaceutical players in terms of sales revenue. With regard to cooperation agreements and development partnerships, they are on a similar level to the pharmaceutical industry. And they themselves are buying other biotech firms: Amgen, for instance, acquired Onyx for around USD 10 billion in 2013.

Comparison of R&D spending in the pharmaceutical and biotechnology industries also shows a major shift. In 2013, twelve of the world's 20 biggest developers of new drugs invested more money in research and development than in the previous year. The other eight big-league players preferred to save money. In the same year, biotech companies also invested more overall than in 2012, albeit still significantly less than the pharmaceutical giants.

BIOSIMILARS – BIOTECHNOLOGY HAS ITS OWN GENERIC VERSIONS

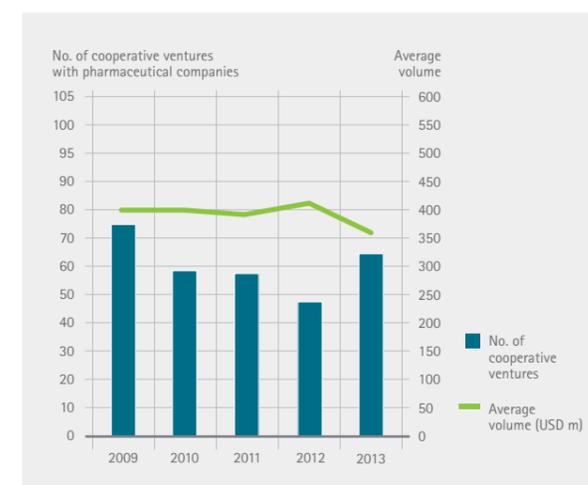
Some biotech drugs are now being confronted by generic versions of themselves for the first time. Only a few such biosimilars have made it to market as yet (a total of nine in Germany, i.e. 4% of all biopharmaceutical actives). **However, a large number of other biosimilars**

from a variety of new manufacturers are waiting only for the impending expiry of patent protection for the corresponding original drugs. These protein actives are much more difficult and expensive than chemical substances to produce in the same way and must, for safety reasons, go through their own clinical licensing procedure. Like the chemical generics that were introduced in the 1980s and 1990s and only gradually rolled up the market, experts believe it will take some time before biosimilars relieve the soon-to-expire original drugs of their market share (10).

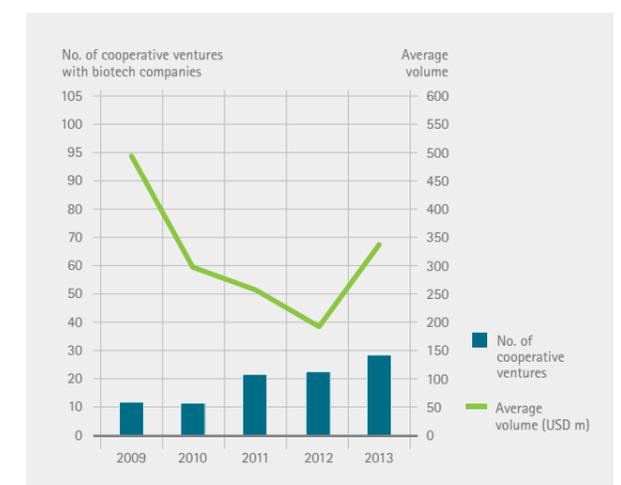
Biotech firms are already adapting strategies used in the pharmaceutical industry and are joining forces with developers of biosimilars in order to share in their (future) revenues. Examples include Amgen and Actavis; Sandoz, which has a number of biotech firms of its own; US company Merck, with India's Dr. Reddy; and right now Germany's Merck KGaA, which is teaming up with a Brazilian biosimilar manufacturer.

Rules governing the licensing of biosimilars vary in different parts of the world. The US licensing agency FDA, for example, cooperates closely with European authorities such as the European Medicine Agency (EMA), and other countries from Latin America to Asia have adopted the same provisions in part, or in modified forms. In the USA itself, however, each federal state decides for itself whether a biosimilar can be used as a substitute for the original product, irrespective of whether it already enjoys national approval; and to defend their own biotech industries, many US states have already legally prohibited the use of biosimilars. Individual state regulations thus predominate at the present time (4).

8 DIFFERENCES IN COOPERATIVE VENTURES BETWEEN PHARMACEUTICALS (LEFT) AND BIOTECHNOLOGY (RIGHT)



Source: Burrill & Company



Source: Burrill & Company

New focal areas in research and development

TREND IN MEDICINAL DRUGS: BIOPHARMACEUTICALS

Despite changes in the reimbursement and pricing processes, **medicinal drugs produced using biotechnology – biopharmaceuticals – are experiencing a slow but steady uptrend in Germany.** A total of 215 biopharmaceutical actives are currently approved in Germany, of which nine are biosimilars. In 2013, 14 new biopharmaceuticals from national and international drug companies were approved in this country – more than in any year since 2001. This group of medicines thus accounts for nearly a third of all newly approved drugs (11). Germany's total pharmaceutical sales volume rose by 4% to around EUR 30 billion in 2014. At the same time, sales of biopharmaceuticals in Germany increased far faster – by 8.5% – to more than EUR 6.5 billion. In recent years, biopharmaceutical products have constantly raised their share of the overall medicinal product market to more than 21% today (compared to around 17% in 2010 and around 20% in 2012). The largest proportions of biopharmaceutical actives are used to treat immunological conditions (where biopharmaceuticals account for about 74% of all drugs used), oncological diseases (37%) and metabolic illnesses (37%).

"PERSONALIZED MEDICINE" AND THE NEW ROLE OF DIAGNOSTICS

Ever since the human genome was decoded, molecular diagnostic approaches that link individual medical conditions with genetic causes have increasingly been integrated in therapeutic routines. **Right now, "personalized medicine" is one of the most important growth areas in the life science sector.** The hope is that diagnoses that drill deep, often to the molecular level, will enable treatment schedules to be tailored precisely to the medical conditions of individual patient groups. Alongside the big pharmaceutical and biotech players, this is also an attractive market for many small and medium-sized biotech firms that develop new applications ranging from diagnostic tools to IT solutions. 80% of the pharmaceutical companies that operate worldwide are already engaged in the field of "personalized medicine" (McKinsey, 2013 (12)).

Without a specific diagnosis, it is not possible to develop individual treatment schedules. In more and more areas of disease, molecular diagnostic outcomes are laying a firm foundation for individual decisions about the choice of suitable therapeutic options. Oncology in particular is taking molecular diagnostic methods as the basis for therapy. Demand for this diagnostic approach is being driven by doctors and patients alike.

Since 2011, the FDA in the USA has been calling for drugs to be approved only in conjunction with special diagnostic agents.

Pharmaceuticals and diagnostics used to be two separate worlds. Now, however, they are becoming interlinked as early as the development phase, when a substance enters the clinical trial phase. Diagnostic agents accompany drug development in their role as "companion diagnostics" (CDx). Experts put the global market volume for companion diagnostics at several billions of US dollars (McKinsey, 2013 (12)). A total of 85 therapeutic agent/companion diagnostic combinations are currently on the market worldwide. In Germany, diagnostic tests are compulsory for 28 of the 36 "personalized drugs" for which approvals have been granted (13).

Some companies, such as Roche, are therefore seeking to develop new drugs together with suitable diagnostic agents from the word go. Other pharmaceutical firms are looking to enlist diagnostic players as long-term partners. Larger diagnostic firms (such as Qiagen) sell their knowledge and marketing skills to a variety of pharmaceutical partners.

Certain countries are already launching national genome programs in order to create even more selective and accurate therapeutic and diagnostic options for their populations. Over the years, the cost of individual sequencing has fallen rapidly from several millions of US dollars to just under USD 1,000. The analysis of individual genetic data in order to track down the causes of specific illnesses or explore the benefits of therapeutic agents is thus seen as a bright prospect for the future.

As a business model, however, genetic diagnostics faces a number of new challenges: In 2013, the patents owned by US company Myriad Genetics for two genome sequences associated with hereditary breast cancer were declared null and void by the highest court of appeal. The firm's existing business model – securing and marketing exclusive worldwide rights to the diagnosis of this genetic mutation – thus failed. Similar cases followed, and **the revocation of patentability has fueled considerable uncertainty on the market for genomic diagnostics.** Around the globe, many companies are seeking to market specific genetic patterns or groups of relevant genes and their detection on various diagnostic platforms. Many healthcare systems across the world are still struggling to agree on which tests they are prepared to refund. In Germany and some other European countries, it could well take ten years before clear decisions are forthcoming (as in the case of the human papillomavirus (HPV) test as a prophylactic measure to fight cervical cancer).

Different countries around the world handle patient data, the exchange of molecular parameters and patients' biospecimens (tissue and blood samples) in widely differing ways. Subject to extremely strict privacy protection, the Scandinavian countries have already been gathering very extensive data sets for many years and placing it at the disposal of research. The UK is currently building a similarly extensive system, while initial approaches to the preservation of tissue samples and related data management are also evident in Germany. **This kind of data archive increasingly serves as the basis for development of new drugs and diagnostic methods.**

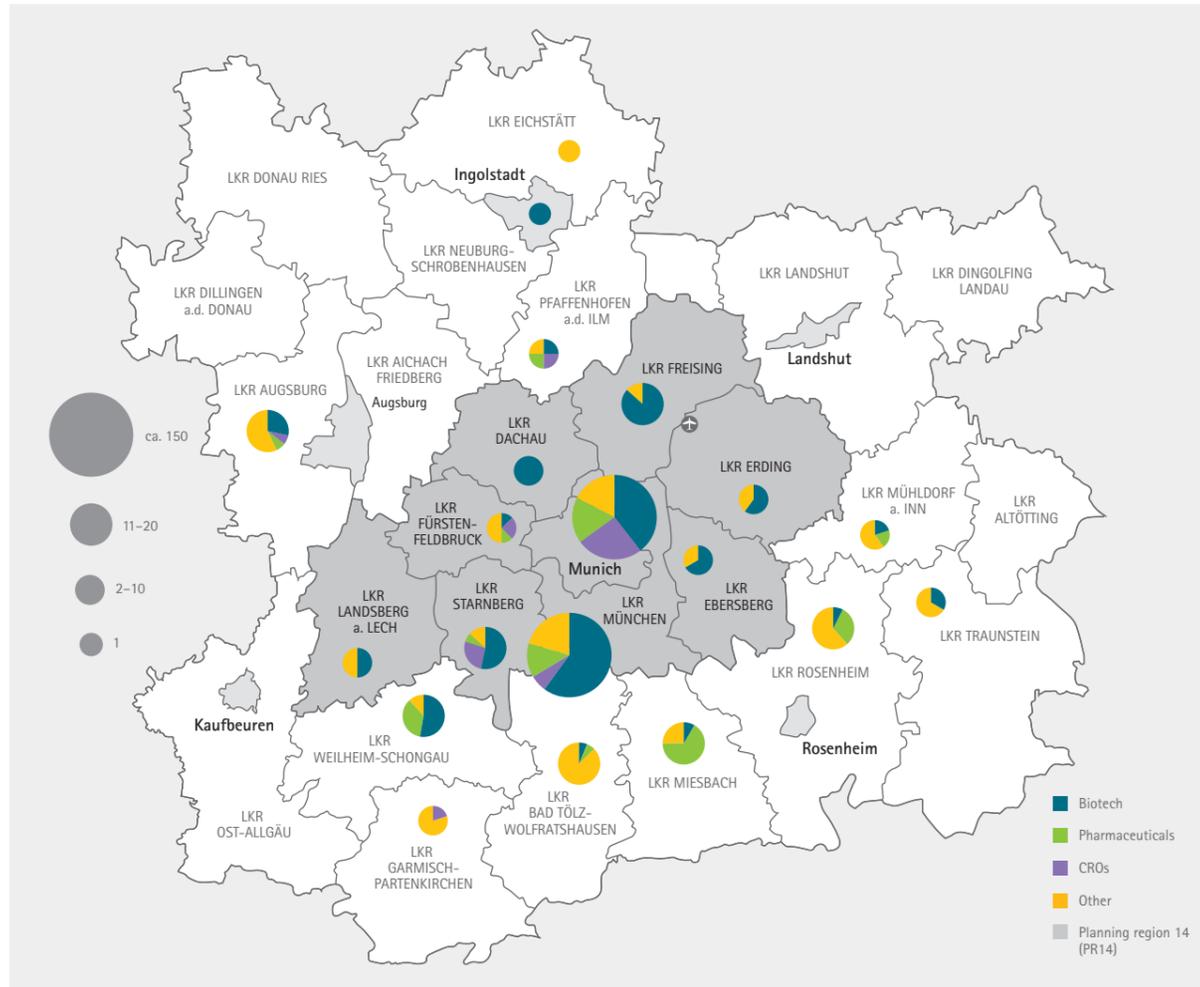
NEW CO-DETERMINATION/SELF-DETERMINATION OPTIONS FOR PATIENTS

Patient organizations in the USA have traditionally played a bigger part even in the development of new drugs. They make their own molecular patient data available for research purposes, for example, or act as investors: In the context of a new kind of crowdfunding projects, scientists are teaming up to solicit donations and subsidies from private individuals and smaller organizations as they seek to pursue their own medicinal drug development. ResearchGate, one of the biggest networks of scientists, sourced around USD 35 million dollars via crowdfunding channels in 2013.



BIOTECHNOLOGY AND PHARMACEUTICALS IN THE MUNICH METROPOLITAN REGION (EMM)

9 BIOTECHNOLOGY AND PHARMACEUTICALS IN THE MUNICH METROPOLITAN REGION



The Munich Metropolitan Region comprises 25 counties in southern Bavaria, six cities (Augsburg, Ingolstadt, Kaufbeuren, Landshut, Munich and Rosenheim) and nearly 40 related towns and communities. It is one of the leading economic regions in Europe. A heavy

concentration of knowledge, a very broad technological basis and a diverse array of forward-looking industries are the region's core competencies.

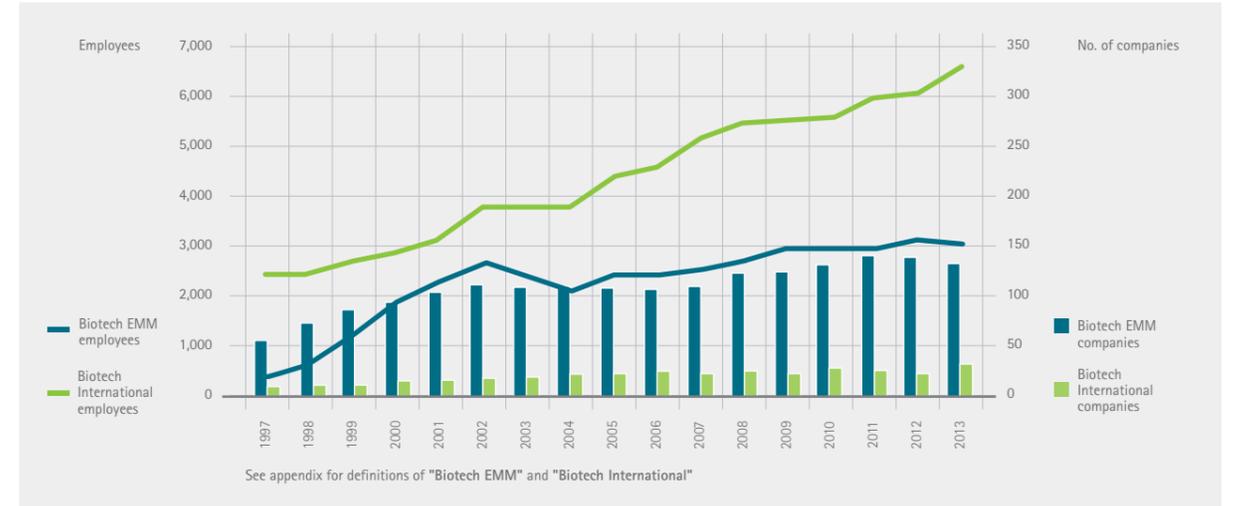
Environment and network

RESEARCH ORGANIZATIONS – THE CORNERSTONE OF THE BIOTECH HUB

The 1970s founding of key scientific institutions such as the Max Planck Institutes of Biochemistry and Neurobiology in Martinsried and the inception of the LMU university hospital in Grosshadern sowed the seeds for the region's focus on molecular biology and biomedicine. Applied biomedical research was conducted first in the laboratories of Boehringer Mannheim in Tutzing on Lake Starnberg and, in 1984, at the newly launched Gene Center, which is now a research institution affiliated to the LMU. In the early 1990s, the first wave of biotech companies then established a base in Munich, including Mikrogen, MediGene, MorphoSys, Micromet and Till Photonics.

