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Biomedical Sciences Sector

SINGAPORE

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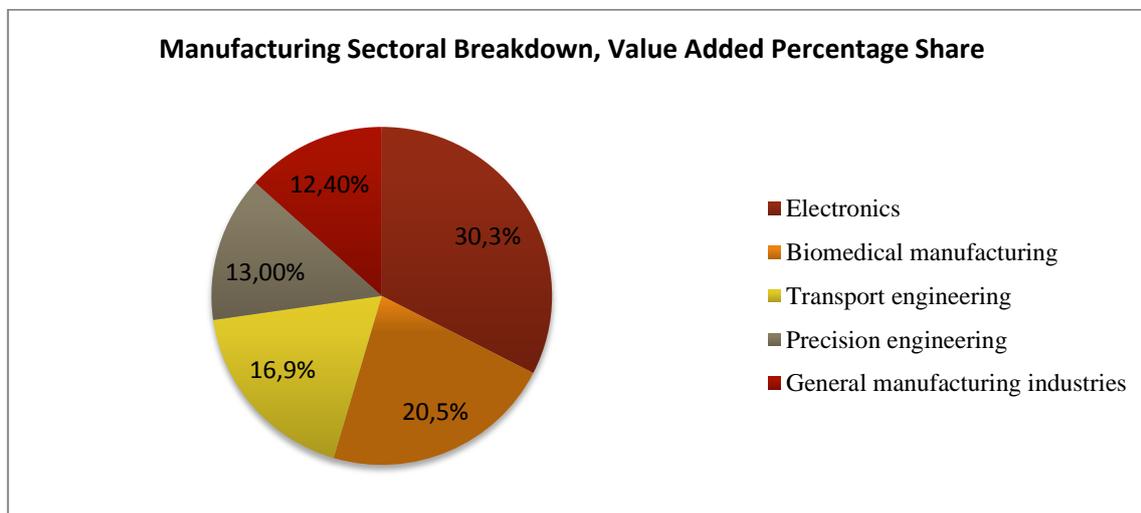
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The biomedical industry is defined by Singapore government as one of the pillars of its economy and is targeted to be one of the major engines of growth. Four areas have been categorized under the biomedical sciences cluster by the Economic Development Board of Singapore: healthcare service, pharmaceuticals, biotechnology, and medical devices. Singapore's economic strategy undertaken is to strengthen the value chain of the entire healthcare industry by integrating it forward into medical services and backwards from manufacturing of pharmaceuticals and medical technologies.

1. BIOMEDICAL SCIENCES SECTOR OVERVIEW

In 2011, Singapore manufactured over S\$27 billion (€15,91 billion) worth of medicines and medical devices for global markets, with more than 50 biomedical sciences companies and 30 research institutes. Between 2000 and 2010, Singapore's biomedical manufacturing output has quadrupled from S\$6 billion (€3,53 billion) to S\$23,3 billion (€13,73 billion) and has grown to account for about 5% of the national GDP, while its employment went from 6.000 to 14.000 over the same period. In the meantime, employment in biomedical Research & Development sector has more than doubled from 2.200 to over 5.000.¹

As of 2013, biomedical sciences sector is the second largest manufacturing component of its economy, accounting for 20,5% of Singapore's total manufacturing output (following the electronics manufacturing sector's 30,3%).



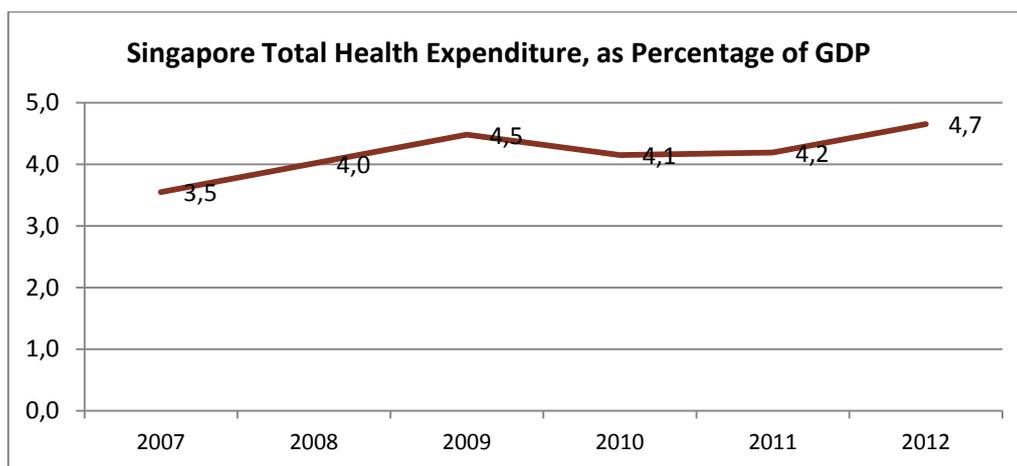
Source: Structure of Singapore Economy 2013, Ministry of Trade and Industry Singapore

