



Rialtas na hÉireann
Government of Ireland

Focus on Biopharmachem

December 2018

Biopharmachem

Ireland - a leading location for Biopharmachem investments, strong research capability, supportive business environment and manufacturing excellence



GLOBAL MARKET SIZE

Pharmaceuticals

\$946.1bn

2016



Biopharmaceuticals

\$160.4bn

2014

Estimated \$211.2bn 2017

Source: Pharmaceuticals: Marketline Industry Profile – Global Pharmaceuticals (June 2017) Note Market size does not include healthcare; Biopharmaceuticals: Global Biopharmaceuticals Market Size, Share, Development, Growth and Demand Forecast to 2020 – Industry Insights (P&S Market Research, 2015)

IRISH EXPORTS

€41.6bn

in 2016

from agency supported firms

Source: Department of Business, Enterprise and Innovation, Annual Business Survey of Economic Impact (ABSEI), 2016



Direct Economy Expenditure (DEE)

€3.8bn

in 2016

Source: Department of Business, Enterprise and Innovation ABSEI, 2016; DEE relates to total payroll costs, and materials and services sourced from Irish suppliers



30%

Ireland is the 2nd largest net exporter of medicinal and pharmaceutical products from the EU, accounting for almost 30% of Ireland's total extra-EU trade, the highest amongst EU countries.

Source: Eurostat, 2017

EMPLOYMENT

26,868

in 2017 in agency supported firms



Source: Department of Business, Enterprise and Innovation, Annual Employment Survey, 2017

TOP 10

All of the world's top 10 biopharmaceutical companies have a manufacturing base in Ireland



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Prepared by the Department of Business, Enterprise and Innovation

The sector in numbers

| Global | Market Size | | | | Growth Forecast | | |
|--|--|---|-------------------------|---------------------------------|---|--|----------------------------|
| | Pharmaceuticals \$946.1bn (2016); annual growth 5.3%, 2016; CAGR 6.1% (2012-2016) ⁱ | Biotechnology (Medical&Healthcare) \$202.3bn (2016) ⁱⁱ | | | | Pharmaceuticals \$1,294.2bn (2021) CAGR 6.5% (2016-2021) | |
| Biopharmaceuticals \$160.4bn 2014, estimated \$211.2bn 2017 ⁱⁱⁱ | | | | | Biotechnology (Medical&Healthcare) (Approx. \$316.8bn) | | |
| | | | | | Biopharmaceuticals CAGR of 9.6% until 2020, Approx. \$278.1bn | | |
| Ireland | Exports (2016) ^{iv} (goods and services) | % of National (Exports) ^v | 5-year CAGR (2011-2016) | Employment (2017) ^{vi} | % of National (2017) ^{vii} | 5-year CAGR (2012-2017) | DEE (2016) ^{viii} |
| Agency | €41.6bn | 21.3% | 0.44% | 26,868 | 1.20% | 4.38% | €3.8bn |
| Irish | €0.4bn | 0.2% | 9.3% | 3,137 | 0.14% | 4.16% | €0.3bn |
| Foreign | €41.2bn | 21.1% | 0.37% | 23,731 | 1.06% | 4.41% | €3.5bn |

- i) Marketline Industry Profile, Global Pharmaceuticals, June 2017 - market size does not include healthcare
- ii) Global Biotechnology, October 2017
- iii) Global Biopharmaceuticals Market Size, Share, Development, Growth and Demand Forecast to 2020, Industry Insights, P&S Market Research, 2015
- iv) ABSEI 2016, DBEI - Agency Supported Enterprises only; CSO Data shows exports of €67.7bn in 2017 of Chemicals and Related products (SITC 5)
- v) Percentage of national exports is derived using total exports from ABSEI 2016.
- vi) AES 2017, DBEI
- vii) Percentage of national employment is derived using CSO total employment
- viii) Direct Economy Expenditure (DEE) relates to total payroll costs, and materials and services sourced from Irish suppliers

Description of the sector globally

- The Biopharmachem sector encompasses the discovery, development, production and sale of pharmaceutical products, both pharmaceuticals (small molecule) and biopharmaceuticals or biologics (large molecule).
 - Pharmaceuticals are small molecule, chemically manufactured, active substance molecules, for human and veterinary applications.
 - Biopharmaceuticals or Biologics are large molecule pharmaceutical drug products manufactured in, extracted from, or semi-synthesised from biological sources. Biologics include monoclonal antibodies, vaccines, recombinant hormones/proteins, and gene therapy in applications across infectious diseases, oncology, immunology, autoimmune diseases, and GMO.