In 1996, scientists, biotech firms and pharmaceutical companies got together for the first time to map out a concept for the future of the region. Under the aegis of the BioRegio initiative launched by the Federal Ministry of Education and Research (BMBF), EMM was then singled out as a model region. Representatives of Bavaria's ministries and banks also joined the Chamber of Commerce and Industry and many others in backing this development. The founding of the BioRegio management company (now cluster manager BioM) thus spawned a network spanning all the scientific organizations and the local and national biotech and pharmaceutical companies in and around Munich. In 1997 and 1998, new funding options for biotechnology start-up projects then triggered a second, larger wave of new business launches.

10 NUMBER OF BIOTECH COMPANIES AND EMPLOYEES IN THE EMM REGION OVER TIME



The financial crisis sparked off when the Internet bubble burst at the turn of the millennium took the entire German biotechnology industry – and hence also biotech players in the Munich region – by surprise. In the midst of forceful start-up growth, the handbrake was pulled on very abruptly. Notwithstanding, the biotechnology industry in the EMM region regained stability within just a few years and has experienced consistently positive development since around 2005/2006.

Today, this biotech region is one of the front-runners in the development of innovative drugs. Six of the eleven drugs currently marketed by German biotech firms were developed at companies in Munich. In 2003, MediGene became the first German biotechnology company to have a drug (Eligard, which treats prostate cancer) approved by America's FDA. The national statistics published by www.biotechnologie.de likewise attest to the special importance of the Munich Metropolitan Region: **Some 15% of German biotech firms (88 out of 570 that meet the OECD definition) are based in the Munich region.** Only the whole of Baden-Württemberg and the whole of North Rhine-Westphalia can boast similar shares.

FOCUS ON "PERSONALIZED MEDICINE"

In 2010, the Munich biotech cluster won the Federal Ministry of Education and Research's nationwide Leading-Edge Cluster competition with its concept "m4 – Toward a new dimension of drug development with 'personalized medicine' and targeted therapies". Munich's academic institutions in general, and the university hospitals, the biotechnology industry and the pharmaceutical industry in particular are committed to this concept. To facilitate its implementation, the federal government contributed subsidies totaling EUR 40 million to complement EUR 40 million provided jointly by the industry and a special grant of around EUR 10 million from the Free State of Bavaria. Personalized medicine linked to research into biomarkers is the concept's focal point. Today, personalized medicine is internationally recognized as the future of healthcare, satisfying the needs of all four stakeholder groups: doctors and patients (optimal treatment), the pharmaceutical industry (competitiveness, fe-

wer drug development failures), the health insurers (a superior cost/benefit ratio, avoidance of ineffective medication) and the licensing authorities (effective and safe treatments).

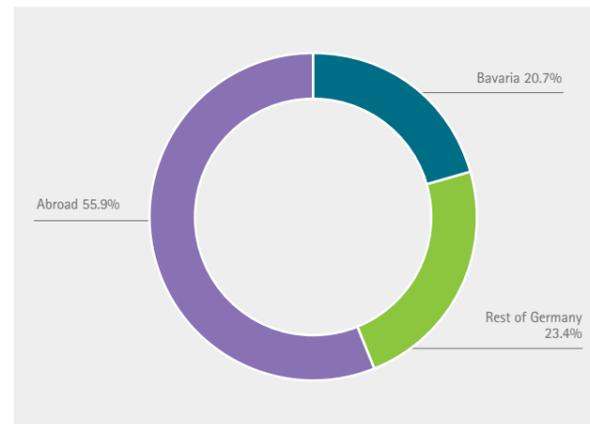
Alongside 43 R&D projects, the m4 program also supports five infrastructure projects that aim to improve the Munich cluster's innovative capabilities. Via the agency of the m4 Biobank Alliance, quality standards for the collection and characterization of patients' biospecimens, a common ethical and legal framework and central access to the specimens were jointly defined. The m4 Trial Service Center was set up in particular to make it easier for less experienced biotech firms to map research approaches onto clinical development – a step that is often critical. Starting in 2015, the m4 eAcademy plans to offer courses of study that are tailored precisely to the needs of the cluster. m4 Scouting & Incubation is a program focused specifically on identifying and actively promoting commercializable projects, especially in the field of personalized medicine. The program partners with the various technology transfer organizations in Munich and is designed to encourage new start-ups. A further important component is the invitation for proposals for the m4 Award, which is issued by the Bavarian Ministry for the Economy (prizes totaling EUR 8.5 million will be granted through 2015). This pre-seed program supports innovative academic projects that exhibit strong potential for commercialization and could thus lead to the launch of a new company. The first start-up as a result of the m4 Award is Trianta Immunotherapies, which was spun off from the German Research Center for Environmental Health in 2013. Munich-based MediGene took over the start-up only a few weeks after it was founded, paying several million euros to secure a broad range of technologies in immunotherapy, one of the most attractive areas of innovation worldwide.

Although the focus on a new cluster strategy did not begin until 2011, it is already driving palpable dynamism in the region in the area of personalized medicine, as reflected in the large number of excellent and innovative new applications and cooperative ventures, for instance.

COLLABORATIVE SUCCESS: BUSINESS AND SCIENCE WORKING HAND IN HAND

The biotechnology industry is exceptionally research-intensive. Accordingly, it is very important for companies to work together with other firms and research organizations to gain access to the latest technological developments, pool strengths and, where appropriate, collaborate in penetrating new markets. **Biotech firms in the EMM region are currently committed to 261 cooperative ventures with other companies in the fields of development and distribution** (2008: around 300). About 60 of these partnerships were launched in 2013 alone. 146 of these ventures focus on distribution (2008: 170). In 2013, companies out-licensed 25 products or technologies and in-licensed 12 products or technologies.

11 GEOGRAPHIC DISTRIBUTION OF COOPERATIVE VENTURES BETWEEN BIOTECH EMM COMPANIES AND OTHER COMPANIES



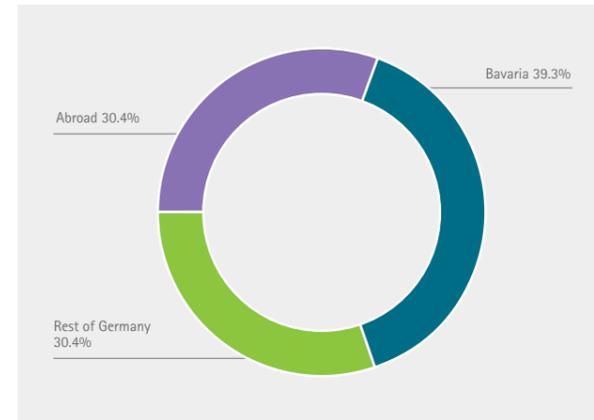
As was already the case in 2008, the majority of cooperative ventures involve foreign partners (2008: 68%). Companies' collaboration with German partners splits almost equally between Bavarian and nationwide companies. The decline in international cooperative ventures since 2008 is attributable to the fact that German biotech firms have been taken over by international groups.

Companies commit to cooperative ventures in both development and sales. Both generate returns from profits and/or sales that have a positive impact on corporate development in the EMM region.

The number of collaborative development arrangements with research organizations (248, against 275 in 2008) is significantly higher than the number of such cooperative ventures with companies. This reflects the fact that **research collaboration requires close geographical proximity to facilitate smooth and swift dialogue**. By consequence, a good 70% of Munich biotech firms' collaborative research ventures are with academic institutions within Germany (40% of which operate purely within Bavaria), while around 30% involve international research organizations.

This distribution also underscores the high quality of the research institutions in the EMM region. **In our survey of companies, Munich scored the highest marks regarding proximity to the research landscape.**

12 GEOGRAPHIC DISTRIBUTION OF COOPERATIVE VENTURES BETWEEN BIOTECH EMM COMPANIES AND RESEARCH ORGANIZATIONS



WHITE (INDUSTRIAL) BIOTECHNOLOGY

Industrielle Biotechnologie Bayern Netzwerk GmbH (or IBB Netzwerk GmbH for short) has proven itself as a networking partner for industrial biotechnology in Bavaria. Since 2008, this organization has been forging and cultivating links between large companies, small and medium-sized enterprises (SMEs) and the scientific community in the context of projects. The network boasts nearly 100 members representing major corporations, SMEs, universities and research institutions. To date, it has mobilized more than EUR 100 million for research and development projects, plants and structural measures in industrial biotechnology.

Focal topics include the biotechnological production of basic and special chemicals with the integrated use of biomass, production of innovative biomaterials and high-grade ingredients for the food and cosmetic industries, production of second- and third-generation biofuels, and process reengineering. The objective is to incorporate white biotechnology as an integral component of the dye and paint industry, in the production of lubricants and adhesives, in lightweight building materials, bioplastics and textiles, to name but a few.

GREEN BIOTECHNOLOGY – AGRICULTURE

Despite a few initial attempts launched in the 1990s, there are no green biotech firms in the EMM region. Some companies, including a number of newcomers, are currently trying to gain a foothold in the market for ancillary products to improve plant growth. However, these firms are grouped together not under genetic engineering, but under technologies that aid plant breeding.

Economic potential of the EMM region as a biotechnology and pharmaceutical hub

PATENTS

The number of patent applications serves as an indication of an industry's innovative capabilities. Patents are especially important as a cornerstone of drug development, because development alone takes up at least half of the patent protection period. The respondent biotechnology companies have filed for 3,521 patents, of which 1,960 have so far been granted. Small and medium-sized biotech firms claim to have applied for 2,190 patents or patent families to date (+900 applications since 2008), of which more than 880 individual patents have already been granted (+350 since 2008).

PRODUCT PIPELINE

Munich's biotech companies focus strongly on drug development, a lengthy process associated with considerable risks. It typically takes between ten and twelve years to advance from initial identification of what might be an effective pharmaceutical agent to market readiness. Moreover, recent experience shows that around 10% of all such agents successfully complete the journey from initial clinical trials to market readiness (see figure 13).

Although Munich-based companies have suffered a number of setbacks with their own phase-III candidates, **biotech firms in the Bavarian capital are currently responsible for clinical development of nearly 30 new actives – around 30% of all clinical active development by biotechnology companies in Germany, and more than any other city in the country**. Of the eleven drugs created by this industry that are currently approved in Germany, six come from Munich, two from Ulm, one from Cologne, one from Berlin and one from Leipzig (although the company responsible for the latter – Euroderm – was forced to file for insolvency at the end of 2013).

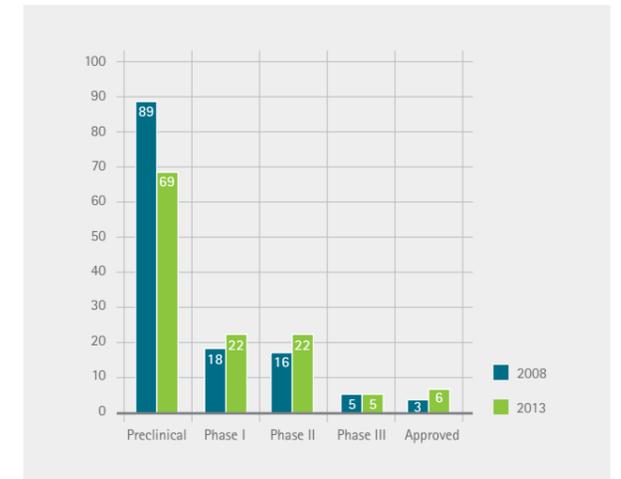
FUNDING FOR BIOTECH FIRMS

Throughout Germany, external funding for the biotechnology industry is subject to pronounced fluctuations. Having said that, **companies in Munich have succeeded in acquiring roughly half of all the country's external funding for biotechnology (between EUR 100 million and EUR 300 million) in recent years**.

Of the EUR 350 million available throughout Germany in 2013, Munich-based MorphoSys acquired around EUR 130 million in the form of two capital increases, while its near-neighbor Formycon raised EUR 17 million on the stock market.

The proceeds of collaborative projects are becoming an increasingly important factor in financing. This cash is performance-linked, is distributed in tranches and testifies to the technological competency of a given location (see figure 14 on page 22).

13 NO. OF NEW ACTIVES IN CLINICAL PHASES (INCLUDING ACTIVES FROM DEVELOPMENT PARTNERSHIPS AND ANTIBODIES) AT BIOTECH EMM COMPANIES

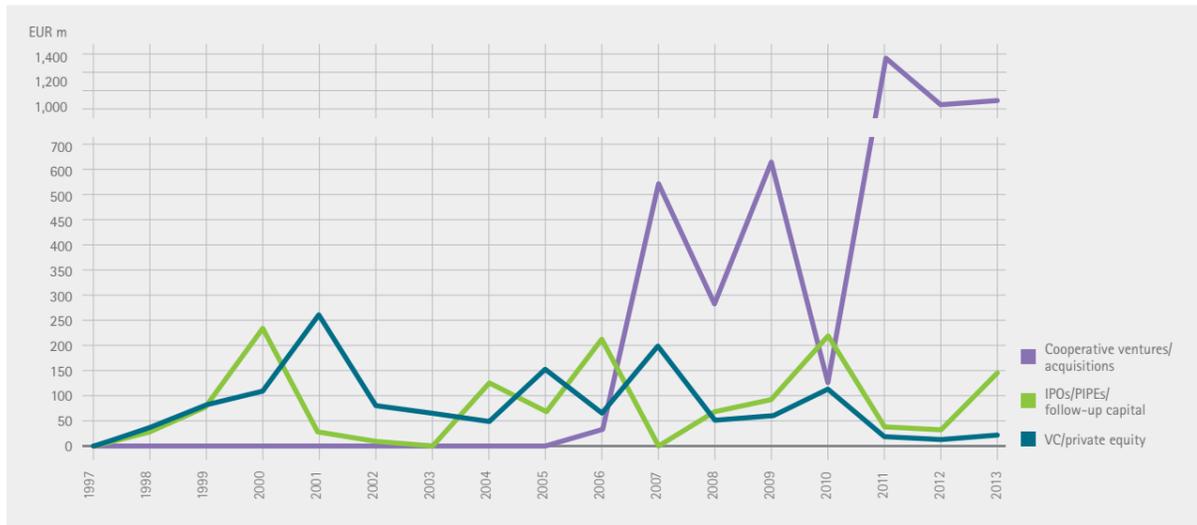


MERGERS – INTERNATIONAL FOCUS ON BIOTECH COMPANIES

Pharmaceutical companies in the EMM region are likewise merging. In the process, some of them are developing into **biotechnology companies in their own right**. Former pharmaceutical company Roche, for example, has transformed itself into the world's biggest biotech player, in part by buying up firms and expanding in Bavaria. In 1998, Swiss-based Roche purchased Boehringer Mannheim including all its operations, one of which is a biotechnology research and production center in Penzberg near Munich. Today, Penzberg is home to Europe's largest production facility for biopharmaceuticals. Since 1998, Roche has invested more than EUR 1.8 billion in this location and doubled the number of staff to over 5,100.

Japanese pharmaceutical company Sankyo bought the venerable Luitpoldwerke (Mobilat) in Munich in the 1990s. In 2005, its merger with another Japanese firm, Daiichi, form Daiichi Sankyo, today one of the 20 biggest pharmaceutical companies in the world. The firm's European headquarters are in Munich. At present, more than four billion tablets a year are produced in nearby Pfaffenhofen and distributed worldwide. Daiichi Sankyo has built up a number of collaborative relationships with Munich's biotech industry (including MorphoSys, for example) and purchased Martinsried-based start-up U3 Pharma in 2008. Since then, Daiichi Sankyo has continued the latter company's early-stage oncological drug projects at the Martinsried facility, which could lay the foundation for a planned European oncological research center.

14 FUNDING FOR BIOTECH FIRMS BASED ON VENTURE CAPITAL (VC), SHARE ISSUES AND OTHER FORMS OF EXTERNAL EQUITY CAPITAL AND COOPERATIVE VENTURES IN THE EMM REGIONS (EUR M)



In 2011, Hamburg-based Evotec AG paid an eight-digit fee for Kinaxo, a company spun off from the Max Planck Institute of Biochemistry. Kinaxo had developed a technology that enabled a certain group of proteins (signal proteins), which are characteristic of certain diseases, to be analyzed in parallel during the metabolic process. This technology complements Evotec's existing portfolio of services for the screening of drug candidates by major drug companies. The acquisition had a positive impact on the location: The Kinaxo team is now continuing to work on the same technology and collaborate with customers in the pharmaceutical industry under the new name Evotec München.