In terms of relative expenditure, more than S\$1,49 billion (€877,22 million) is spent on biomedical R&D annually. Furthermore, Singapore has committed S\$16,1 billion (€9,48 billion) in continued support of research and innovation between 2011 and 2015, out of which, S\$3,7 billion (€2,18 billion) is dedicated to enhancing existing biomedical R&D infrastructure, integrating multi-disciplinary research and translating basic science into tangible outcomes.

¹ Source: Economic Development Board of Singapore

2. HEALTHCARE SERVICES IN SINGAPORE

Healthcare in Singapore is offered by both the public and private sectors, with the public sector providing 20% of primary care and 80% of more costly tertiary care, and the latter providing the rest. According to the World Bank, Singapore's total healthcare expenditure (including public and private) constitutes 4,7% of its GDP in 2012.



Source: World Bank

In 2012, total value added generated by the health services industry was \$5.789 million (€3.412 million), representing an increase of 7,1% compared to 2011². Hospitals were the largest contributor in terms of value added, accounting for 56,8% of the total industry value added in 2012, followed by western clinics with 29,4% of share of industry totals.

2.1 HEALTH SERVICE INFRASTRUCTURE

There were 4.600 establishments in the health services industry in Singapore as of 2012, comprising a total of 25 hospitals and specialty centres (15 public and 10 private), 18 public polyclinics, as well as some 2.200 private medical clinics.

However, new medical facilities will have to be built to meet the needs of its growing and ageing population³. A set of government budgets have been announced to develop Singapore's healthcare infrastructure over the following years, including: 1) new hospitals and medical centres, redevelopment of older hospitals 2) new community hospitals and nursing homes, senior care and home care, activity centres 3) new polyclinics and redevelopment of older polyclinics 4) new teaching and research institutes.

² Source : Health Services Survey, Department of Statistics Singapore

³ Cfr. V

GOVERNMENT BUDGET FOR IMPROVING HEALTHCARE INFRASTRUCTURE:



Source: Ministry of Finance, Singapore Budget

Specifically, as a result of the 2020 Healthcare Masterplan launched by Ministry of Health and aimed at “enhancing accessibility, quality and affordability of healthcare for Singaporeans”, two new general hospitals and four new community hospitals will be completed by 2020.

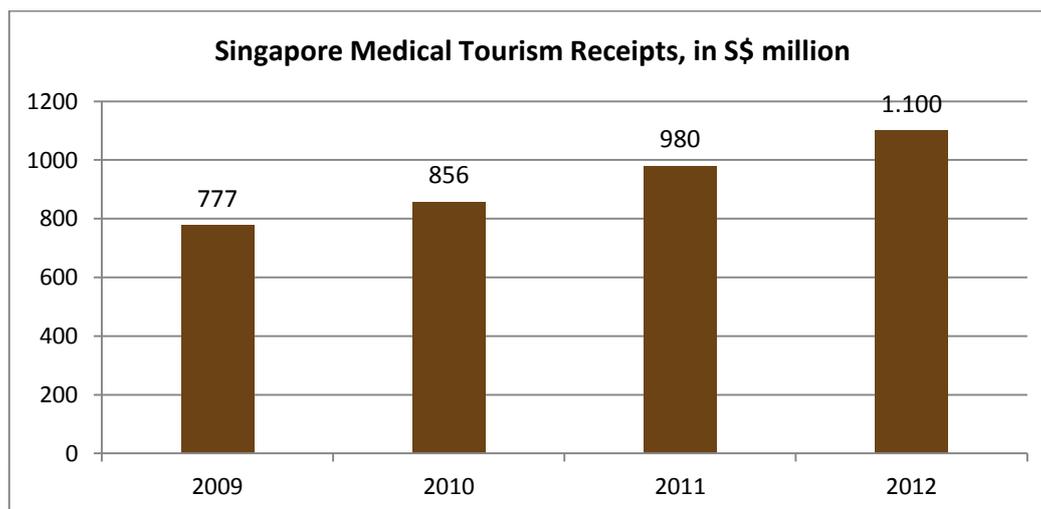
2.2 HEALTHCARE HUB

Singapore has established strong fundamentals in healthcare excellence and its standard of medical practice ranks among the best in the world. Singapore’s major healthcare rankings are as follows:

- Best healthcare infrastructure in Asia and 3rd out of 55 countries in the world ⁴
- Best healthcare system in Asia and 6th out of 191 countries in the world ⁵
- 2nd out of 48 countries in Bloomberg’s 2013 ranking of healthcare systems
- Best Medical/Wellness Tourism Destination ⁶

Its world-class healthcare quality has made Singapore the go-to place for complex medical procedures, with international patients pouring into Singapore each year for a whole range of medical care. In particular, Singapore was the first country in the region to officially articulate an aim to attract medical tourists and promote the export of health services overseas.

In 2012, medical expenditure generated from international travelers was S\$ 1.110 million (€647,48 million), a 13% increase over 2011 (accounting for 5% of its total tourism receipts in 2012).



Source: Singapore Tourism Board

⁴ By World Competitiveness Yearbook 2010, International Institute for Management Development

⁵ By World Competitiveness Yearbook 2010, International Institute for Management Development

⁶ By World Health Organisation TravelWeekly (Asia) Industry Awards

3. PHARMACEUTICALS & BIOTECHNOLOGY SECTOR

3.1 SECTOR OVERVIEW

The biopharmaceutical sector represents a thriving sector of Singapore's economic growth, contributing about S\$22,8 billion (€13,43 billion) in output and over 6.000 jobs in 2011, with a 30% expansion compared to 2010. Moreover, Singapore was the third fastest growing country globally in the export of pharmaceutical goods from 2000 to 2010, said Datamonitor, a consultancy. It is estimated that expenditure on pharmaceuticals will amount to S\$1,04 billion (€612,58 million) in 2014, a 5,5% rise over 2013⁷.

Singapore has built up a scientific foundation with seven institutes and five research consortia. More than 50 companies are carrying out R&D activities involving drug discovery, translational and clinical research, frequently collaborating with research institutes.

Notably, the pharmaceutical and biotechnology manufacturing sector in Singapore is currently supported by a growing manpower base of more than 4.800 engineers and technicians, as well as a workforce of over 300.000 employees in related sectors such as chemicals, electronics and engineering.

3.2 GOVERNMENT INITIATIVES

3.2.1 FINANCING PROGRAMS AND INCENTIVES

According to Singapore Economic Development Board, a multitude of clinician scientists has been built up through government incentives such as the Singapore Translational Research (STaR) Investigator Award, which is designed to recruit and nurture world-class clinician scientists to undertake translational and clinical research in Singapore, as well as the Clinician Scientist Award (CSA), which provides research funding and salary support to enable medical researchers to devote more time to research.

Other financing programs are also put in place to foster Singapore's clinician scientist base, which incorporates:

- The Translational & Clinical Research (TCR) Flagship Program with a five-year budget of up to S\$25 million (€14,72 million)
- The Competitive Research Program (CRP) with a maximum of S\$10 million (€5,89 million) per program over three to five years
- The Health Services Research Competitive Research Grants (HSR-CRGs) providing a maximum of S\$1 million (€589.02) over a two-year period

⁷ Source : www.marketresearch.com

3.2.2 PUBLIC-PRIVATE PARTNERSHIPS

With view to nurture a dynamic R&D environment in biomedical industry, Singapore promotes public-private partnerships (PPP) among its public-sector research institutes, clinical research units in hospitals, international research organizations and leading pharmaceutical and biotechnology companies.

Some major PPP examples are as follows⁸:

- **Roche** established its CHF 100 million (€82,15 million) Singapore Hub for Translational Medicine with 30 scientists on board to partner with **Singapore's scientific and medical institutions**.
- **Maccine** forged a collaboration with **A*STAR's** (Agency for Science, Technology and Research) **Singapore Bioimaging Consortium** to form a Translational Imaging Industrial Lab (TIIL) in preclinical imaging to enhance the drug development process.
- **Siena Biotech** is partnering **A*STAR's Experimental Therapeutics Centre** to develop molecular inhibitors of a major signalling pathway in oncology to target difficult-to-treat forms of cancer such as gastric cancer, leukaemia and brain tumours.
- Also partnering with **A*STAR, research institutes and hospitals, Novartis** teamed up with the Swiss Tropical and Public Health Institute, and The Scripps Research Institute, leading to the discovery of a new drug against malaria called spiroindolone NITD609.
- **GSK Biologicals** and **A*STAR's Bioprocessing Technology Institute** engaged in a S\$2 million (€1,18 million) public-private partnership to collaborate on vaccine and adjuvant system-related research projects.