- The sector includes a mix of large global companies, service providers and smaller operations with complex value chains.
- The Biopharma sector is delivering high growth rates (between 6.5% and 9.6%). The market is dominated by monoclonal antibodies (mAbs) (25.8% share in 2014). 27% of the biopharma market is focused on the oncology segment (2014).
- The sector is highly regulated, requiring strict compliance with legislation and regulation relating to patenting, testing, production, marketing and sale of end-products. Approval may require several years of clinical trials, including trials with human volunteers. Even after the drug is released, it will still be monitored for performance and safety risks.
- Significant up-front RD&I product investment is required and it can take 10-15 years to bring a product to market. The proportion of products entering the RD&I pipeline that is ultimately approved for commercial use is very low (in the case of the US Food and Drugs Association, the proportion of products approved may be as low as one for every 5,000-10,000).

Global developments and implications

- Increased urbanisation, climate change and antibiotic resistance present challenges in treatment of communicable diseases; increased life expectancy, an ageing population and changes in lifestyle and dietary habits linked to obesity are resulting in increased incidence of chronic and non-communicable diseases (NCDs). There is also a growing trend in healthcare towards wellness, prevention and early diagnosis.
- Trends towards diversification in therapeutic modalities encompassing more complex mAbs, antibody-drug conjugates, cell and gene therapies, RNA therapies as well as regenerative medicines and genomics based precision medicines.
- Market penetration of these advanced therapy medicinal products (ATMPs) is expected to be slow over the next 5 years but potentially revolutionary thereafter¹.
- Competition for Biopharma FDI is intensifying. A number of jurisdictions are adopting NIBRT² like models (CPI-UK, EASE-France, Denmark, Belgium, NIIMBL-USA, WPI-USA, Incheon – Korea).
- Rising costs of healthcare systems in the developed world are becoming unsustainable for payers to fund. International healthcare systems are moving towards value-based healthcare, a model in which healthcare providers are paid based on achieving patient health outcomes at the lowest cost. New reimbursement models will emerge to reflect these changes.

¹ ATMP is a classification by the European Medicines Agency (EMA). Typically, cell / gene therapies for personalised medicine.

² NIBRT is Ireland's National Institute for Bioprocessing Research and Training- a global centre of excellence providing training and research solutions for the biopharmaceutical manufacturing industry.

- Regulatory agencies, and consumer and patient expectations continue to put pressure on companies to focus on patient and drug safety. The regulatory process drives the overall costs of development and time taken to deliver new drugs to market. Increased regulation stringency worldwide poses a risk to innovation activity.
- Serialisation to combat counterfeit drugs will soon become mandatory for all drugs which will slow down production.
- The European Commission is proposing a targeted adjustment to IP rules: the “export manufacturing waiver” on Supplementary Protection Certificates (SPC) Rules in relation to human and veterinary medicaments. This waiver on the SPC rules will allow manufactures of generics and biosimilars to target 3rd country markets where patent/SPC protection has expired. The waiver is currently under discussion in a Council Working Group.
- Significant advances in manufacturing technologies are anticipated over the next 5 years (including process intensification, digitisation, automation, single use etc) as well as the drive to reduce manufacturing costs. The scale and technology of the manufacturing platform will be dictated by the therapeutic product e.g. traditional large scale stainless steel for CNS, MABs or single use modular platforms for rare diseases.
- Development of Big Data and Data Analytics and the growing demand for information-based medicine is driving advanced data capture from patients, more complex therapeutics and more customised, information-based medicine and innovative delivery mechanisms. Data analytics is also core to manufacturing excellence, quality and customisation.
- Technological developments are also opening possibilities for measuring and ensuring effective drug administration and patient compliance. For example, developments in sensor technology allows for the remote measurement of drug absorption into a patient’s system which, in parallel with intelligent administration devices, maximise the potential for drugs to deliver intended outcomes.
- There is an increasing strategic shift of major pharma companies towards M&A, partnering, outsourcing and corporate venturing to increase efficiency and keep the costs of pharmaceutical R&D and innovation down.

