

Overview of the Singapore PharmBio Sector



INTRODUCTION

From manufacturing, research and development to commercial operations, Singapore is the region's leading biomedical sciences cluster for companies to serve the needs of the regional market and beyond.

The pharmaceutical sector is an important contributor to the Singapore economy, accounting for almost 3% of the country's Gross Domestic Product (GDP). Pharmaceutical manufacturing output has more than tripled since 2000, with the sector generating about S\$16 billion worth of products in 2017. The sector is also supported by a highly skilled workforce of more than 7,000 people. 4 of the top 10 prescription drugs by 2017 sales are also manufactured in Singapore.

SUPPORTING MANUFACTURING OPERATIONS

Singapore is a leading location for best-in-class manufacturing plants, where a wide range of products including Active Pharmaceutical Ingredients (API), drug products and biologics drug substances are launched and produced. Industry leaders like GSK, MSD, Pfizer, Novartis, Roche, Sanofi, AbbVie and Amgen have global manufacturing hubs in Singapore.

Recent investors like AbbVie and Amgen have chosen to establish campuses in Singapore that have both small molecules and biologics manufacturing capabilities, a testament to the diversity

of capabilities that have been built up in Singapore.

AbbVie opened its Biologics Manufacturing Facility in Singapore in October 2017, a move which expanded its manufacturing capabilities to include biologics, in addition to chemical APIs. The US\$400 million campus will support the company's global manufacturing operations to boost AbbVie's production capacity in immunology and oncology. As for Amgen, its new facility in Singapore was also the world's first commercial-scale "Next-Generation" biomanufacturing facility using single use technology.

There have also been a growing number of pharmaceutical companies investing in newer manufacturing technologies in Singapore, including GSK, who has invested in a commercial continuous processing plant using newly-developed hybrid continuous batch synthesis processes. This is the first of its kind within GSK's Global Manufacturing Site's network.

Singapore remains committed to investing in infrastructure, talent and technology to support the growth of the pharmaceutical manufacturing industry.

Infrastructure

Singapore has invested significantly in developing infrastructure and the general ecosystem to support pharmaceutical manufacturing. 280ha of land has

been dedicated to pharmaceutical manufacturing at Tuas Biomedical Park, where basic infrastructure like road networks and utilities (e.g. power, water, telecommunication, sewage lines) have been pre-built, to accelerate set-up times for pharmaceutical companies.

There are flexible options available to enable pharmaceutical manufacturers to plan for capacity needs. Firstly, the government has been working with contract manufacturers to expand their capacity in Singapore, such that they can offer commercial and clinical scale production options to companies intending to outsource their manufacturing needs. 2018 also saw the introduction of a newer player into the ecosystem, Wuxi Biologics, which announced their plans to invest S\$80 million to establish a biologics manufacturing facility in Singapore, which can handle both clinical and small-volume commercial production. The state-of-the-art "facility of the future" will utilize approaches pioneered by WuXi Biologics, deploying single-use bioreactors that can run continuous bioprocessing. An early-stage bioprocess development lab will also be included.

In addition, there are a number of prebuilt, GMP-ready facilities that can be fitted-out to accommodate a variety of manufacturing scales and technologies, such as single-use technology (SUT) manufacturing platforms. This allows companies to set up manufacturing with

smaller footprints quickly, and at a much lower upfront capital cost.

Talent

Another strategic advantage Singapore holds is its world-class education system and highly-skilled workforce. Many companies set up their operations here to tap on the deep manufacturing expertise developed over the years.

To ensure that the workforce is continually equipped with relevant skills, Singapore will continue to develop the country's talent pool by focusing on three fronts – ensuring a future-ready workforce through skills mastery and life-long learning, integrating industry experience into the school curriculum and boosting on-the-job training.

Through the SkillsFuture national movement, the Singapore government aims to provide individuals with opportunities to develop to their fullest potential by providing information on the sector, as well as the relevant skills and training programmes to enable individuals to make well-informed decisions on their careers.

Institutes of Higher Learning have also been integrating extensive industry experience into their curriculum through internships to prepare students for the industry. This includes the newly introduced Pharma Engineering degree by the Singapore Institute of Technology (SIT)

that was jointly developed together with industry, which just saw its first cohort of students graduate. Students undergoing this SIT program would undergo an 8-month internship to gain exposure to the industry, and allow them to hit the ground running immediately after graduation.

Since 2014, the Singapore government has been developing new training programmes for the industry, in partnership with pharmaceutical companies. These programmes are developed with the goal of training up an expanded pool of manufacturing-ready talent to meet the growing needs of the local industry. Pharmaceutical manufacturers can tap on these programmes to train fresh graduates and mid-career professionals on the job.

Advanced Manufacturing and Technology

Singapore has also made strides to establish herself as a key hub for Advanced Manufacturing. In 2018, the Singapore Smart Industry Readiness Index (SSIRI) was launched as the world's first Industry 4.0 tool to catalyse the transformation of Singapore's manufacturing landscape, including that of biopharmaceutical manufacturing companies.

On the technology front, the government has worked closely with pharmaceutical manufacturers to not only support adoption of new manufacturing technologies to Singapore manufacturing sites, but also build up capabilities to

develop, testbed and industrialise new technologies from Singapore.

In September 2017, the landmark Pharma Innovation Programme Singapore (PIPS) project was launched at the Future of Manufacturing Summit. PIPS draws upon the combined expertise of the Agency for Science, Technology and Research (A*STAR), the National University of Singapore (NUS) and Pfizer, Merck (known as MSD outside of the US) and GlaxoSmithKline (GSK). In October 2018, the consortium of leading public research agencies and global industry leaders inked a S\$34million agreement to jointly invest in developing new manufacturing technologies and subsequently supporting their adoption in the companies' Singapore facilities.