US company Amgen's purchase of Munich-based Micromet likewise began with a collaborative development arrangement. This was upgraded to a technology partnership in 2011 before Amgen finally bought the LMU spin-off for USD 1.16 billion in 2012 (the biggest biotech company takeover in Germany). Today, what used to be Micromet (and now operates as Amgen Research Munich) employs 200 people in Munich-Sendling and is Amgen's biggest research unit outside the USA.

In summer 2012, international pharmaceutical group Johnson & Johnson (USA) snapped up Munich start-up Corimmun for about USD 100 million. Corimmun had developed a new active to prevent heart failure in a specific high-risk group. Six months later, the founders launched successor company AdvanceCor with additional development projects in Martinsried.

BIOTECH FIRMS EVOLVING INTO TECHNOLOGY SERVICE PROVIDERS

For all their successes, Munich's biotech firms too face huge challenges due to financing difficulties throughout Germany. It is becoming increasingly apparent that a biotechnology company acting on its own in Germany can get one (or even several) drug(s) through licensing and onto the market only in isolated cases. The regulatory requirements in the pharmaceutical industry often exceed the financial and organizational capacity that is available to SMEs. Nor is successful licensing any guarantee of economic success.

"Like other venues, Munich too has seen the business models of many of its biotech firms changing. The notion of using a proprietary technology (platform) for one's own product development is increasingly giving way to (mostly parallel) service offerings for pharmaceutical and large biotechnology companies. As far back as 2007/2008, Martinsried-based firm MorphoSys signed a long-term partnership agreement with Novartis. Since then, the proceeds from more than 70 other cooperative ventures with big pharmaceutical players have given MorphoSys a solid financial base on which it has, for a number of years, once again been able to pursue its own product developments. Further examples of the transition to technology providers for external companies with proprietary development in parallel include 4SC-Discovery and Pieris.

A few Munich-based biotech firms with no specific platform technology of their own are continuing to develop their own drug candidates. However, a number of them – including GPC Biotech/Agennix, Curacyte and even the publicly traded Willex AG – have suffered setbacks.

Today, a good 50% of Munich's developers of therapeutic agents also make their proprietary technology platforms available as a service to larger pharmaceutical and biotechnology companies. This puts them in line with the trend, described above, toward cooperation with the major pharmaceutical players.

"Regarding the international importance of the location, we speak of Munich in the same breath as Cambridge/US, San Francisco and Cambridge/Oxford UK."

Thorsten Schüller
Spokesman, Daiichi Sankyo Europe/Germany



COMPANIES IN THE EMM REGION IN 2013

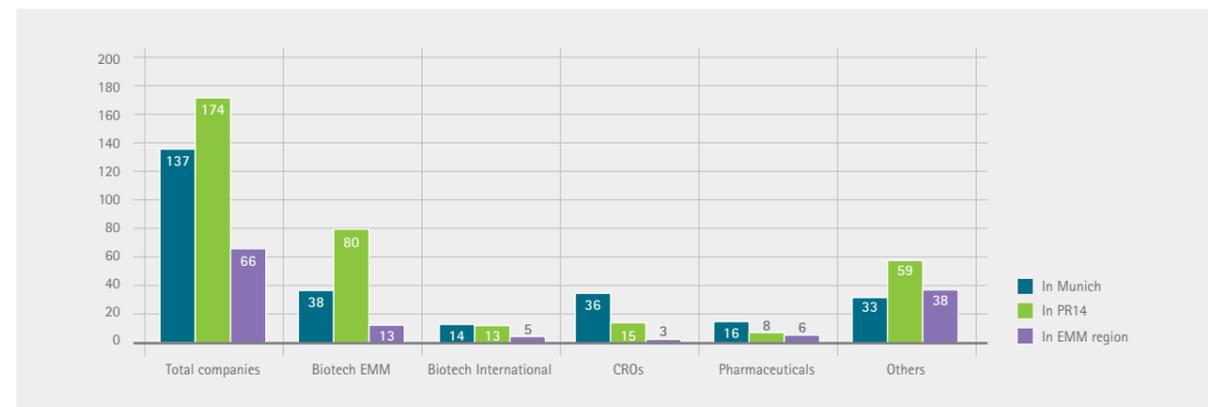
SURVEY METHODOLOGY

Our survey and analysis spans biotechnology and pharmaceutical companies, both preclinical and clinical contract research organizations (CROs) and other firms operating in the life science industry. Medical engineering firms are not included. For the purposes of this study, the biotechnology industry was split into two sub-groups: "Biotech EMM", which includes those companies that are headquartered in the EMM region; and "Biotech International", which includes the offices and subsidiaries of international groups. Pharmaceutical companies are companies that produce or sell prescription drugs for humans and producers of veterinary medicines. Producers of phytopharmaceuticals, pure OTC distribution companies, other distributors and other producers of natural medicines are assigned to the category "Others". The latter also include suppliers, wholesalers and other companies with activities in the field of dietary supplements, veterinary medicine (excluding veterinary surgeons) and other areas.

15 CORE DATA FOR THE EMM REGION IN 2013

	Number	Employees	Sales revenue (EUR m)
All companies	377	23,000	8,500
Biotech EMM	131	3,100	415
Biotech International	32	6,600	2,700
Pharmaceuticals	30	6,500	3,850
CROs	54	2,000	190
Others	130	4,700	1,340
Research organizations	8	ca. 10,000	n.a.
TOTAL		33,000	8,500

16 NUMBER OF COMPANIES BY CATEGORY AND GEOGRAPHIC DISTRIBUTION



The total number of companies studied this year thus differs only minimally from the situation in 2008: A total of 377 companies currently form the hard core of the biotechnology and pharmaceutical industries in the EMM region (against 385 in 2008).

TREND TOWARD ACQUISITIONS AND DISPOSALS

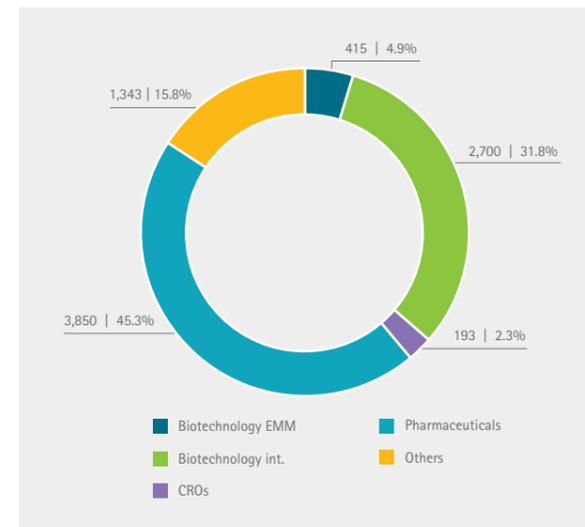
Over the past five years, seven companies in the region have been acquired by international groups and therefore belong to the category "Biotech International". Since 2008, a total of eleven new companies have also been added to the "Biotech EMM" category (+8.6%). The geographic distribution of the companies is shown in figure 16.

The vast majority of biotech and pharmaceutical companies are located in the City of Munich and within the boundaries of Planning Region 14 (PR14), which includes the two biotech clusters in Martinsried and Weihenstephan. The CROs operate in close proximity to Munich itself. Compared to the 2008 study, the companies in the "Others" category are more widely spread around the remainder of the EMM region. Around 30% of these companies are based in parts of the EMM region outside of Planning Region 14.

ECONOMIC DEVELOPMENT

In 2013, total sales revenue for all companies in the EMM region's biotechnology and pharmaceutical industries came to approximately EUR 8.5 billion. Of this amount, pharmaceutical companies accounted for EUR 3.8 billion (+3%), biotech firms for roughly EUR 3.1 billion (+11%) and the CROs for around EUR 195 million (+62%). Other companies contributed EUR 1.3 billion to the overall total.

17 SALES REVENUE IN INDIVIDUAL INDUSTRY SEGMENTS IN 2013 (EUR M)

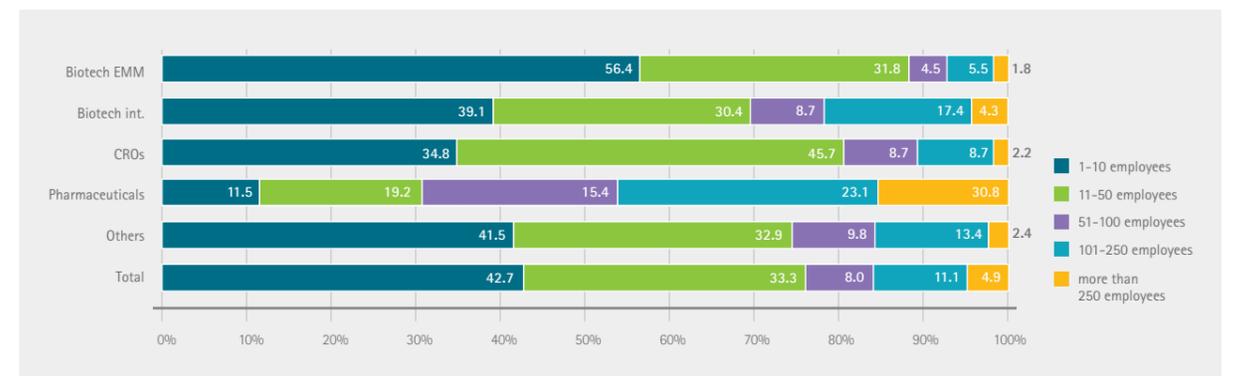


STRUCTURE OF COMPANIES

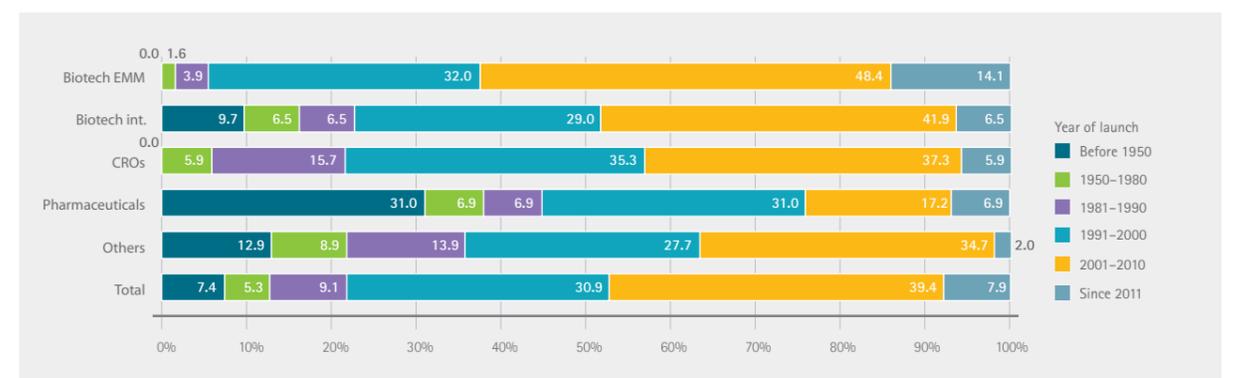
More than 30% of employees in the pharmaceuticals industry work for companies with more than 250 people on their payroll. By contrast, small firms of up to ten people dominate in the Biotech EMM category (56% today, against 60% in 2008). Martinsried-based biotech company MorphoSys employs around 300 people here and is the biggest company in this sector. The majority (70%) of the international subsidiaries (Biotech International) have fewer than 50 employees. Roche Diagnostics is the only company in this category whose 5,100 employees make it a very exceptional case.

Differences in size reflect the age of the companies. Only about a quarter of the pharmaceutical firms (23%) have been founded since the turn of the millennium. The vast majority were founded more than 30 years ago, and 30% have even been around for over 60 years. Of the Biotech EMM companies, more than 60% have been launched since 2001, including 14% that are start-ups (founded after 2011). Only 30% of the companies in this category are more than 15-20 years old.

18 PERCENTAGE DISTRIBUTION OF EMPLOYEE FIGURES BY COMPANY SIZE



19 DISTRIBUTION OF COMPANIES IN THE EMM REGION BY YEAR OF LAUNCH



CHANGE IN THE NUMBER OF JOBS

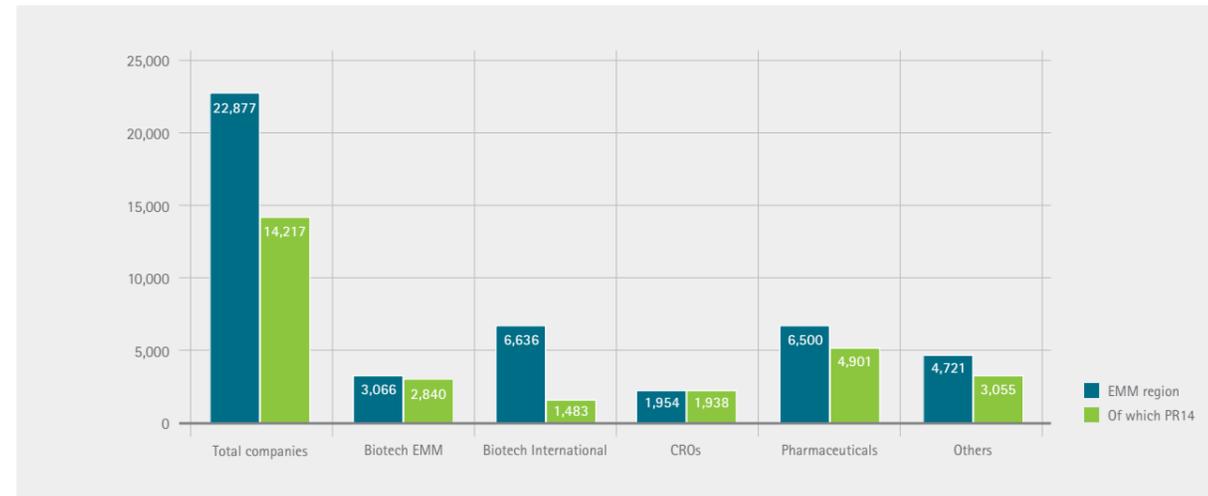
The number of jobs across the whole of the biotechnology and pharmaceutical industries has risen by 10% to 22,500 in the past five years (2008: 20,900). **Since 2008, more than 1,600 new jobs have been created – over 300 per year.** Biotech companies in both categories (Biotech EMM and Biotech International) have seen their headcount increase at an above-average rate of around 20%. Penzberg-based Roche Diagnostics alone has added around 600 jobs (38% of all the new jobs created in biotechnology) in recent years.

International offices and subsidiaries (Biotech International) are the biggest employers in this sector. Their combined workforce of 6,600

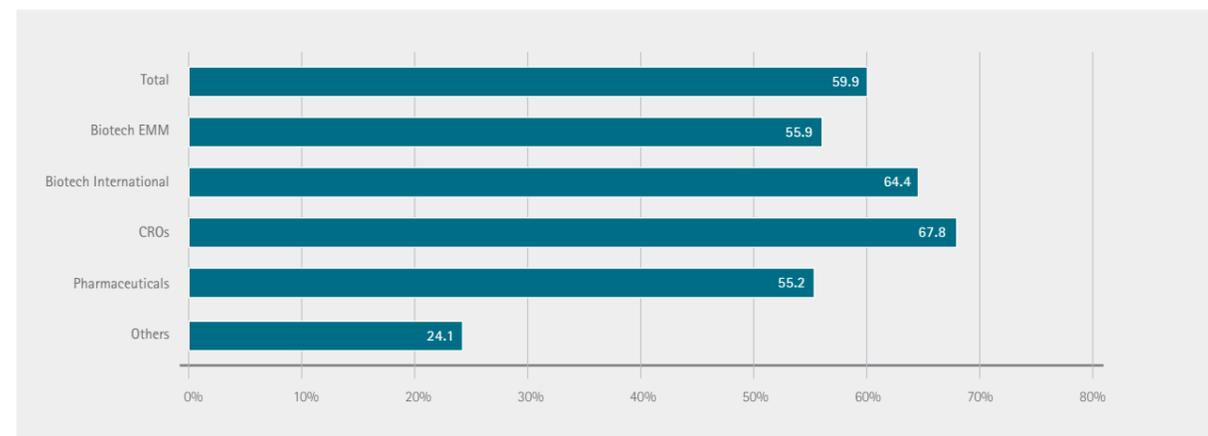
has pushed the pharmaceutical industry back into second place (pharmaceuticals ranked first in 2008). The acquisition of biotech firms in the region has added about 350 employees to the international players' category. This also explains why the Biotech EMM category (biotech companies headquartered in the EMM region) has seen its workforce increase by only 15% (to 400 employees).

The CROs have also grown by a good 15%, taking on about 250 new recruits. The number of employees at the other companies has remained virtually unchanged (+1%). The presence of Roche Diagnostics in Penzberg makes the Weilheim-Schongau district a focal region in its own right, alongside Munich.