The sector in Ireland

- Ireland has a strong international reputation due to: excellence in manufacturing and regulatory compliance; a highly qualified workforce operating in manufacturing sites that are globally recognised as manufacturing ‘process/product’ development specialists; competitive corporate taxation rates with competitive R&D tax credits and supports; and a world-class research landscape.
- There has been significant capital investment of approximately \$10bn in new biologics facilities in Ireland. There are 90 biopharma plants here, 40 of which are FDA approved, highlighting Ireland’s positive regulatory track record.
- The Biopharma Sector is a high value-added sector and a large contributor to corporation tax receipts³.

³ <http://www.audgen.gov.ie/documents/annualreports/2016/report/en/Chapter20.pdf>

- Irish exports of Chemicals and related products were valued at €67bn representing 56% total exports in 2017. Within this, exports of Medical and pharmaceutical products and Chemical materials and products were valued at €39bn representing 32% total exports⁴. Exports of Chemicals from Agency supported firms amounted to €41.6bn in 2016⁵, 21% of total exports from agency supported firms.
- Ireland is the second largest net exporter of Medicinal and pharmaceuticals from the EU accounting for almost 30% of Ireland's total extra-EU trade, the highest amongst EU countries.⁶
- There is a strong mix of start-ups, high growth SMEs and large multinationals located here. Top biopharmaceutical companies such as Pfizer, Eli Lilly, GSK, MSD, Sanofi, BMS, Alexion, and Allergan have made significant investments in Ireland which have facilitated the rapid growth of the industry.
- There are over 100 Irish owned enterprises supported by Enterprise Ireland, with capabilities in drug discovery/development/ delivery (technology intermediaries); the manufacture of active pharmaceutical ingredients; the manufacture of human and veterinary finished products; and pharma services including process development; clinical trials management, regulation, engineering and construction.
- The indigenous sector is highly innovative with companies competing successfully in global markets throughout the world e.g. Sigmoid, Opsona, Alimentary Health, ICON, Chanelle, TopChem, GMI, APC. ICON is now the third largest global contract research organisation.
- Ireland has a highly skilled workforce that has achieved critical mass. There are approximately 30,000 in direct employment, of which over 60% hold a third level qualification. The sector employs approximately 25% of all PhD graduates currently employed in Irish industry.
- It is anticipated that there will be over 11,000 people employed in Biologics Manufacturing in Ireland within the next five years, which places increased demand for up-skilling of the workforce.
- A move from traditional stainless steel to single use bioreactors in biopharma manufacturing will require investment in facilities in Ireland.
- Ireland is seeing a significant development of supply chain management operations supporting the sector, particularly in Dublin. The skills for this services area in many cases are coming from the manufacturing sector.
- Trade and investment policy shifts in the US and international tax developments intensify the need for Ireland to continuously strengthen its competitive advantage for Biopharma investment and to remain a location of choice for innovation and manufacturing.

⁴ CSO, TSA06: Value of Merchandise Trade by Commodity Group, Year and Statistic SITC 5 and 54, 59 respectively.

⁵ ABSEI 2016

⁶ Eurostat, 2017

- The pharmaceutical sector in Ireland is part of an EU and global value chain, integrated with the EU via supply chains. Chemicals and Related Products (SITC 5) exports to the UK represent 1.7% of total Irish exports and 26% of total Irish exports to the UK. While the UK only represents 7% of the sectors total exports, 23% of the imports in the sector are from the UK. Although the sector is not overly exposed to the UK, it is the largest single sector exporting to the UK from Ireland with over €5 billion annual exports.⁷