3.3 KEY INFRASTRUCTURE

One-north, the cooperation facility for research, innovation and test-bedding, plays host to 3 purpose-built hubs to house key public and private institutes and organizations: 1) Biopolis, the biomedical R&D facility; 2) Fusionopolis, dedicated to R&D in the Infocomms, Media, Science and Engineering industries; 3) Mediapolis, a self-contained digital media cluster.

Most notably, the Biopolis is established as the key infrastructure for the life sciences R&D. It co-locates public sector research institutes with corporate labs and is designed to foster a collaborative culture among the institutions and organizations under its roof, where scientists, technopreneurs as well as researchers meet and forge partnerships. The Biopolis also provides more than 306.58 square meter of space for biomedical sciences R&D activities.

While the Biopolis is built specially for R&D activities, the Tuas Biomedical Park (TBP) is primarily focused on manufacturing activities, home to a 360-hectare stretch of ready-prepared and specifically-zoned land set aside by the government for pharmaceutical and biologics manufacturing.

⁸ Source : Singapore Economic Development Board

3.4 LEADING INDUSTRY PLAYERS

Numerous leading biopharmaceutical companies (including Abbott, GlaxoSmithKline, Lonza, MSD, Novartis, Pfizer and Sanofi-Aventis) have chosen to make Singapore their global manufacturing base. These companies, many of which have diversified their operations over the years, operate multi-purpose plants with the capability to manufacture a wide range of active pharmaceutical ingredients (APIs), biologics and nutritionals.

Key biopharmaceutical players in Singapore include⁹:

- **Abbott (United States):** established its first pharmaceutical R&D laboratory at the Biopolis in the Southeast Asia, which is dedicated to analytical studies on active pharmaceutical ingredients and novel formulations; established its regional headquarters in Singapore for businesses covering diabetes care, diagnostics, nutrition, pharmaceuticals and vision care; particularly, Abbott's S\$450 million (€265,05 million) nutritional powder manufacturing plant in Singapore represents its first major capital investment in Asia and its largest nutritional investment to date.
- **GlaxoSmithKline (Great Britain):** active in Singapore since 1972, it has expanded its manufacturing presence to three API production buildings while initiating its first R&D pilot plant in Asia Pacific; it established its first Academic Centre of Excellence in Singapore; it also presented close to S\$8 million (€4,71 million) of research funding to the GSK-Singapore Partnership for Green and Sustainable Manufacturing; it has anchored its Emerging Markets & Asia Pacific headquarters in Singapore since 2000, which generates almost 40% of GSK's turnover.
- **MSD (United States):** is accelerating its manufacturing, marketing and research investments in Singapore, incorporating the US\$250 million (€183,98 million) investment on manufacturing operations and S\$700 million (€410,9 million) on local research and training collaborations between Singapore and its global sites; its total workforce amounts to 1.500 employees with a total investment value of US\$1,1 billion (€809,51 million).
- **Novartis (Switzerland):** has located its Regional Business Units such as strategic planning and development, marketing control and brand management for the Asia-Pacific region in Singapore; additionally, it has set up the Novartis institute for Tropical Diseases, and two major global supply sites for pharmaceuticals and contact lenses in Singapore.
- **Roche (Switzerland):** set up a major translational research hub in Singapore in 2010 to develop new personalized treatment approaches in translational medicine; its wholly owned member, Genentech, opened its first Asia-Pacific biologics manufacturing site in TBP, with an investment of about US\$500 million (€367,97 million) on a 12,6-hectare manufacturing site; its manufacturing areas also comprise cancer therapy for multiple cancer tumours.
- **Takeda (Japan):** inaugurated its regional headquarters and regional clinical coordination centre in Singapore: it acquired Paradigm Therapeutics Singapore and is collaborating with the Singapore Bioimaging Consortium.