20 NO. OF EMPLOYEES IN THE VARIOUS SEGMENTS IN THE EMM REGION



21 PERCENTAGE OF UNIVERSITY GRADUATES IN THE VARIOUS SEGMENTS

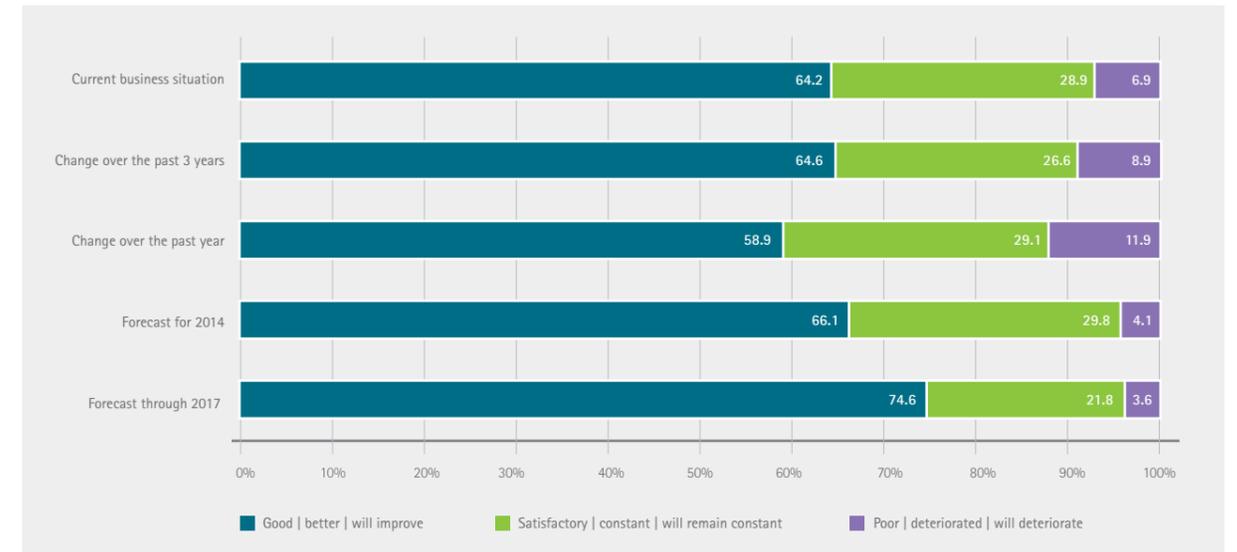


The biotechnology and pharmaceutical industries are a high-tech sector in which university graduates account for around 60% of all employees. The percentage is highest in the especially research-intensive contract/clinical research organization (CRO) segment, which provides preclinical and clinical research and development services for the companies that develop drugs.

ASSESSMENT OF THE BUSINESS CLIMATE

The fundamental mood among companies is mostly positive. 66% of respondents expect to see further improvement in the current year, while as many as 75% anticipate positive development between now and 2017.

22 ASSESSMENT OF THE BUSINESS CLIMATE IN THE BIOTECHNOLOGY AND PHARMACEUTICAL INDUSTRIES IN THE EMM REGION



Biotechnology companies

SALES, STRUCTURE OF COMPANIES AND LINES OF BUSINESS

163 biotechnology companies were based in the EMM region in 2013, 14 more than in 2008. Of these, 131 have their headquarters in the EMM region (Biotech EMM). The remaining 32 are offices and subsidiaries of international biotech groups (Biotech International).

Biotechnology is a highly dynamic industry within which 70 Biotech EMM companies (50%) have for years formed a stable core in the region. The other half of the Biotech EMM companies are start-ups that first have to become established on the market. Ten SMEs have been acquired by larger companies in the past five years. In the same period, 20 companies have had to give up and file for insolvency, while one other firm has moved to a different part of Germany.

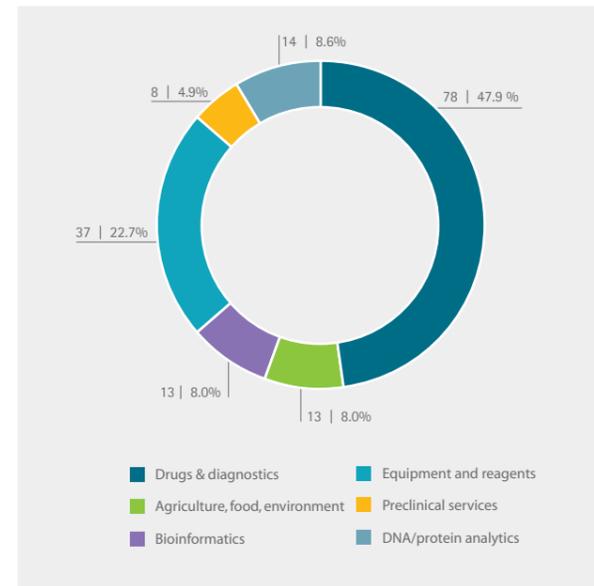
Nearly half of all biotech companies in the EMM region (48%) operate in the development of drugs or diagnostics. At the present time, 22 Biotech EMM companies are developing therapeutic agents, accounting for a large proportion of the firms that do this nationwide (48). Eleven Munich-based drug developers also make their proprietary technology platform and specific in-house expertise available as a service to the (inter)national pharmaceutical and biotechnology industries. This successful business model enables them to finance much of their proprietary product development (e.g. MorphoSys, Pieris, Evotec München).

WHITE BIOTECHNOLOGY

In the form of Wacker and Clariant (formerly Süd Chemie), two major global players that are migrating their chemical production processes to biotechnology methods in more and more areas have established a base in the EMM region. Two other core biotech companies can be assigned to the same category: Biomer produces biodegradable plastic substitutes (polymers), while AMSilk creates new biomaterials and applications from spider silk.

Major industrial players traditionally collaborate closely with universities that have an applied and technological focus, enabling interesting ideas to find their way directly into industry. Since networking partner Industrielle Biotechnologie Bayern Netzwerk GmbH (IBB) was recently able to win projects backed by the Federal Ministry of Education and Research and the EU, more start-up activity can be expected in the future.

23 LINES OF BUSINESS AT BIOTECH COMPANIES OVERALL (BIOTECH EMM + BIOTECH INTERNATIONAL)



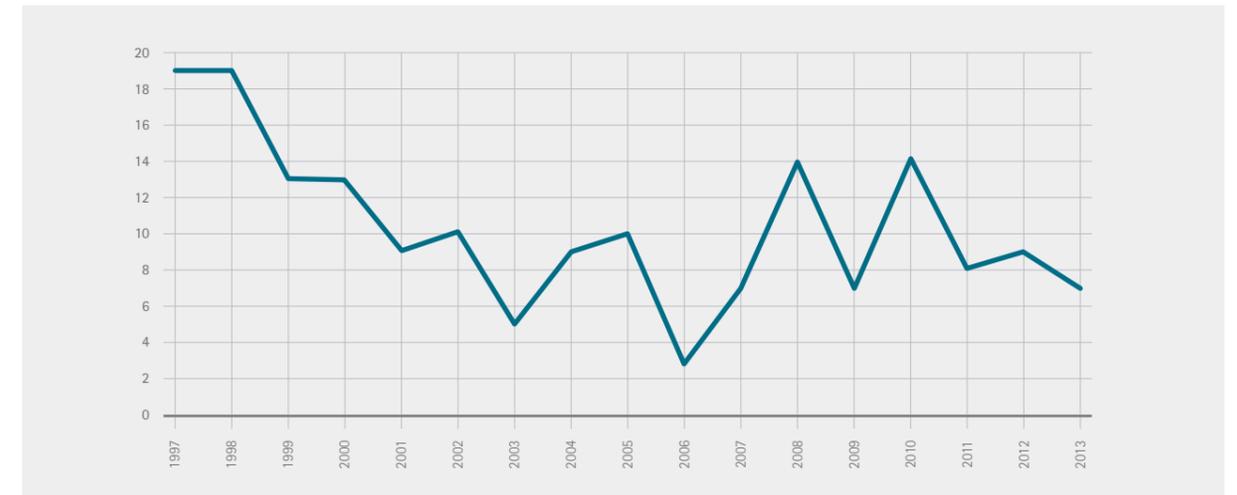
SALES AND R&D EXPENSES

The 163 biotech companies in the EMM region generated total sales revenue of EUR 3.1 billion in 2013, up 12% from 2008. Sales realized by the offices and subsidiaries of international biotech companies came to EUR 2.7 billion.

The Biotech EMM companies posted sales of around EUR 415 million in 2013. Of this amount, some EUR 110 million was generated by four publicly traded companies (4SC AG, Medigene AG, MorphoSys AG and Willex AG). A good EUR 150 million (approx. 36% of sales) was reinvested in the companies' own research and development activities. That is a far lower percentage than in 2008, despite a comparable sales volume: In 2008, the total R&D spend for Biotech EMM companies stood at EUR 297 million (76% of sales). This effect could be attributable to the shift in business models toward more contract research on behalf of third parties, which ties more resources. As a result, less capacity is left to devote to proprietary research and development projects.

The five biggest Biotech EMM companies accounted for more than a third of sales revenue in 2013 (roughly EUR 150 million), while a further 20 Biotech EMM companies generated sales totaling about EUR 100 million. In other words, 20% of companies currently account for 60% of total sales revenue in this category.

24 NO. OF BIOTECH START-UPS



START-UPS

A total of 44 biotech companies have either been launched or moved to the region since 2008. Of these, 16 start-up firms were launched by local academic institutions (Technische Universität München, Ludwig Maximilians Universität, the German Research Center for Environmental Health, various Max Planck institutes), 13 start-ups were launched as new commercial enterprises, eight firms were spun off from existing companies and seven start-ups were the result of international subsidiaries moving into the region. Of the latter, five biotech firms from the USA and two from Japan have established a base in the EMM region since the previous survey.

Overall, the number of new start-ups since has remained stable at around ten per year since the turn of the millennium. The pace of new business launches has thus consolidated over the past ten to 15 years, though there is no verifiable link to the crises in 2000 and 2008.

CHANGE IN THE NUMBER OF JOBS

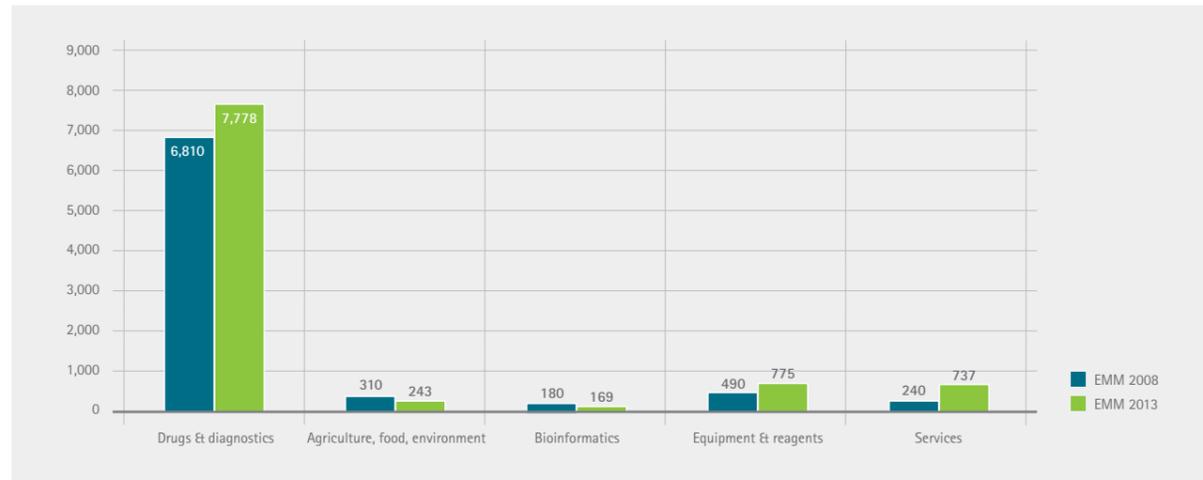
The 163 biotech companies in the Munich Metropolitan Region employ approximately 9,700 people (of whom 4,300 – roughly 45% of all biotech employees – work in Planning Region 14). Biotech employees in the EMM region concentrate primarily on biopharmaceutical/medical biotechnology.

The number of employees at all biotech companies taken together has risen by around 20% since 2008. The strongest nominal growth – by more than 900 employees – has taken place among developers of drugs and diagnostic agents (+14%). In percentage terms, producers of equipment and reagents have added 58% more staff. In the same period, the other biotechnology service providers have actually tripled their workforce (+200%). This latter group of companies includes providers of genome and proteome analysis such as the Eurofins Group in Ebersberg (see figure 25 on page 30).

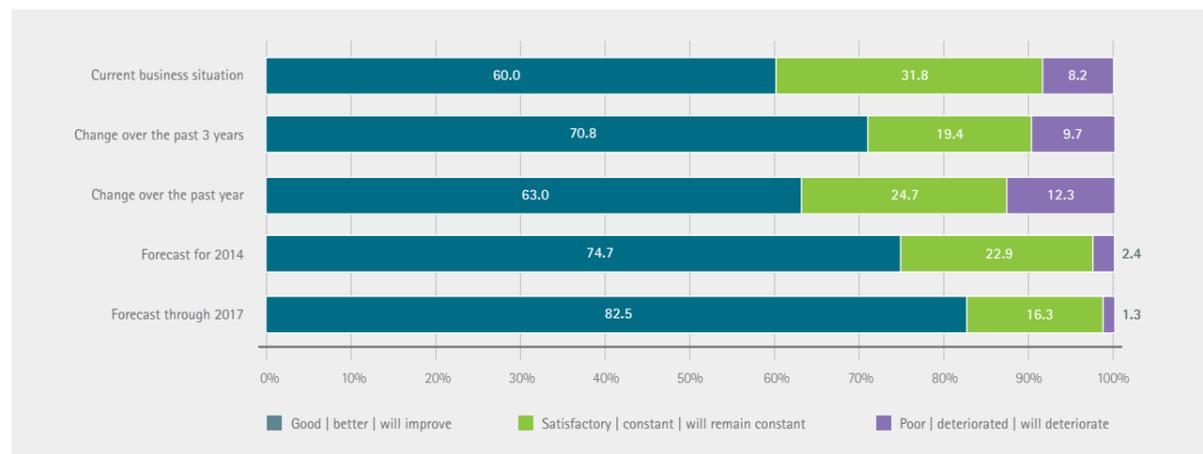
ASSESSMENT OF THE BUSINESS SITUATION

70% of the biotechnology companies in the EMM region rate the past three years as "good". 74% are also upbeat about the current business situation in 2014, while 82% are optimistic about the longer-term future (see figure 25 on page 30).

25 DISTRIBUTION OF THE EMPLOYEES OF ALL BIOTECH COMPANIES BY BUSINESS LINE



26 ASSESSMENT OF THE BUSINESS SITUATION BY BIOTECH COMPANIES IN THE EMM REGION



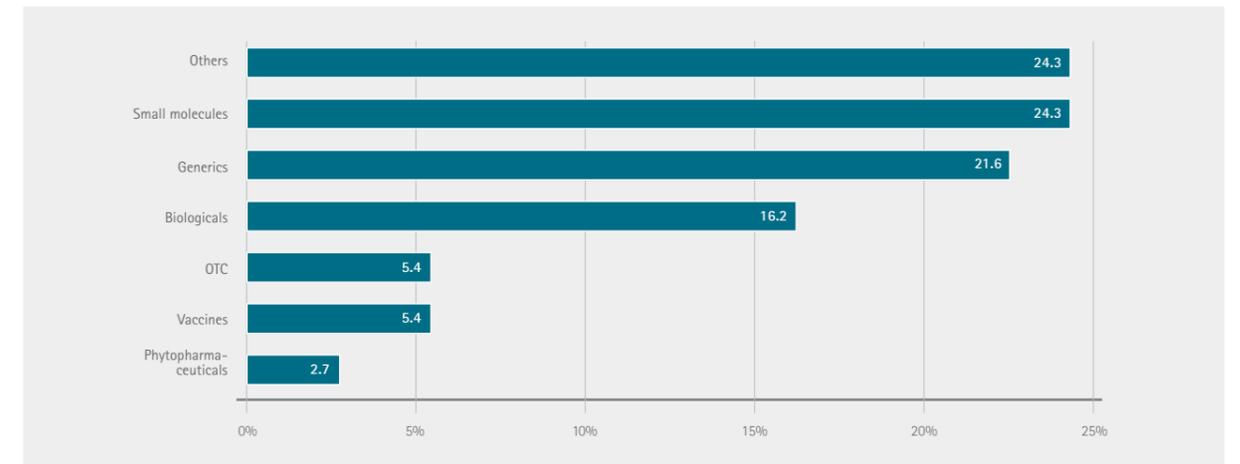
Pharmaceutical companies

SALES, STRUCTURE OF COMPANIES AND LINES OF BUSINESS

The pharmaceutical industry essentially consists of manufacturers of human medicinal products. This survey only covers those companies that also have prescription drugs in their product portfolio. A total of 30 pharmaceutical companies were thus identified and surveyed in the EMM region. Since 2008, sales revenue in the pharmaceutical industry in the Munich Metropolitan Region has risen by about 3% to EUR 3.8 billion.