Ecosystem

- Therapeutics research is a priority area for Irish research.⁸ Ireland has developed strong capabilities and capacity in research associated with manufacturing and research disciplines underpinning the development and discovery of therapeutics. Ireland is recognised internationally in: Immunology, Oncology, Neuroscience, Gastroenterology and Microbiome. However Irish Biopharmaceutical R&D Intensity is lower than other jurisdictions.
- R&D is a vital feature of the life sciences sector and steady increases have been seen in in-house R&D expenditure and the number of employees involved in R&D. Pharmaceutical companies, both multinational and indigenous are partnering with the research system on biopharma-related projects.
- IDA, Enterprise Ireland, SFI, Health Research Board (HRB) and other Government Bodies play key roles in supporting innovation to sustain growth in the pharmaceutical sector: increasing the innovation capability of industry through in-house R&D programmes; building capacity in the research base; and catalysing linkages with academic institutions, companies and the clinical community.
- Technology developments in areas such as Industry 4.0, Robotics, IOT, Data Analytics are also relevant to Irish Biopharmachem companies.
- Relevant Centres include: NIBRT, Ireland's National Institute for Bioprocessing Research and Training, a global centre of excellence providing training and research solutions for the biopharmaceutical manufacturing industry; the Synthesis and Solid State Pharmaceutical Centre (SSPC); the Pharmaceutical Manufacturing Technology Centre (PMTTC); the Pharmaceutical and Molecular Biotechnology Research Centre (PMBRC); AMBER Advanced Materials and Bio-engineering Research; APC Microbiome Institute; Irish Manufacturing Research (IMR); I-Form - focusing on Additive Manufacturing and 3D Printing; CONFIRM - Smart Manufacturing Centre focused on the convergence of IT systems and industrial automation systems; and Technology Gateways (PMBRC, Shannon ABC, MICRA, MEDIC, CREST).
- Clinical Research Coordination Ireland, a joint initiative between the Health Research Board and Enterprise Ireland, and supporting five national clinical research facilities provides infrastructure and staff (including a Clinical-Industry Liaison Officer and a Quality and Regulatory Affairs Manager) to enable clinical research to be undertaken in a safe and appropriate environment.

⁷ UK EU Exit: Trade Exposures of Sectors of the Irish Economy in a European Context, *Department of Finance* (September 2017)

⁸ Research Priority areas 2018 to 2023, *Department of Business, Enterprise and Innovation*, 2018

- H2020 funding is a highly important research programme for the Irish Biopharmachem sector. ATXA Therapeutics Ltd, a University College Dublin (UCD) life sciences spin-out, for example has secured €2.5m in funding under the European Union's Horizon 2020 SME Instrument Programme Phase 2. It's developing novel therapeutic drugs to treat pulmonary arterial hypertension (PAH), and other related cardiovascular conditions. Ireland has won almost €540m in competitive funding from Horizon 2020 to date, with over 1,300 successful participants. At 13%, Ireland had one of the highest success rates for the SME Instrument in Europe 2017, compared to 6% EU average. In the recently announced results to the Fast Track to Innovation call, Irish companies won almost 16% of the total budget allocated, with only Germany having as many successful applicants.
- Continuing to drive integration between Irish and foreign-owned base together with the R&D capabilities of the University/hospital systems will support the longer-term development of the sector.
- From 2018, apprenticeships for Laboratory Analysts and Laboratory Technicians will be available. These have been developed in collaboration with industry and it is expected that further apprenticeships will be developed over coming years in line with industry needs.

Relevant Reports

Click on hyperlinks below

- [Enterprise Ireland: The Irish Life Sciences Directory](#)
- [EU Exit: Trade Exposures of Sectors of the Irish Economy in a European Context, Department of Finance, September 2017](#)
- [UK EU Exit – An Exposure Analysis of Sectors of The Irish Economy, Department of Finance, October 2016](#)
- [Addressing the Skills Needs Arising from the Potential Trade Implications of Brexit, Expert Group on Future Skills Needs, June 2018](#)
- [Ireland and the Impacts of Brexit, Copenhagen Economics, prepared for Department of Business, Enterprise & Innovation, February 2018](#)
- [The Pharmaceutical Industry in Ireland –Innovation and the IP Framework for the IPHA, EY, August 2018](#)
- [An Assessment of the Firm-Level Impact of Brexit on Most Exposed Sectors, Department of Business, Enterprise and Innovation, June 2018](#)
- [Future Skills Needs of the Biopharma Industry in Ireland, EGFSN, August 2016](#)

Key actors

Health: Department of Health (DoH), Health Service Executive (HSE), Health Research Board (HRB), Health Information and Quality Authority (HIQA).