⁹ Source : Singapore Economic Development Board

LEADING BIOPHARMACEUTICAL COMPANIES IN SINGAPORE



Source: BFTA research

4. MEDICAL TECHNOLOGY SECTOR

4.1 SECTOR OVERVIEW

In 2011, Singapore's medical technology sector, part of Singapore's biomedical sciences sector, contributed about €2,53 billion (tripled from €883,65 million in the year 2000) in output and about 9.000 jobs (doubled from about 4.000 in 2000). By the year 2015, the medical technology sector targets to achieve €2,95 billion in manufacturing output.

The number of employment in Singapore's medical technology manufacturing sector is set to grow, with more than 20.000 science and engineering graduates entering the workforce from Singapore's tertiary institutions each year.

4.2 MEDICAL TECHNOLOGY HUB

Singapore is committed to being the "Biopolis of Asia", a leading international biomedical sciences cluster. The government has invested over S\$5 billion (€2,95 billion) in building up industrial, human and intellectual capital in this area. On one hand, Singapore's protection and enforcement of intellectual property rights and core capabilities in science and engineering make it a pro-business, pro-innovation environment for medical technology companies to invest. On the other hand, Singapore's "hard" infrastructure, the Biopolis and Fusionopolis¹⁰, proves favorable to business growth.

As Asia's leading location for medical technology, Singapore is home to over 30 medical technology companies which have set up R&D centres and commercial-scale plants. While the U.S., Japan and Germany are the top three leading suppliers of medical equipment in Singapore, local production by multinational corporations and indigenous Singapore companies is primarily for export.

In addition, a variety of medical products, ranging from syringes and catheters, to research instruments and scientific analytical equipment, are manufactured in Singapore, including 10% of the world's contact lenses, over 70% of the world's microarrays, and about half the world's thermal cyclers and mass spectrometers¹¹.

4.3 KEY INFRASTRUCTURE

The Biopolis and Fusionopolis - key purpose-built research campuses, where corporate labs co-locate with public-sector research institutes, are designed to facilitate private-public partnerships and entrepreneurial networks.

Most notably, **the Biopolis** at one-north, as mentioned earlier, anchors the development of the entire R&D value chain of life sciences, encompassing basic drug discovery, clinical development and medical technology research.

¹⁰ Cfr. IV c

¹¹ Source: Singapore Economic Development Board

The Fusionopolis, strategically located next to the Biopolis, houses Singapore's public sector research institutes that specialise in physical sciences and engineering disciplines, which is crucial for medical technology development.

4.4 LEADING INDUSTRY PLAYERS

All of the top 10 medical technology companies have their regional headquarters in Singapore for their business expansion in Asia. Major medical devices companies operating in Singapore incorporate:

- **AB SCIEX (US):** an important player in life science analytical technologies, set up its sole global manufacturing site for all of its instruments in Singapore and has a R&D centre undertaking instrument design and development. It also opened its Asia Pacific Application and Training Centre in Singapore.
- **Alcon (Switzerland):** an eye care company that has two manufacturing facilities in Singapore, producing daily disposable contact lenses and ophthalmic pharmaceuticals. Specifically, its 30.658 square metre plant at Tuas Biomedical Park manufactures sight-saving pharmaceutical products for Asian markets with treatments for glaucoma, eye infections, eye inflammation and dry eyes.
- **Baxter (US):** a healthcare company in medical devices, pharmaceuticals and biotechnology, established its South and Southeast Asia regional headquarters in Singapore and manufactures various medical and bioscience products including ADVATE®, a recombinant factor VIII (rFVIII) that is free of blood-based additives to meet the growing needs of people living with hemophilia A in Asia Pacific and around the world.
- **BD Medical Singapore (US):** Asia Pacific regional headquarter of Becton, Dickinson & Company, a medical device company. It possesses its corporate R&D centre in Singapore and manufactures a wide range of medical devices such as hypodermic needles and syringes, catheters, immunization products, safety needles and blood collection needles.
- **Biosensors (Singapore):** it manufactures its flagship drug eluting stent the Biomatrix and established its global R&D centre alongside its global business headquarter functions in Singapore.
- **Edwards Lifesciences (US):** a tissue heart valve company, whose 24.000 square metre manufacturing facility producing surgical and transcatheter tissue heart valve has expanded into an investment of S\$95 million (€55,96 million) since 2005.
- **Hoya Surgical Optics (Japan):** a manufacturer of intraocular lenses, established its headquarters, manufacturing operations as well as key function units in Singapore.
- **Life Technologies (US):** an important player in the life science tools industry, whose instrument manufacturing facility designs and manufactures products such as next-generation sequencing and molecular diagnostic instruments in Singapore. In particular, its Ion Torrent's Personal Genome Machine will also be manufactured in Singapore.
- **Medtronic (US):** it manufactures Cardiac Rhythm Disease Management devices and set up its Asia headquarters operating supply chain management, business development, and regulatory affairs.