Around 24% of these pharmaceutical companies focus their activities on chemically synthesized small molecules, while a good 16% concentrate on biologicals (biologically produced protein molecules). The lines of business subsumed under the "Others" category include chemicals, cosmetics and the manufacture of other niche products, for example. OTC products are "over-the-counter" medicines that do not require prescriptions.

27 PHARMACEUTICAL COMPANIES' LINES OF BUSINESS IN THE EMM REGION (MULTIPLE MENTIONS POSSIBLE)

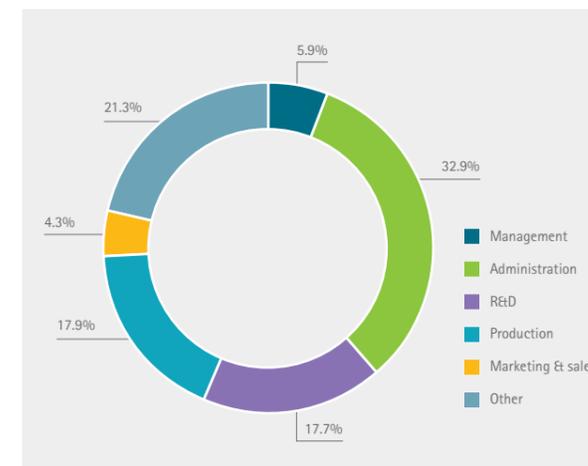


EMPLOYEES AND THEIR PRINCIPAL ACTIVITIES

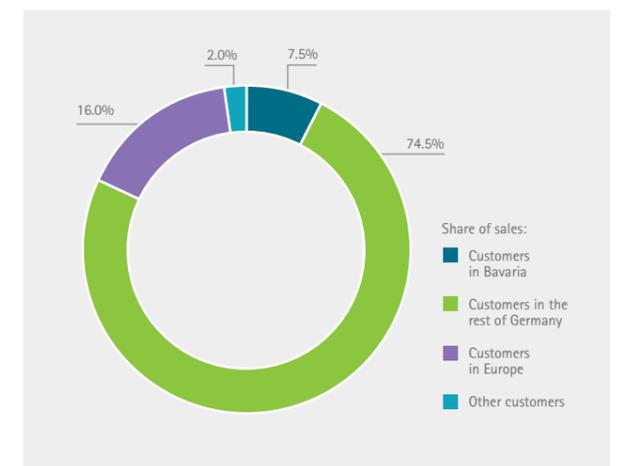
The sales offices of international pharmaceutical groups shape the drug industry in the EMM region. 70% of these companies also engage in local research and development activities, especially clinical trials, most of which are conducted within the international networks of clinical trial centers. Depending on their assignments, the distribution of employees differs sharply from the R&D-heavy pattern in evidence at biotechnology companies.

Many of the pharmaceutical firms in the EMM region are the German headquarters of major international companies and, by consequence, have a domestic sales and distribution focus. 82% of the pharmaceutical players in the EMM region focus primarily on activities within Germany. These companies are thus more heavily influenced by national crises and events such as healthcare reforms and market regulations.

28 DISTRIBUTION OF EMPLOYEES AT PHARMACEUTICAL COMPANIES BY FUNCTION



29 GEOGRAPHIC DISTRIBUTION OF THE CUSTOMERS OF PHARMACEUTICAL COMPANIES IN THE EMM REGION



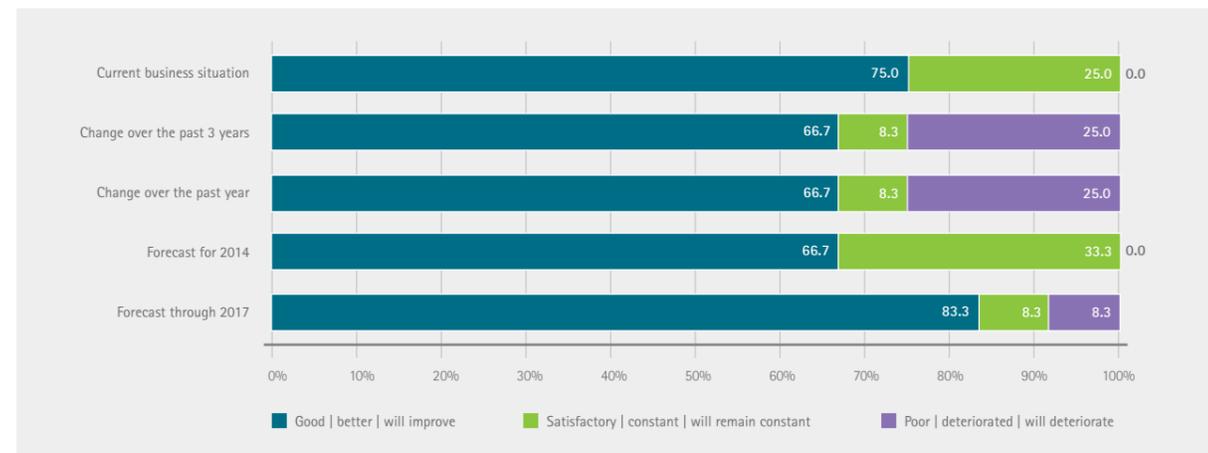
BUSINESS SITUATION

Unlike the biotechnology industry, a quarter of the pharmaceutical companies in the region have suffered setbacks in the past three years as their business situation deteriorated. However, the forecast for 2014 and the years ahead is substantially more optimistic (see figure 30 on page 32).

Pharmaceutical companies' assessment of the current business situation is much more positive today than it was in 2008, when 25% of respondent firms saw the current situation as "poor". Despite the buoyant business situation and the mood of optimism, however, only 10% of companies want to employ more people.

Efforts to cut costs are a strong focus of the pharmaceutical industry in Germany, even though the cost of drugs is not the biggest item in the nation's annual healthcare spend of EUR 300 billion (2013), of which it accounts for between about 15 and 17% (depending on the source). Patent-protected drugs currently account for around 4% of total drug costs in Germany. The remaining 11 to 13% are made up by less expensive generic products (14). **The tremendous efforts associated with healthcare reforms and compulsory discounts target a savings volume of roughly EUR 12 billion, meaning that 96% of costs – EUR 288 billion – remains unaffected.**

30 ASSESSMENT OF THE BUSINESS SITUATION BY PHARMACEUTICAL COMPANIES IN THE EMM REGION



Contract research organizations (CROs)

COMPANIES, SALES AND MARKET DEVELOPMENTS

The Munich Metropolitan Region is home to 54 contract research organizations (CROs) that conduct and coordinate both preclinical research and development activities and clinical trials on behalf of biotechnology and pharmaceutical firms. CROs are growing in importance in two key ways: as external preclinical research facilities for major pharmaceutical companies in the context of drug development; and in clinical development and clinical trials for Munich-based developers of therapeutic agents in the biotechnology and pharmaceutical industries.

Reported sales by CROs rose from EUR 119 million in 2008 to a total of EUR 193 million in 2013. This significant gain of around 60% translates into average annual sales growth of 10% since the last survey, underscoring the forceful growth dynamic in this segment.

A good 80% of the contract research organizations were founded or opened an office in the Munich region after 1990. 66% of these companies are located within the boundaries of the city of Munich, while 28% are based in the immediate vicinity. CROs are thus a relatively youthful branch of industry in and around the Bavarian capital, their growth in recent years and decades having been driven by the ever greater requirements placed on clinical trials. Although the number of companies has remained virtually unchanged (+1) since the previous survey, a whole series of CROs – especially those with clinical activities – have joined forces, while others have moved into the area.

EMPLOYEE STRUCTURE AND CHANGES OVER TIME

The number of employees increased by about 250 (+15%) to 1,954 between 2008 and 2013. The current survey shows that the very fast pace of growth that saw the workforce nearly double between 2005 and 2008 (2005: 900 employees; 2008: 1,700 employees) has slowed considerably, even though the industry is continuing to expand vigorously.

Logically, the largest proportion of CRO staff (61%) are deployed in R&D. The majority (51%) of the roughly 50% of companies that provided information about the projected trend in employment expect the number of employees to remain constant. A good 45% of these companies expect staffing figures to rise, while only 3% anticipate a reduction in the headcount.

CUSTOMER STRUCTURE

The pharmaceutical industry constitutes the largest customer segment for CROs. Compared to the 2008 study, a slight shift in the structure of customers was in evidence in 2013 (biotechnology: 26% in 2008, 20% in 2013; pharmaceuticals: 65% in 2008, 69% in 2013).

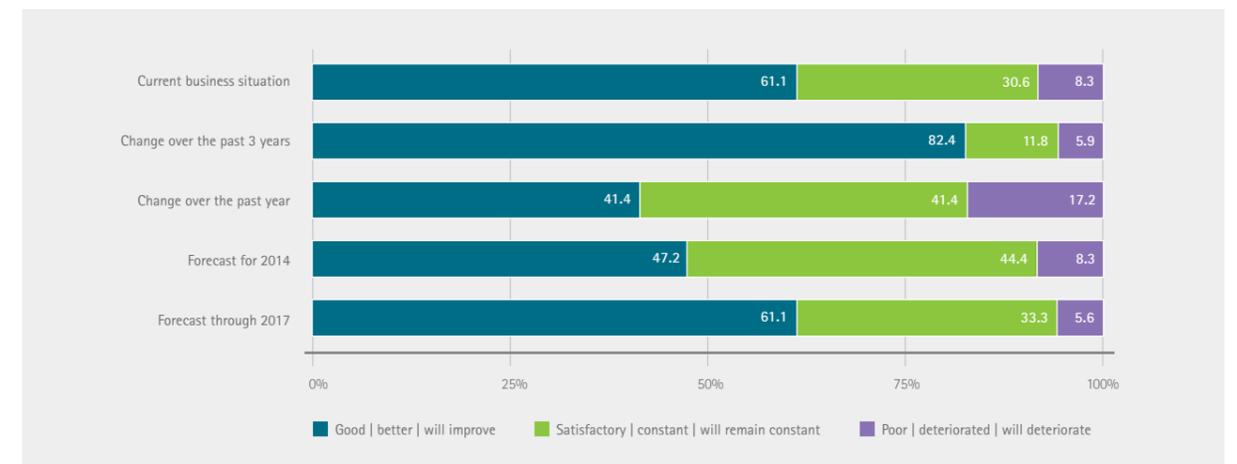
The regional focus is outside the EMM region, with only about 25% of customers based in Bavaria (against 17% in 2008). The Bavarian capital's close business ties outside the region suggest that **companies in Munich often serve as the Central European coordination hub for polycentric international clinical trials.**

ASSESSMENT OF THE BUSINESS SITUATION

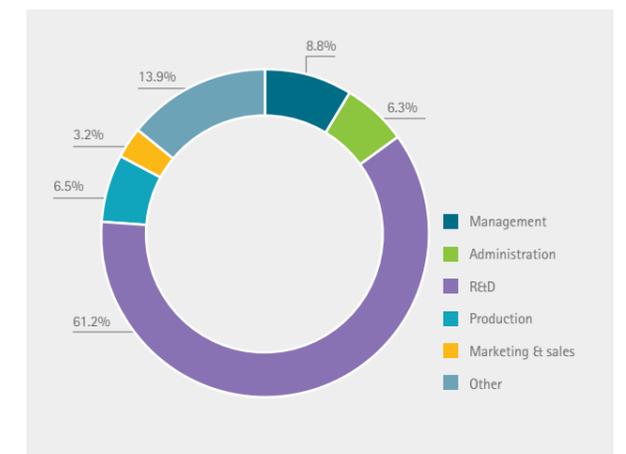
More than 80% of the CROs have experienced positive development over the past three years. A good 60% also see their current business situation as positive. While 2013 draws a mixed response, 61% of companies expect business development to improve through 2017.

As in 2008, the CROs traditionally take a more cautious view of the business situation than the other analyzed segments of industry do. Overall, however, they are noticeably more upbeat about the business situation today than they were in 2008, when only 23% rated their current business situation as "good".

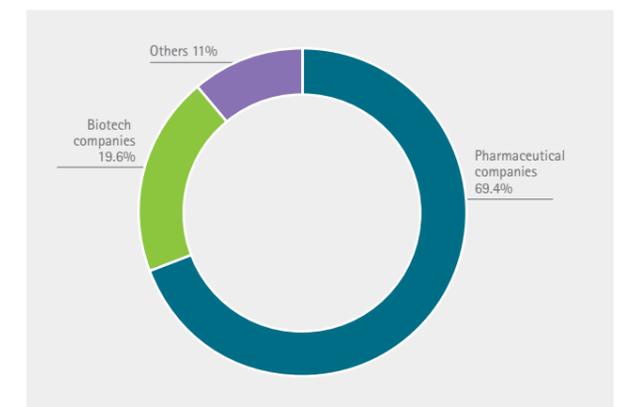
33 ASSESSMENT OF THE CURRENT BUSINESS SITUATION BY CONTRACT RESEARCH ORGANIZATIONS (CROs) IN THE EMM REGION



31 DISTRIBUTION OF EMPLOYEES AT CROs IN THE EMM REGION



32 CURRENT STRUCTURE OF CROs' CUSTOMERS IN THE EMM REGION



Other companies

COMPANIES, SALES AND MARKET DEVELOPMENTS

130 other life science firms can, in the wider sense, be seen to belong to the pharmaceutical and biotechnology industries in and around Munich. **These companies are an important economic factor in the region, employing a good 4,700 people and generating sales revenue of around EUR 1.3 billion.**

Some of these companies are contract manufacturing organizations (CMOs), which produce active medicinal agents on behalf of biotechnology or pharmaceutical companies. Wholesalers of pharmaceuticals and/or diagnostics are also grouped together under "other companies". They account for a large share of the other life science category.

Suppliers to the biotech and pharmaceutical industries likewise belong in this group, although it is difficult to draw a clear line. When assigning suppliers to an industry, the general rule is that they predominantly supply the industry in question with specialized products, such as laboratory equipment in this case, for example.

Lastly, firms with a focus on dietary supplements or other medical products have also been included, as have veterinary medicine companies. Pure medical engineering firms were excluded from the survey, as were pure cosmetics firms, although some companies in the survey cited cosmetics or other medical products as one of their business lines. One change since the 2008 study is the inclusion of a number of companies that operate in phytopharmaceuticals and

natural medicines, both of which were still subsumed under pharmaceuticals in 2008. This restructuring and the resultant new inclusions mean that these findings of the study cannot be compared with those from 2008.

LINES OF BUSINESS

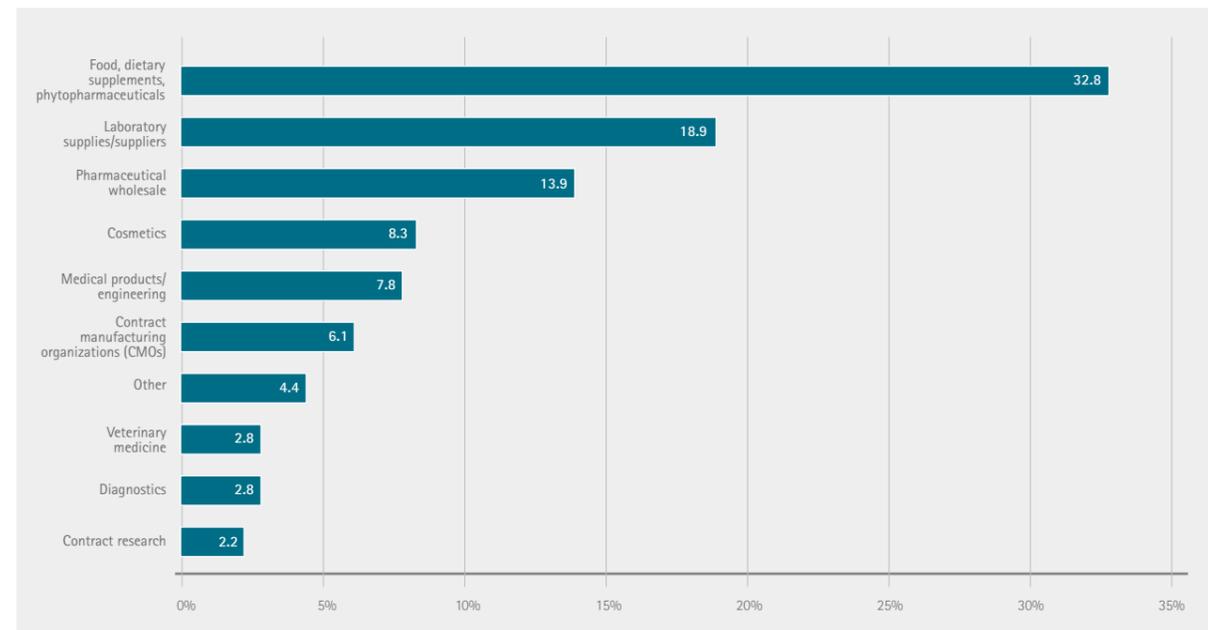
In line with the heterogeneous nature of the other life science category, these companies operate a very broad spectrum of local activities. A good 30% of them are located outside the Munich region (Planning Region 14).