Enterprise: Department of Business Enterprise and Innovation (DBEI), Enterprise Ireland (EI), Science Foundation Ireland (SFI), IDA Ireland

Regulatory and Agencies: Health Products Regulatory Authority (HPRA), National Standards Authority of Ireland (NSAI), European Medicines Agency (EMA), all chemicals subject to EU REACH Regulation with European Chemicals Agency as the main regulator.

Industry Associations: BioPharmaChem Ireland (BPCI), Irish Pharmaceutical Healthcare Association (IPHA)

Academia and Education: Department of Education and Skills (DES), Clinical Research Development Ireland (CRDI)

Recent Developments

Company Developments

- Genomics Medicine Ireland (GMI), announced ambitious \$400 million genome research programme following acquisition by Chinese genomics specialists [WuXi Nextcode](#) with recruitment of as many as 600 people over the next five years, on top of the 125 that it currently employs. The Irish Strategic Investment Fund (ISIF), an early-stage investor in GMI, will put \$70 million in as part of an exercise that will place Ireland at the cutting edge of precision medicine. (November 2018)
- WuXi Biologics, a Hong Kong-listed global open-access biologics technology platform company, is to invest €325 million and create 400 new jobs over five years in a new biologics drug substance manufacturing facility in Dundalk (April 2018). This will be the world's largest facility using single-use bioreactors, and will also be able to run continuous bioprocessing.
- PCI Services has added 30 new positions to its Drogheda facility since it acquired Millmount Healthcare last year, and will create 50 new jobs at its facility in Co. Meath (April 2018)
- Takeda Pharmaceutical Company Limited is to create up to 70 new jobs and invest €25m in the construction of a new regenerative medicine facility at its site in Grange Castle (March 2018)
- Emerson is providing automation software and systems valued at \$1 million (approximately €820,000) to Ireland's National Institute of Bioprocessing Research and Training (NIBRT) to help train next-generation workers on the latest technologies designed to optimize pharmaceutical production (February 2018)
- MSD is to develop a new biotechnology facility in Dublin, with the expected creation of up to 350 new jobs (February 2018)
- SK biotek, South Korean pharma-company announced the acquisition of the former Bristol-Myers Squibb API (active pharmaceutical ingredients) facility in Swords (January 2018)
- Almac Group announced £30 million investment and further expansion in Dundalk (January 2018)
- AbbVie announced €113.6 million investment in new sterile manufacturing technology in facility in Sligo, creating approximately 100 new jobs over 3 years in technical and manufacturing positions (January 2018)

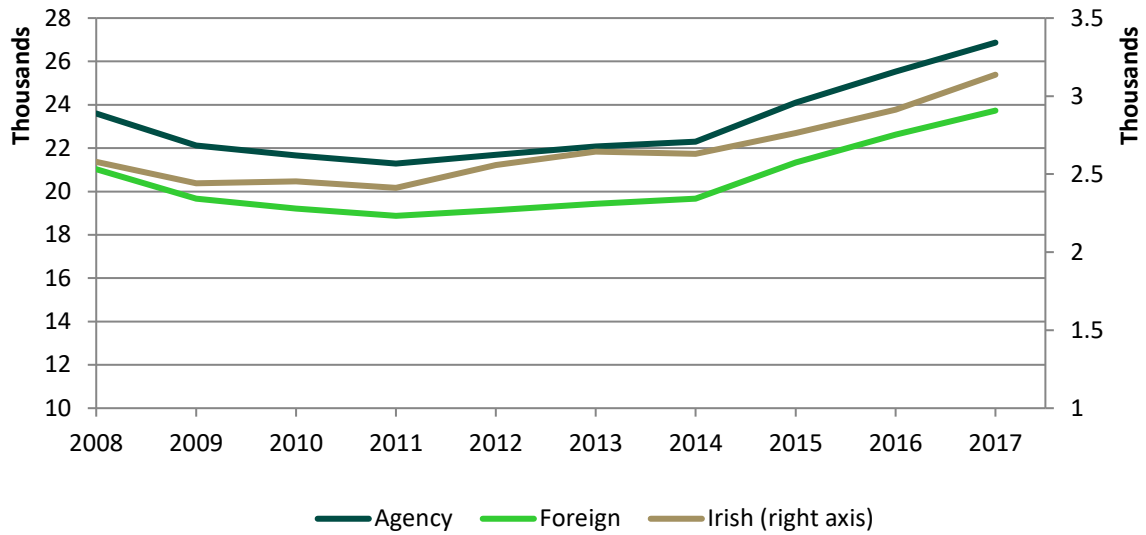
- UK pharmaceutical services company Wasdell Group is to establish a pharmaceutical packaging, testing and distribution facility in Dundalk, creating 300 jobs over five years (November 2017)
- Regeneron Pharmaceuticals announced further expansion of its Limerick Industrial Operations and Product Supply (IOPS) bioprocessing campus with an additional 300 jobs and investment of \$100 million (October 2017)
- Janssen Sciences Ireland UC announced an investment of more than €300 million that will increase the existing manufacturing space in Ringaskiddy, Co. Cork by an additional 19,100m², provide employment for up to 450 people during construction and an extra 200 people once completed (October 2017)
- Bausch + Lomb, global eye health company, opened an €85 million extension at the company's Waterford facility creating 125 additional jobs, bringing the total to 300 since the Waterford facility expansion first began in 2015 (July 2017)
- APC, a 2011 spinout from UCD, announced the opening of a 30,000-sq.ft. specialist R&D unit at its Cherrywood facility which will allow it to double capacity over the next 5 years (May 2017)