- **Philips Healthcare (Netherlands):** its business units in Singapore comprise its APAC headquarters, sales and marketing, product support and supply chain management, as well as Hospital to Home¹².
- **TriReme Medical (US):** it has located its Asia pacific headquarters, R&D, global sales and manufacturing centre in Singapore.
- **Quattro Vascular (US):** a subsidiary of TriReme Medical, is developing medical device (implantable device) and Chocolate percutaneous transluminal angioplasty ballon catheter in Singapore.
- **Siemens Medical Instruments (Germany):** subsidiary of Siemens Audiologische Technik GmbH, a company in hearing solutions. Its operations in Singapore consist of its global commercial headquarters, global manufacturing and supply chain management headquarters, global product lifecycle management, IP management headquarters and regional competence centre for customer relationship management. Notably, its R&D facility in Singapore, accounting for 40% of its R&D, is the group's second largest one worldwide. Its investment in Singapore amounts to S\$110 million (€64,54 million).

LEADING MEDICAL TECHNOLOGY COMPANIES IN SINGAPORE



Source: Singapore Economic Development Board

¹² Hospital to Home, a new business unit providing chronic disease management solutions of care from hospitals to homes, in accordance with Singaporean government's 2020 Home Care Development Plan.

5. SINGAPORE AND ASIA MARKET POTENTIAL

The Economist estimates that healthcare spending in Asia has risen from 14% of the global total in 2006 to 23% in 2012, which is on par with Western Europe's 24% healthcare spending share.

According to Frost & Sullivan, a consultancy, the Singapore healthcare expenditure market was worth US\$ 11,7 billion (€8,61 billion) in 2012 and will grow to US\$ 22,3 billion (€16,41 billion) by 2018, which represents a Compound Annual Growth Rate (CAGR) of 11.4% from 2012 to 2018. In the meantime, the Asia Pacific healthcare market was worth US\$369,9 billion (€272,22 billion) in 2012 and is expected to reach US\$ 752 billion (€553,42 billion) in 2018, growing at a CAGR of 12,8% while global growth rates continue at less than 6% during the same period.

Government healthcare expenditure reinforcement also signifies more market opportunities. Singapore government will increase its healthcare spend by 6% a year to reach US\$12,6 billion (€9,27 billion) in 2015 from US\$9,27 billion (€6,82 billion) in 2011, while governments across the Asia-Pacific will beef up healthcare budgets to US\$420 billion in 2015 from US\$309 billion (€227,4 billion) in 2011, an annual increase of 8%¹³.

Such steady rise in healthcare expenditure market is due to a variety of factors:

- **Rising and ageing population:** Singapore's total population of residents and nonresidents currently stands at 5,3 million. It has been projected that by 2020 the population of Singapore will be between 5.8 and 6 million and by 2030 between 6.5 and 6.9 million. Singapore has one of the lowest fertility rates in the world and one of the fastest ageing populations. In 2011, 9,4% of the population was aged 65 years and older. By 2030, this figure will rise to 18,7%.

Asia's population will expand from 4,3 billion in 2013 to 5,3 billion in 2050 (60% of world's population)¹⁴. The average percentage of people above 65 will rise from 9,8% in 2013 to 11% in 2018 across the Asia Pacific region.
- **Expanding middle class:** Asia's middle class is growing faster than any other continent in the world. By 2030, Asia is expected to contain two-thirds of the world's middle class. An OECD study projected that this rising middle class will increase consumer spending in Asia from \$4,9 trillion (€3,59 trillion) in 2009 to more than \$30 trillion (€22 trillion) in 2020. That is, the Asian middle class will grow from 20% to an astounding 60% of global middle class spending.
- Prevalence of chronic diseases, increasing urbanization, accelerating population density and growing consumer awareness also contribute to healthcare market expansion.

In line with rising demand for better healthcare, brand-conscious Asian consumers will be more inclined to opt for Western drugs and medical devices, giving rise to more opportunities for Western industry players.

¹³ Source : Frost & Sullivan

¹⁴ Source: 2013 World Population Data Sheet, Population Reference Bureau



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