EMPLOYEE STRUCTURE AND CHANGES OVER TIME

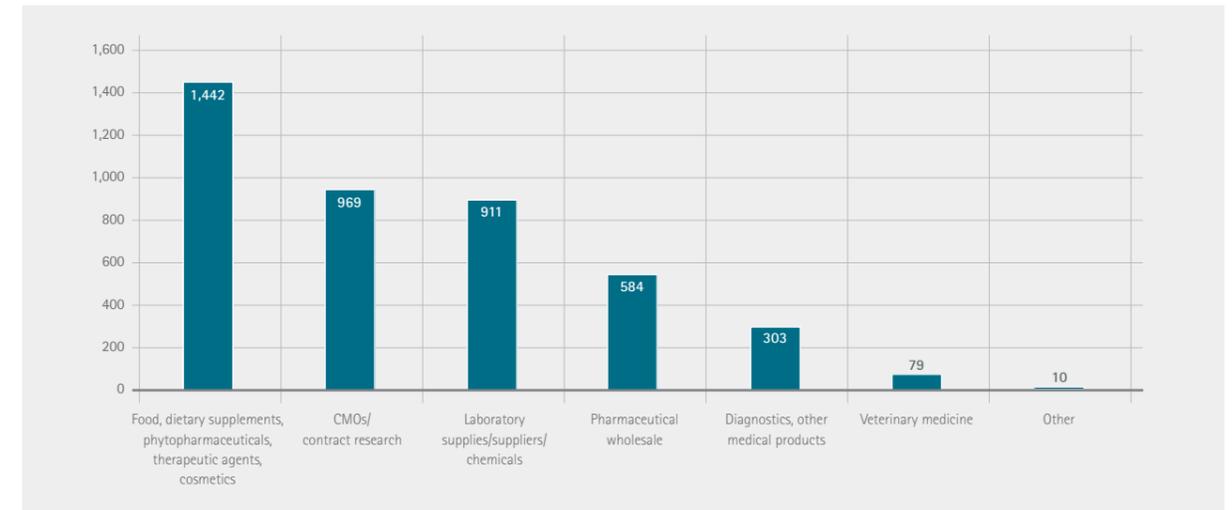
Taken together, CMOs, suppliers, resellers and other life science companies employ a good 4,700 people in the Metropolitan Region Munich. The majority of employees at these companies work in food, dietary supplements and phytopharmaceuticals, followed by contract manufacturing organizations (CMOs) and suppliers. The 20 biggest companies together employ about 3,000 people, around 70% of this segment's workforce.

Since the individual companies operate in widely differing lines of business, the conclusions that can be drawn from aggregated presentations are inherently limited. It is nevertheless conspicuous that a large proportion of these companies do not only conduct research and development but also manufacture in the EMM region. All in all, around 50% of the total workforce is assigned to these two disciplines (production: 37%; R&D: 12%).

34 LINES OF BUSINESS AT OTHER LIFE SCIENCE COMPANIES IN THE EMM REGION



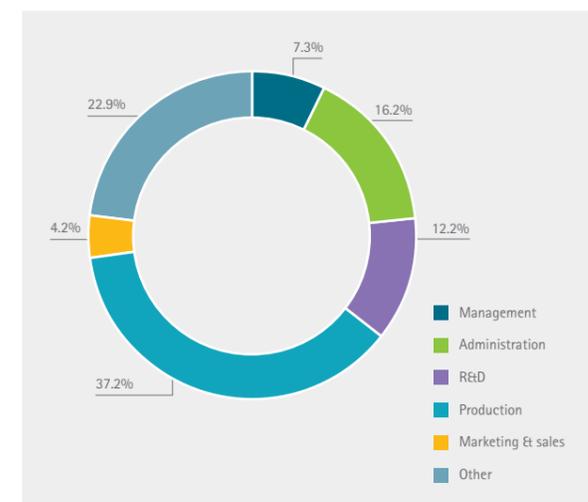
35 NUMBER OF EMPLOYEES BY LINE OF BUSINESS IN THE EMM REGION



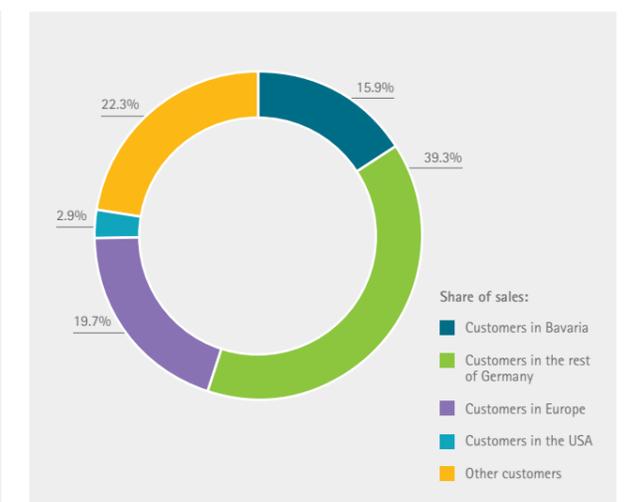
CUSTOMER STRUCTURE

A good 55% of the customers of companies in this segment are located in Germany (39%) or Bavaria (16%). The remaining 45% are thus spread across other countries, with Europe accounting for 20%. The Middle East, the Arab countries and African countries too are emerging as geographic market hotspots, adding to a singularly diverse and colorful set of sales markets.

36 DISTRIBUTION OF EMPLOYEES AT CMOs, SUPPLIERS, RESELLERS AND OTHER LIFE SCIENCE COMPANIES IN THE EMM REGION, BY FUNCTION



37 GEOGRAPHIC DISTRIBUTION OF THE CUSTOMERS OF OTHER LIFE SCIENCE COMPANIES IN THE EMM REGION IN TERMS OF SHARE OF SALES REVENUE

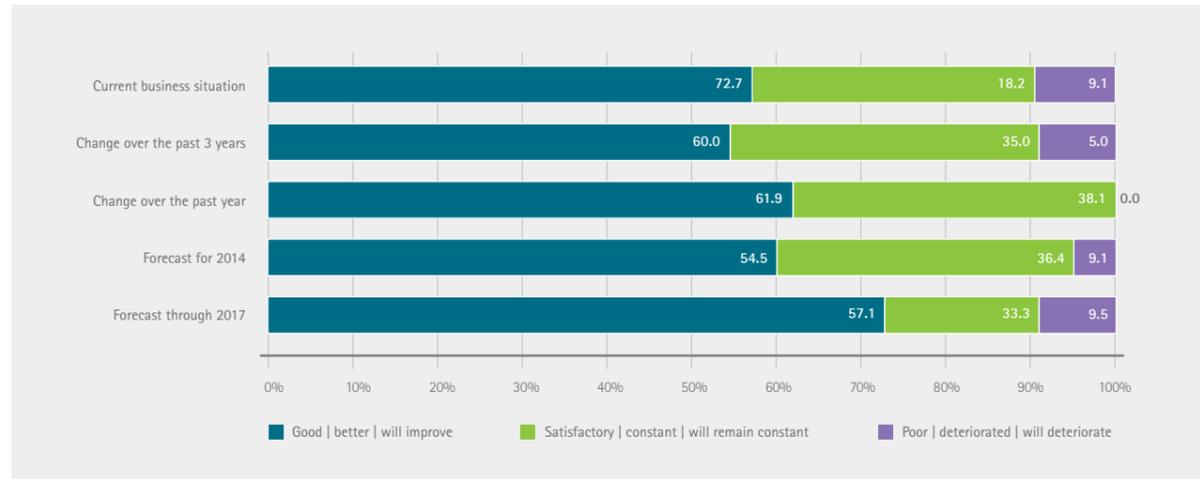


BUSINESS SITUATION

73% of companies see their current business situation as very positive, while 60% claim it has improved over the past three years. The majority of the companies (55%) anticipate an improvement in 2014, and 57% believe the business situation will improve further through 2017.

The survey shows that, alongside the core areas of biotechnology and pharmaceuticals, an economically stable yet still dynamic landscape comprised of service providers, contract researchers, contract manufacturers, distribution companies and suppliers of laboratory equipment has been able to take root in the region.

38 ASSESSMENT OF THE BUSINESS SITUATION BY SUPPLIERS, RESELLERS AND OTHER LIFE SCIENCE COMPANIES IN THE EMM REGION



ATTRACTIVENESS OF GERMANY AND THE EMM REGION

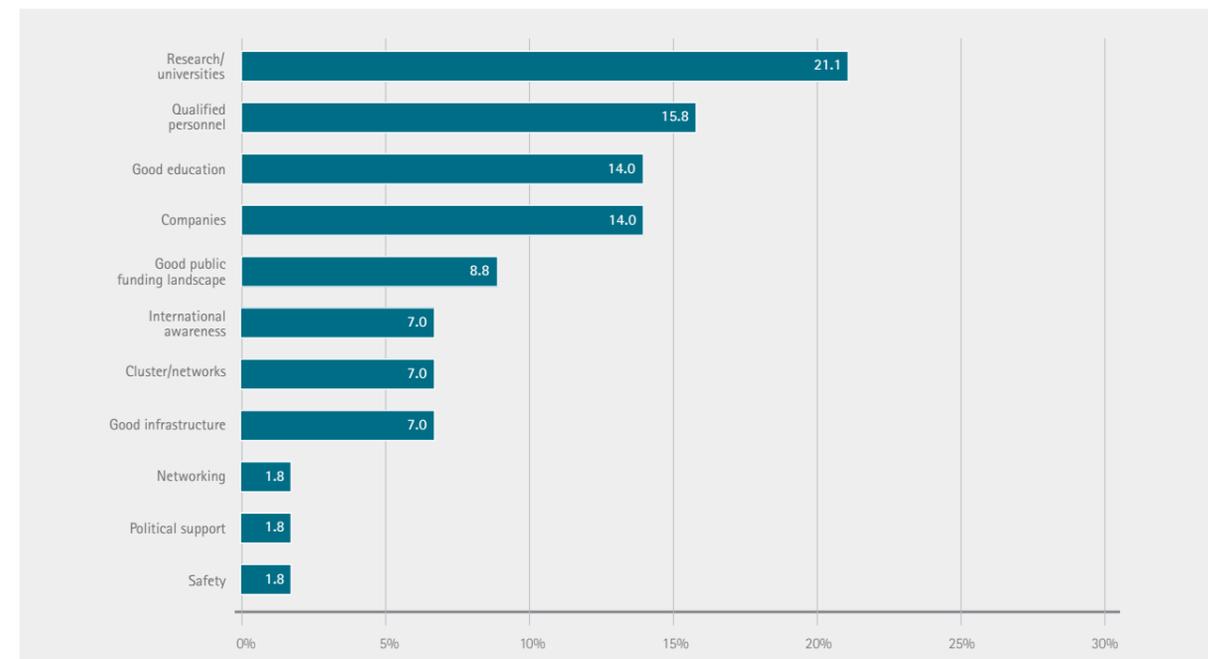
Attractiveness of Germany and the EMM region

Above and beyond a location's economic and content-related quality factors, a raft of further, softer factors also tie companies to a given place or can be instrumental in attracting companies to a region. As in the 2008/2009 study, companies in all segments of the pharmaceutical and biotechnology industries were also asked about the quality of Germany in general and the Metropolitan Region Munich (EMM) in particular as places to do business.

STRENGTHS OF GERMANY AND THE EMM REGIONS AS VENUES FOR BIOTECHNOLOGY AND PHARMACEUTICALS

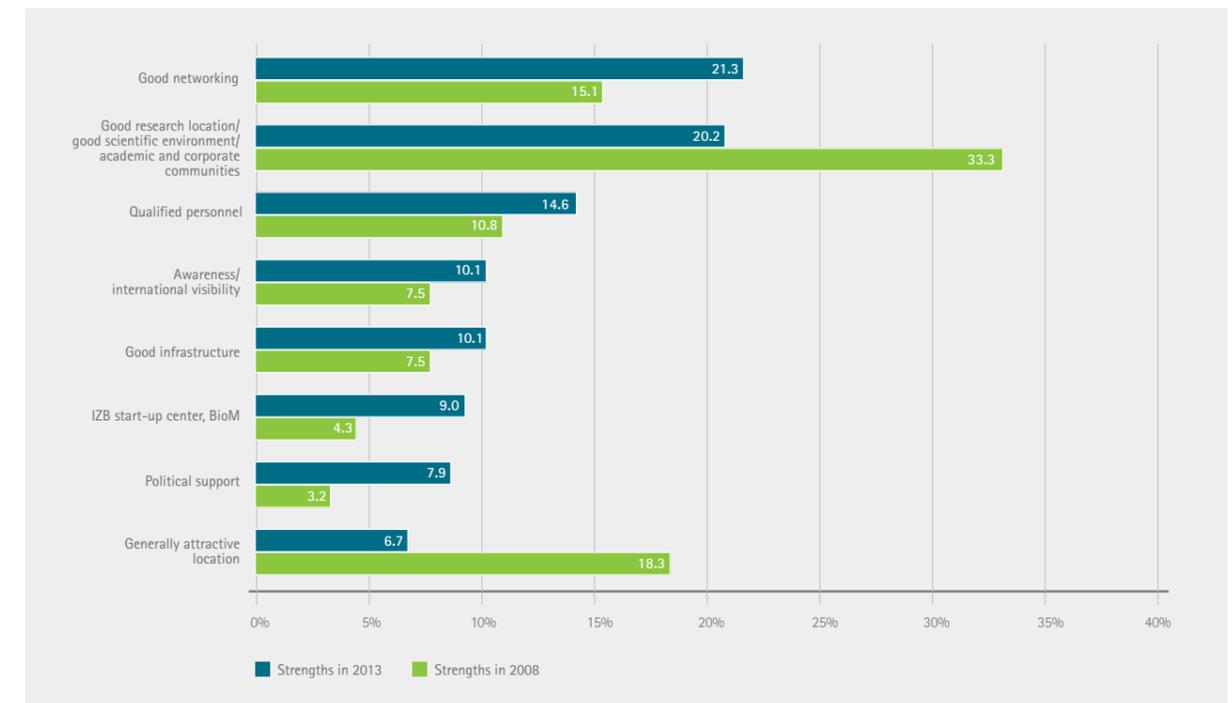
22% of companies identify a "good research landscape/good universities" as Germany's greatest strength as a venue for the biotechnology and pharmaceutical industries. This factor is followed by "qualified personnel" (16%) and "good training/education" (14%). Germany's biotech companies as a whole – the overall biotech landscape, in other words – are rated as another of the country's strengths.

39 STRENGTHS OF GERMANY AS A VENUE FOR THE BIOTECHNOLOGY AND PHARMACEUTICAL INDUSTRIES



These leading nationwide factors are comparable to those cited for biotechnology and pharmaceuticals in the EMM region. Here, companies pointed to "good networking" (22%) as a key strength, followed by a "good research location/good scientific environment in the academic and corporate communities" (20.5%) and access to "qualified personnel" (14.5%). Other points that were frequently mentioned include the generally "good infrastructure" and "awareness of the region/international visibility", but also, very specifically, the "start-up center" and the "cluster organization". Compared to the answers given in 2008, it is apparent that the factors "good research location" and a "generally attractive location" were cited less frequently as strengths of the region this time around.