GROWING THE BIOTECHS

The nascent biotech industry in Singapore has made good progress over the past few years - the result of continued investments in public sector basic science and research, as well as an increase in financing and commercialisation opportunities.

As of 2018, there are more than 300 biotechnology and medical technology companies in Singapore, and the pool of Singapore-based companies continues to grow and mature. In September 2018, Tessa Therapeutics, a clinical stage biopharmaceutical company focusing on cellular immunotherapy treatments

for cancer, opened its latest technical operations facility in Singapore to support the research and development of next-generation immunotherapy products, as well as the optimization and characterization of the manufacturing processes for these products. This is a key step to Tessa building a fully-fledged manufacturing facility in Singapore that is set to commence development in 2019.

The reasons for the biotech sector's strong growth are multi-fold. Singapore provides a conducive environment for biotechs to set up and commercialise their innovations. A*StartCentral, an incubator lab with a co-working space and a life sciences lab, was established in March 2016 to provide biotechs with a central networking area and an asset-light model to kick start operations and continue developing their assets in the initial start-up phase. At the same time, there is growing interest from private investors into the local biotech space. In February 2016, Lightstone Ventures partnered with Singapore investment firm Temasek Holdings and EDB Investments to close a S\$50 million fund focused on investing Singapore-based life sciences technologies and companies.

Much emphasis has also been given to ensure that Singapore's local enterprises get access to the growing pool of biotech talent. Under the Technology for Enterprise Capability Upgrading (T-Up), run by A*STAR, research scientists

are seconded to local enterprises for up to 2 years to boost their research and development capacity. In addition, the technology transfer offices (TTOs) in various universities also provide avenues to mentor academics and guide their research towards commercialisation opportunities.

BOOSTING DRUG DISCOVERY AND DEVELOPMENT

Singapore remains committed to strengthening capabilities in translational and clinical research. In 2016, S\$4 billion – more than one fifth of the S\$19 billion national research and development budget – was dedicated to the Health and Biomedical Sciences (HBMS) domain as part of the Research Innovation Enterprise 2020 plan to strengthen Singapore's innovation capabilities and develop a pipeline of early stage companies for the ecosystem.

The sustained investments into HBMS over the years has allowed Singapore to build scientific strengths in key therapeutic areas like oncology and ophthalmology. Singapore has committed to building the relevant capabilities within its public sector drug discovery and development institutes, including the Experimental Therapeutics Centre (ETC) and Experimental Biologics Centre (EBC) for small and large molecule drugs respectively, as well as the Drug Discovery and Development Unit (D3). As of 2017, Singapore has seen two home-

grown cancer drug candidates, ETC-159 and ETC-206, move into clinical trials.

Singapore's strong track record in clinical trial operations has also drawn leading pharmaceutical companies like Novartis, Bayer and Roche to conduct their clinical trials here. Today, about half of the trials conducted in Singapore are oncology trials. Singapore's public healthcare clusters such as SingHealth, have also invested to build a network of early phase clinical research units to support companies' clinical trial needs, including conducting first-in-human trials.

Singapore will continue to provide an integrated research ecosystem for pharmaceutical companies, emerging biotechs and entrepreneurs to access world-class facilities and forge public private partnerships to advance the discovery and development of healthcare solutions for human health and wellness.

DIGITAL HEALTH

The way healthcare is delivered is changing and will continue to evolve in the future. The costs of healthcare are rapidly rising, resulting in government budgets that are becoming increasingly strained in the face of ageing populations.

Against the backdrop of these changing healthcare trends, there is a shift-towards value-based care, which focuses more on patients' healthcare outcomes. Globally, healthcare is also

seeing the emergence of new health paradigms, with the development of new precision treatments in which therapies are tailored to the individual, as well as a growing emphasis on wellness and disease prevention. These trends call for a rethink of traditional business models, and an embrace of digital technologies and data-driven decisions.

The success of digital health endeavours and the wider implementation of these solutions would depend on the analysis and collection of patient data. In the future, this will be further enabled by the adoption of national electronic health records, combined with personal genomic, clinical and lifestyle data. For example, A*STAR aims to harness consolidated data for joint projects and leverage data-driven genomics for more precise diagnoses and treatments to enable precision medicine.

In April 2017, the Singapore government had also launched AI Singapore, a 5-year S\$150 million national programme to increase the translation of AI research to commercial applications. As part of the initiative, AI Singapore also has a 100 Experiments programme which aims to accelerate the adoption of AI by the industry by matching AI researchers in Singapore to problem statement holders across industries.

Investments by multinationals into digital health here also suggests that Singapore is on the right track. In 2015, US

healthcare giant MSD set up its Singapore IT Hub focusing on areas such as data science and analytics, cyber security, and software engineering. Since then, it has grown to a team of over 200 employees. For example, key projects include the development of mobile applications that help people reduce chances of chronic disease by living healthier lives and improving how patients take prescribed medication.

In the digital health scene, Singapore has drawn interest from regional health technology companies, investors and even tech giants including Apple, IBM and Google.

The digital start-up scene is also growing rapidly. Singapore ranks 3rd in Asia after India and China in terms of the number of digital health startups in 2017, driven by ongoing technology innovation investments and a favourable business climate.

CONCLUSION

The future of the pharmaceutical industry remains bright. Demand for healthcare will continue to grow as populations age and incomes rise, particularly in Asia. There will be challenges from disruptive technologies to new modes of drug delivery.

Seizing new opportunities while tackling these challenges will require companies to adapt and embrace change.

To this end, we will work with our partners to meet these challenges and ensure that Singapore remains a trusted location for the industry.

Ms Ho Weng Si
Director, Healthcare
Singapore Economic Development Board