Sector Developments

- The National Institute for Bioprocessing Research and Training (NIBRT), has partnered with Philadelphia's Thomas Jefferson University to set up the first education and training centre for biologics manufacturing in North America (February 2018)

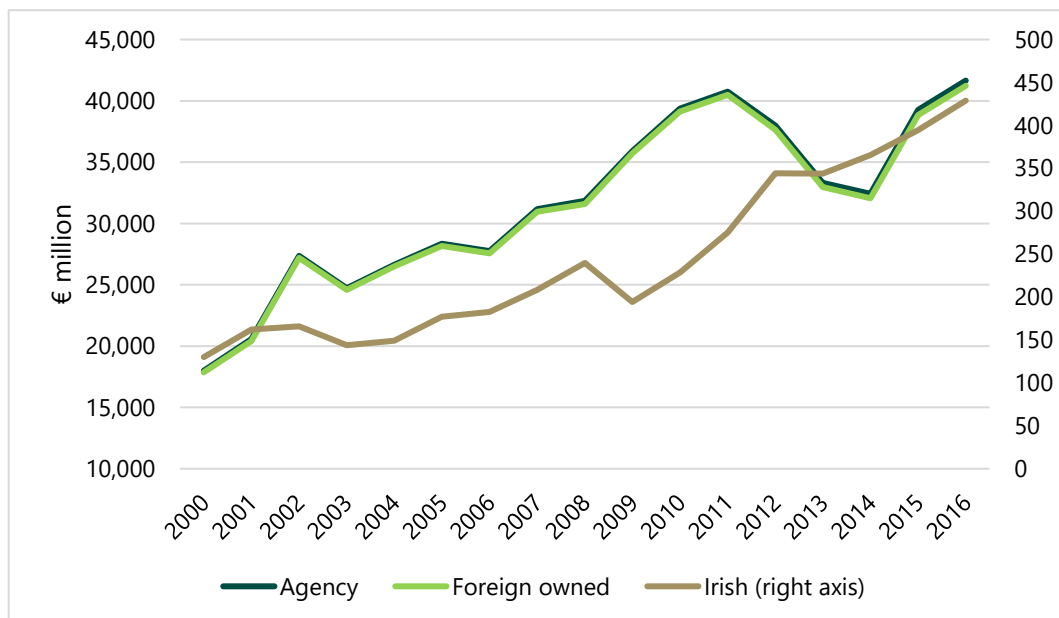
Data Trends

Employment in Agency-Assisted Companies in the Biopharmachem Sector (2008-2017)



Employment, in both Irish and foreign owned firms, has been steadily increasing since 2011.

Exports of Agency-Assisted Companies in the Bio Pharmachem Sector (€) (2000-2016)



Exports from Irish owned enterprises have tripled since 2000, although with some volatility. Foreign firm's exports continue to recover since a decline experienced in the period between 2011-2014.

Sources: Annual Employment Survey (employment), ABSEI 2017 (exports)