40 STRENGTHS OF THE EMM REGION AS A VENUE FOR THE BIOTECHNOLOGY AND PHARMACEUTICAL INDUSTRIES (COMPARISON OF RESPONSES IN 2008 AND 2013)



WEAKNESSES OF GERMANY AND THE EMM REGION AS VENUES FOR THE BIOTECHNOLOGY AND PHARMACEUTICAL INDUSTRIES

Looking at Germany's weaknesses as a venue for the biotechnology and pharmaceutical industries, more than 40% of companies cited the "poor public funding landscape" as an especially weak point, far ahead of other factors such as "bureaucracy" (16%) and "poor acceptance of biotechnology" (13%).

It comes as a surprise that the funding landscape is rated so poorly, given that federal government's industry development instruments – often in combination with those of the Free State of Bavaria, and especially for the start-up phase – are described by experts as "exemplary" and throughout Europe as "outstanding" (most recently in an expert panel discussion on Finance Day at the trade show Analytica 2014, for example). Notwithstanding, the question about the biggest challenges to the future of the biotechnology industry confirms the need for better development instruments, with more

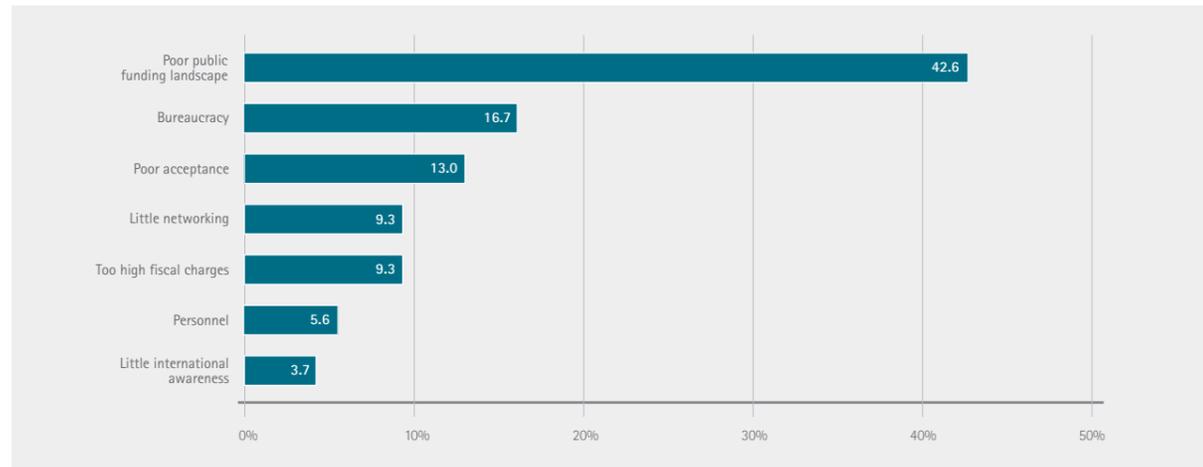
than 50% of companies citing this issue. One reason could be government's focus on start-up financing over the past decade. This funding provides only inadequate cover for the protracted and expensive product development and market launch phases in the biopharmaceutical biotechnology industry. Beginning in 2015, Bavaria plans to set up a growth fund as a new tool to finance growth. However, this instrument covers all fields of innovation rather than focusing on any specific industry.

Other weaknesses become apparent from a regional perspective: Around 30% of respondents cite the "high cost of rents/living/personnel" in and around Munich as the region's biggest weakness. Nearly 15% identify the "poor funding situation/investments/too few development measures" as a weakness – far more than the 4% that concurred in this view in 2008. Fewer companies mentioned "tax law/bureaucracy" or "high costs" than in 2008. Overall, the respondent companies cited more negative factors for the EMM region than in the 2008 survey (see figures 41 and 42 on page 40).

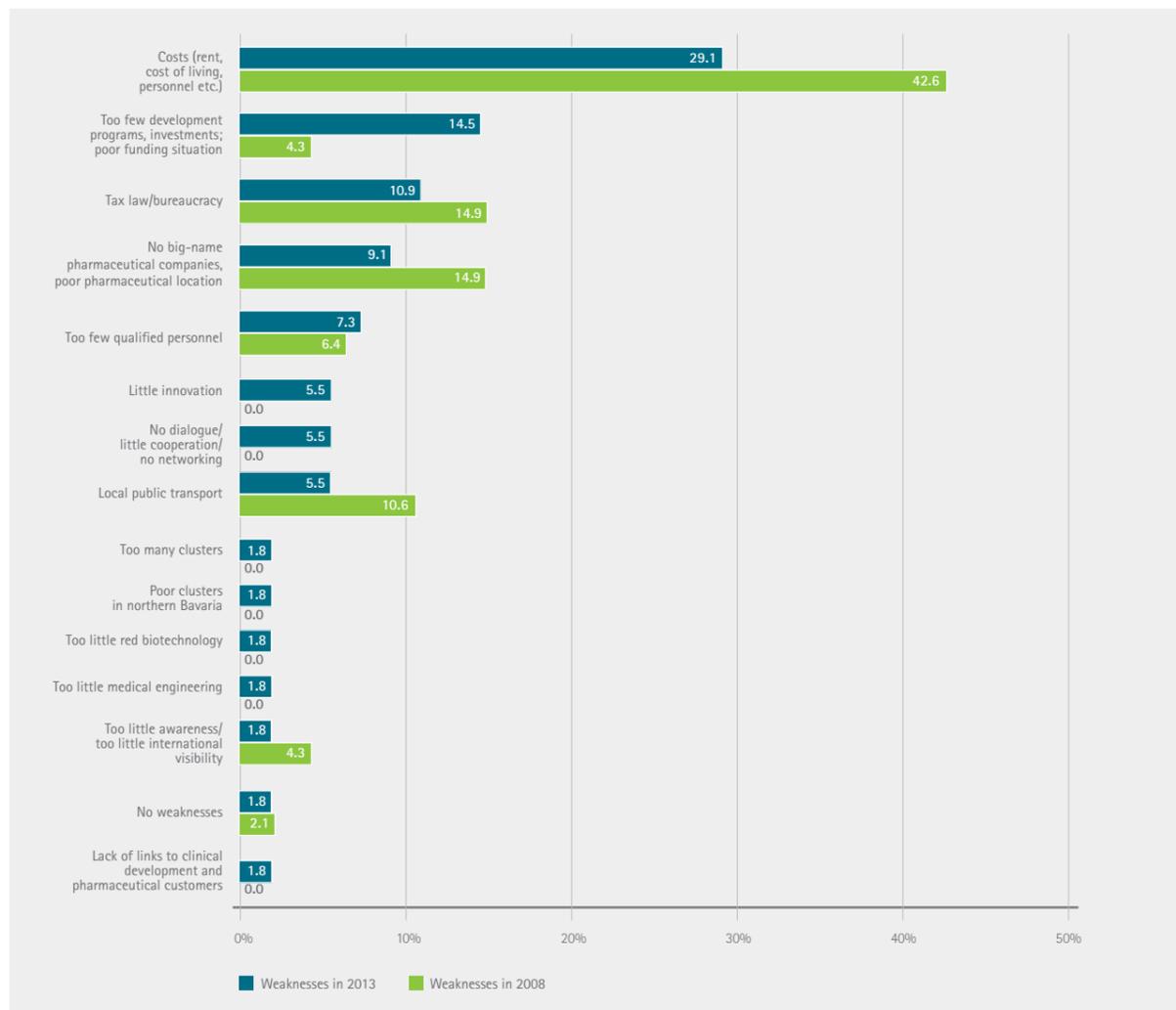
*"The region needs a new wave of success stories.
American investors need to regain confidence.
There is a need to ramp up international advertising
for Munich as a biotech hub."*

Prof. Dr. Patrick Bauerle
CSO Amgen Research Munich GmbH

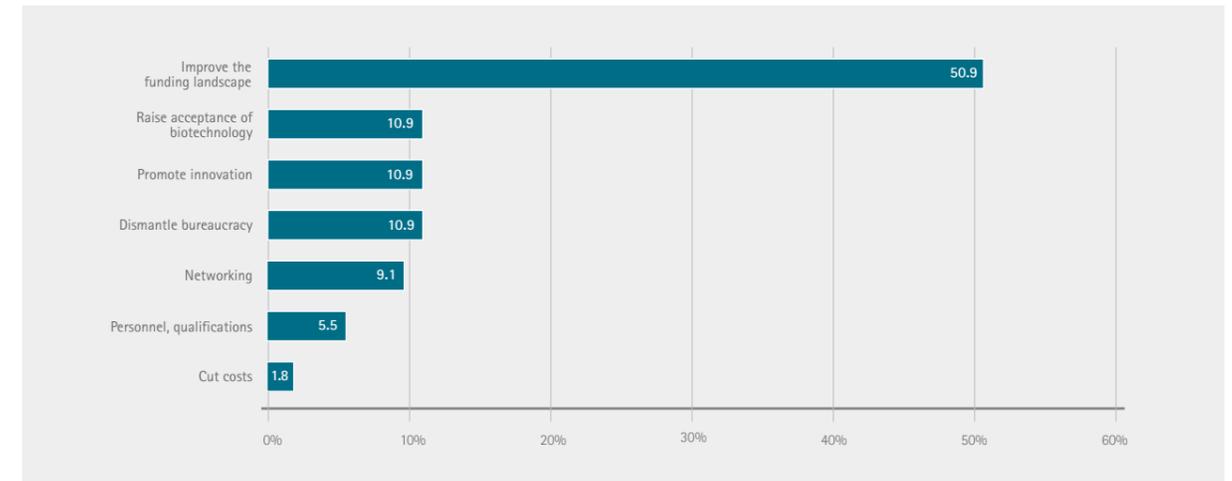
41 WEAKNESSES OF GERMANY AS A VENUE FOR THE BIOTECHNOLOGY AND PHARMACEUTICAL INDUSTRIES



42 WEAKNESSES OF THE EMM REGION AS A VENUE FOR THE BIOTECHNOLOGY AND PHARMACEUTICAL INDUSTRIES (COMPARISON OF RESPONSES IN 2008 AND 2013)



43 BIGGEST CHALLENGES TO THE FUTURE OF THE BIOTECHNOLOGY AND PHARMACEUTICAL INDUSTRIES IN GERMANY



OVERALL SATISFACTION RATINGS

As in previous studies of the EMM region as a venue for the biotechnology and pharmaceutical industries, the latest survey again also asked about general location factors to complement the findings with regard to specific strengths and weaknesses of the region (see figure 45 on page 42).

In 2008/2009, "quality of life" drew the highest satisfaction rating (83%) as a general location factor. In the 2013/2014 survey, however, it has been overtaken by "contact with research organizations", which was cited by a total of 84% of respondents (29% of whom were very satisfied and 55% satisfied). This outstanding score reflects the fact that much has been done in recent years to improve collaboration both between scientific institutions and with industry. Examples include the Excellence Initiative run by German research association DFG, the national healthcare research centers, clinical cooperation groups involving the German Research Center for Environmental Health together with both elite universities, and Munich's m4 Leading-Edge Cluster program.

Cultural and recreational offerings rank second in the current survey with a score of 75%, closely followed by a whole series of other factors such as "supply of qualified personnel", "supply of office and laboratory space" and the "general acceptance of biotechnology", each of which achieved satisfaction ratings of around 74%.

Some 72% of companies are also satisfied with traffic and transportation links. However, a regional breakdown shows that more than 40% of companies in the south of Munich/Martinsried are less satisfied or dissatisfied with traffic and transportation links because of the lack of connections to a subway line.

44 DIFFERING OPINIONS ON TRAFFIC AND TRANSPORTATION LINKS IN MARTINSRIED AND THE REST OF THE EMM REGION

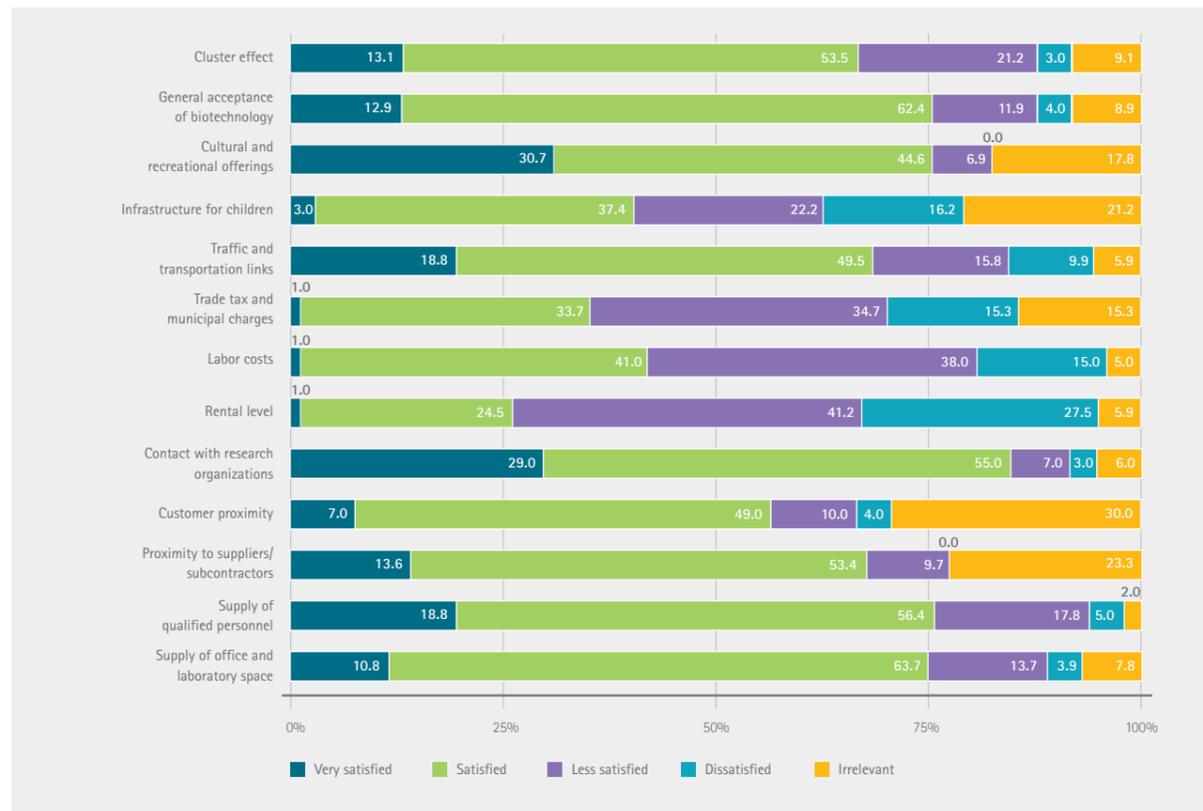
Traffic and transportation link responses from:	Martinsried	Whole EMM region
Very satisfied	7.1%	18.8%
Satisfied	42.9%	49.5%
Less satisfied	28.6%	15.8%
Dissatisfied	13.3%	9.9%
Irrelevant	7.1%	5.9%

Broadly speaking, companies are less satisfied or indeed dissatisfied with rental levels (nearly 80%), labor costs and trade tax/municipal charges. As in 2008, these issues were cited most frequently as weaknesses of the location in the survey's free-text fields. Since then, they have been regarded as areas in need of urban policy action, especially given that Munich remains one of the most coveted European cities for real estate investments.

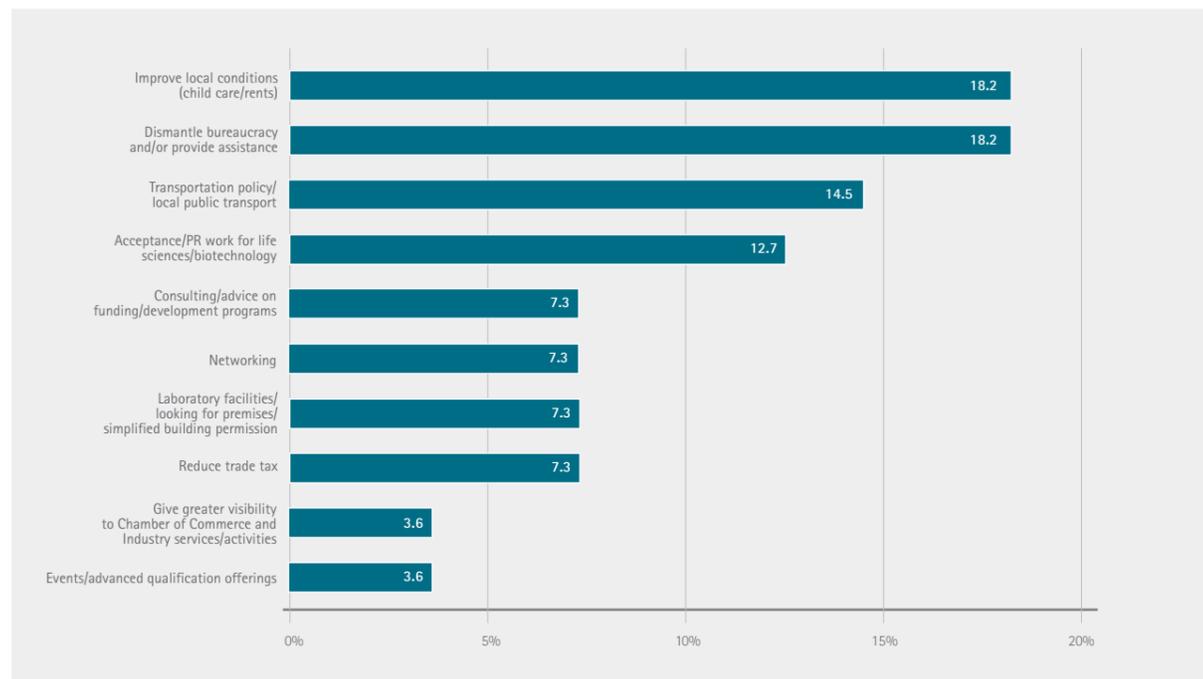
In the current survey, respondents are noticeably more dissatisfied with the infrastructure for children than they were in 2008. On this point, the share of satisfied respondents has fallen by 20 percentage points to 38%. One of the main reasons appears to be strong, unfulfilled demand for child care (e.g. day-care centers and crèches).

There is virtually no change in respondents' satisfaction with the cluster effect (around 66% in both 2008 and 2013) and with "general (local) acceptance of biotechnology" (around 74% in both years). The latter point runs counter to the findings for Germany as a biotechnology venue, indicating the existence of a particularly high-tech-friendly climate in Munich.

45 ASSESSMENT OF LOCATION FACTORS AT A GLANCE (WHOLE EMM REGION)



46 EXPECTATIONS/WISHES IN RESPECT OF THE CHAMBER OF COMMERCE AND INDUSTRY, THE CITY OF MUNICH AND THE BioM CLUSTER ORGANIZATION



EXPECTATIONS AND WISHES IN RESPECT OF LOCAL GOVERNMENT AND INSTITUTIONS

The survey gave respondents room to freely express their expectations and wishes in respect of local government. While these free-text fields naturally elicited a very broad spread of responses, it is nevertheless possible to identify several focal points.

The most frequent mentions were given to the traditional tools of regional economic development: improvements to location factors (such as child care, rental levels etc.) and moves to dismantle bureaucracy.

Alongside the wishes addressed to the City of Munich itself in 2008/2009 (and repeatedly since then), the Chamber of Commerce and Industry too is called on to **do more for public relations work in the life science sectors in order to make people more aware of this industry and its importance, as well as to raise acceptance of the industry among the population at large.**

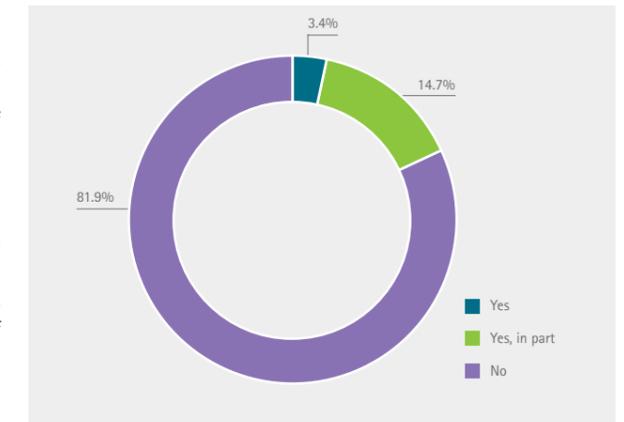
On the whole, the survey reveals that **companies are generally very satisfied with the location.** In spite of the challenges posed by a rather expensive region, very positive perceptions of the regional (infra)structure and the presence of numerous research organizations and educational/training institutions weigh heavier, as do the opportunities to interact with the latter in the form of cooperative ventures and thanks to cluster management.

CONSIDERABLE LOYALTY TO THE LOCATION

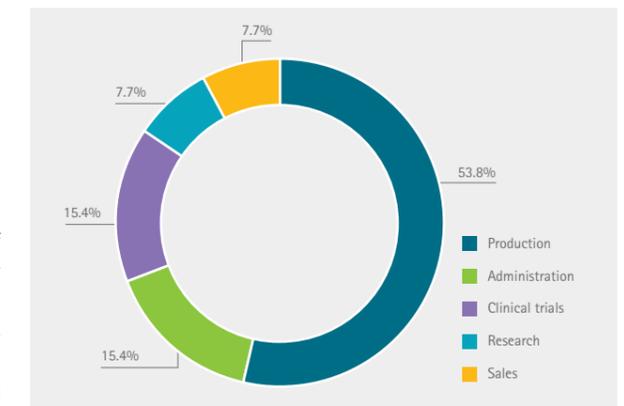
Companies' satisfaction with the quality of the EMM region and the Munich region is reflected in particular in their very considerable loyalty to this location. In the 2008/2009 survey, around 25% of the respondent companies were planning to move some of their business units (about 18%) or even the entire company (about 7%) out of the EMM region. In the current survey, **82% of companies are satisfied with the location and have no plans to move to other regions or countries.** The percentage of companies planning to withdraw entirely has also halved since 2008.

Most of the roughly 18% of respondent companies that are planning relocations are only planning to move isolated units (about 15%); and most of these units are aspects of production. Geographically, the focus of the units being moved out of the EMM region splits more or less evenly between Asia (predominantly India) and other European countries (with no clear preference for Southern, Central or Northern Europe). 13% of companies cited the USA as a target destination.

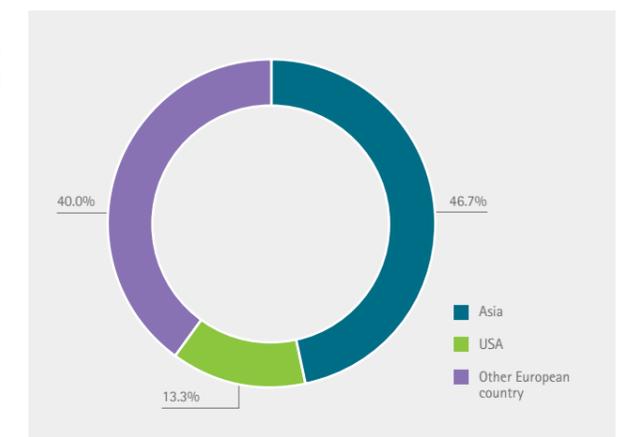
47 OVERVIEW OF COMPANIES' PLANS TO MOVE PART OR ALL OF THEIR ACTIVITIES ABROAD



48 OVERVIEW OF ACTIVITIES TO BE MOVED ABROAD (BY A TOTAL OF 18% OF COMPANIES)



49 GEOGRAPHIC DISTRIBUTION OF PREFERRED RELOCATION DESTINATIONS



Appendix

SURVEY METHODOLOGY AND DATA BASIS

The data basis used for this study comprised the addresses of all biotechnology and pharmaceutical businesses registered with the Chamber of Commerce and Industry for Munich and Upper Bavaria in January 2014, plus the address database maintained by BioM GmbH. The available address data was completed and sharpened by additional Internet-based research. The questionnaire was circulated to companies in the biotechnology and pharmaceutical industries, contract research organizations and other companies in the life science industry (such as wholesalers, contract manufacturers, suppliers and veterinary medicine firms. Medical engineering companies were excluded from the survey.

The Munich Metropolitan Region (EMM) constitutes the regional framework for this study. As used in Germany, the term "metropolitan region" was coined in the mid-1990s by the nationwide Ministerial Conference for Regional Planning (MKRO). Metropolitan regions are larger than the planning regions defined within the framework of regional and state planning. Each metropolitan region consists of a densely built-up core area and a surrounding area that is closely connected to this core area. Planning Region 14 (PR14), another spatial planning term referenced in this study, covers the city of Munich itself, the wider Munich administrative district and the neighboring communities of Freising, Ebersberg, Erding, Starnberg, Landsberg/Lech, Fürstfeldbruck and Dachau. After analyzing the completed and returned questionnaires and conducting extensive research, 377 companies were identified that belong to the life science sector. These companies constitute the basic population for this study.

NUMBER OF COMPANIES SURVEYED

	2008	2014
Total	385	377
In the city of Munich	144	137
In Planning Region 14 (excluding the city of Munich)	182	174
In EMM (excluding Planning Region 14)	59	66

DATA ACQUISITION (METHODOLOGY)

Analysis was based on an exhaustive written survey conducted from January through March 2014.

COMPLETED AND RETURNED QUESTIONNAIRES

Of the 377 companies contacted, a spontaneous return rate of around 20% was achieved. Telephone follow-up in February and March 2014 and follow-up research subsequently boosted the return rate to 79.8%. Resellers, suppliers and other life science firms ultimately delivered a return rate of 67.7%, pharmaceutical companies 83.3%, contract research organizations 88.9%, the offices of international groups ("Biotech International") 84.4% and biotechnology companies in the EMM region 86.3%. In addition to these companies, the eight scientific institutions in the region that engage in life science research were also incorporated in the survey.

In-depth qualitative information was gathered from detailed interviews with nine company representatives and three experts from research institutions. These interviews served to reinforce the acquired data, identify trends and substantiate developments on the basis of concrete examples.

ESTIMATES

To identify employee numbers, a flat figure of ten employees was assumed for companies that did not respond and for which Internet research revealed no headcount data. This figure was chosen because many of the firms concerned are small businesses. Sales revenue was determined by checking boxes for revenue categories. The mean for each category was used to calculate total sales revenue. Average sales revenue per employee was calculated for each category of company based on the number of employees at those companies that provided information about sales revenue. Total revenue for the industry was then calculated on the basis of the resultant average per-capita revenue. In the same way, average spending per employee was used to calculate R&D spending at biotechnology firms. Again, the results were extrapolated for the total number of employees at companies which engage in research and development. Sales revenue and R&D spending were calculated in the manner described above for biotechnology SMEs that are not publicly traded. To arrive at total figures for the industry, the sales revenue and R&D spending of publicly traded companies was then added. Extrapolation makes no sense in the context of cooperative ventures, internationalization and patents. In these cases, the existing figures were thus used without modification.

ANALYSIS

For the purposes of our analysis, companies were assigned to four categories:

1. **Biotechnology companies headquartered in the EMM region (Biotech EMM) and the offices and subsidiaries of international biotech groups (Biotech International)**
2. **Pharmaceutical companies**
3. **Contract research organizations (CROs) engaging in preclinical and clinical research**
4. **Other life science companies, including suppliers, contract manufacturers, wholesalers and firms in related areas such as dietary supplements, phytopharmaceuticals, veterinary medicine, certain aspects of laboratory equipment, and cosmetics other than those in the lifestyle segment.**

In some cases, these categories were further subdivided.

With regard to location-specific questions, analysis was performed separately for the city of Munich, Planning Region 14 excluding the city of Munich, and the EMM region excluding Planning Region 14.

DEFINITIONS

As in the previous study in 2008, companies that develop and/or manufacture products on the basis of modern methods of molecular biology were defined as biotechnology companies. Since traditional pharmaceutical companies are also increasingly applying such methods, it is often difficult to draw a clear distinction between the biotechnology and pharmaceutical industries.

Pharmaceutical companies are companies that develop and market medicinal drugs. This definition corresponds to NACE categories 73104* (research and experimental development in the medical sciences), 24420* (manufacture of pharmaceutical preparations), 241* and 244* (manufacture of pharmaceuticals, basic and medicinal chemicals and botanical products). In isolated cases, companies were categorized as pharmaceutical companies as they had assigned themselves to category 51461* (wholesale of pharmaceutical goods). These categories reflect the system of branches of industry promulgated by the German Federal Statistical Office in 2008.

Contract research organizations (CROs) are companies that carry out and coordinate clinical trials for drug candidates on behalf of biotech or pharmaceutical companies. CROs that are not responsible for trials and that instead advise clients regarding regulatory aspects or prepare registration dossiers, for example, were also included due to their specific focus.

Pharmaceutical wholesale is defined by NACE code 51461* as "wholesale with pharmaceutical goods". Of the types of company that fall under NACE category 5185* (dealers of pharmaceutical goods, medical and orthopedic articles and lab equipment, medical supplies, dental instruments, hospital and elderly care supplies), only the pharmaceutical sector was considered.

Other life science companies from related areas such as veterinary medicine, contract manufacturing (CMOs), suppliers, and certain sectors of medical technology and cosmetics were assigned to the respective NACE codes and categorized on the basis of the business segments stated by the respondent companies in the questionnaire. In this study, the term life science comprises all above-named categories of enterprise, i.e. those companies that concern themselves mainly with the production or distribution of pharmaceutical or biotechnological products or inputs or equipment for the manufacture of these products. All public health institutions and pharmaceutical product retailers (pharmacies) are excluded from the definition of life sciences used in this study. Medical engineering firms were likewise excluded from the study.

BIBLIOGRAPHY

1. German Association of Research-Based Pharmaceutical Companies (VfA). <http://www.vfa.de/download/branchenportrait.pdf>. [online] 2013.
2. Federal Ministry of Education and Research (BMBF). www.biotechnologie.de. [online] 2009 ff.
3. Food and Drug Administration (FDA). Paving the way for personalized medicine. <http://www.fda.gov/downloads/scienceresearch/specialtopics/personalizedmedicine/ucm372421.pdf>. [online] 2013.
4. Burrill. S. Burrill's 28th Annual Report on the Life Sciences Industry: Biotech 2014 – Life Sciences: Transforming Healthcare. 2014.
5. Techniker Krankenkasse. http://www.tk.de/centaurus/servlet/contentblob/641174/Datei/121105/Innovationsreport_2014_Kurzfassung.pdf. [Online] 2014.
6. German Association of Research-Based Pharmaceutical Companies (VfA). http://www.vfa.de/de/download-manager/_stellungnahme-erfahrungen-amnog.pdf. [Online] 2013.
7. Ernst & Young. Deutscher Biotechnologie-Report 2014. 2014.
8. Schwarz, Harald. <http://www.finanzen.net/nachricht/private-finanzen/Vermoegensverwalter-Kolumne-Biotech-Investitionen-Investitionen-in-die-Branche-mit-staerkster-Wachstumsdynamik-3553761>. [Online] 2014.
9. <http://www.drugs.com/stats/lipitor>. [Online] 2012.
10. McKinsey. McKinsey 2013, Biosimilars – Seven years on, WhitePaper. 2013.
11. VfA-Bio. <http://www.vfa-bio.de/vb-de/vb-presse/vb-pressemitteilungen/pr-001-2014-biopharmazeutika-auf-wachstumskurs-durch-therapieoptionen-fuer-patienten-mit-krebs-und-immunkrankheiten.html>. [Online] 2014.
12. McKinsey. Personalized Medicine – The Path forward. 2013.
13. German Association of Research-Based Pharmaceutical Companies (VfA). www.vfa.de/personalisiert. [online] 2014.
14. PharmaInitiative, Bayern. Die Pharmazeutische Industrie in Bayern, 2013. 2013.
15. Wissenschaftsstatistik im Stifterverband der dt. Wirtschaft, http://www.stifterverband.info/statistik_und_analysen/wissenschaftsstatistik/publikationen/fue_datenreport/fue_datenreport_2013_tabellen_und_daten.pdf. [Online] 2013.
16. German Pharmaceutical Industry Association (BPI). http://www.vcihessen.de/ZahlenFakten/Documents/Pharmadaten_2013_DE.pdf. [online] 2013.
17. Schwabe, Ulrich und Paffrath, Dieter (Hrsg.). Arzneiverordnungs-Report 2013. Aktuelle Daten, Kosten, Trends und Kommentare.

LIST OF ABBREVIATIONS

BMBF	German Federal Ministry of Education and Research
CMO	Contract manufacturing organization
CRO	Contract research organization
DNA	Deoxyribonucleic acid
EMA	European Medicines Agency
EMM	Munich Metropolitan Region
FDA	Food and Drug Administration, US drug licensing authority
CCI	Chamber of Commerce and Industry, here: for Munich and Upper Bavaria
IZB	Innovations- und Gründerzentrum für Biotechnologie (biotechnology innovation and start-up center)
LMU	Ludwig Maximilians Universität
NACE code	Nomenclature général des Activités Économiques (statistical system of branches of industry used in the EU)
OTC	Over the counter (i.e. non-prescription drugs that can be sold over the counter)
PR14	Planning Region 14
R&D	Research and development
SME	Small and medium-sized enterprises
TUM	Technische Universität München
VC	Venture capital

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