

Frugal Innovation

in Medical Devices
and Technologies

The India Opportunity

DECEMBER 2019



Australian Government
Department of Industry,
Innovation and Science

Industry
Growth
Centres

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Australian Government
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Acknowledgements

The *Frugal Innovation in Medical Devices and Technologies: The India Opportunity* report was developed by MTPConnect and Asialink Business.

Collaboration partners

The report has been developed with a broad cross section of sector participants, including government organisations and businesses and research institutions engaged in medical device and technology industries. The input from these participants has been invaluable in the drafting of this report. We would like to thank all of those who gave their time to participate in consultations for the report and thank the collaboration partners for their efforts and support (see page 31 for a full list of organisations consulted for this report).

In developing this report, Asialink Business has also drawn on the expertise of its key collaboration partner, Austrade.

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1. Foreword

The global market for medical devices and technologies is expanding rapidly, creating new opportunities for Australian businesses, research organisations and non-government organisations. Developing countries are increasing their share of global demand for medical devices and technologies as rising incomes enable more people to access high-quality healthcare. As a consequence, cost considerations have become increasingly important in the design and delivery of medical goods and services.

To adjust to emerging cost considerations, medical device and technology companies are applying the principles of frugal innovation. Frugal innovation involves the design and delivery of goods and services at minimum cost without compromising quality to meet demand from new consumers of healthcare.

This report offers new insight into the importance of frugal innovation in the development of medical devices and technologies for the global market. In focusing on India, it provides a snapshot of one of the world's most dynamic centres of low-cost innovation.

Frugal Innovation in Medical Devices and Technologies—The India Opportunity is the first report to discuss opportunities for Australian developers and producers of medical devices and technologies in India created by the rise of frugal innovation. MTPConnect and Asialink Business' collaboration on this report is based on a shared understanding that Australia's 1,285 MTP businesses, which exported \$6.5 billion worth of goods in 2018,¹ are best placed to increase their global competitiveness when they are across the major global trends shaping their industries. It also recognises the growing space for collaboration between research institutions and other non-government organisations in innovating for emerging markets.

We would like to thank Austrade for their outstanding in-market support and expert review of this report. We would also like to thank all the businesses, industry organisations and government bodies that have contributed to the development of this report.



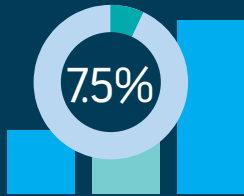
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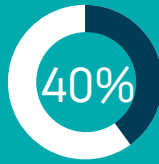
Mukund Narayanamurti
CEO
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¹ MTPConnect, Sector Competitiveness Plan 2019, (2019), 9.

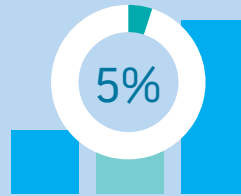
2. Fast Facts



Developing country growth in health spending: 75 percent
Developing countries are increasing their health spending at three percentage points above the global average.²



Developing country share of global GDP: 40 percent
Between 2000 and 2018, developing countries' share of global GDP almost doubled to 40 percent in absolute dollar terms.



India 10-year growth average: 5.5 percent
Over the past decade, India's per capita GDP has grown at an average of 5.5 percent per year.³



India health care sector: \$213 billion
The Indian healthcare sector has grown from \$60 billion in 2008 to \$213 billion in 2017 and is expected to more than double in size on 2017 levels by 2022.⁴



India per capita spend on medical devices: \$4
India spent \$4 per capita per year in 2015 on medical devices, which is significantly below the global per capita spend of \$63.



India medical device imports: 80 percent
India imports approximately 80 percent of the medical devices it uses (by value). In 2018-19, these imports were worth \$7.9 billion.



India health tech start-ups: 4892
The healthcare start-up ecosystem in India is in its infancy, raising just \$672 million in the period between 2014 and 2018.⁵



India start-up incubators: 250
India has a growing number of start-up incubators with a track record of helping foreign companies enter the Indian market.⁶

² KPMG, 'Medical Devices 2030: Making a power play to avoid the commodification trap', <https://assets.kpmg/content/dam/kpmg/xx/pdf/2017/12/medical-devices-2030.pdf>
³ Gupta, P., 'This is the story of India's GDP growth', World Economic Forum, 13 April 2018 <https://www.weforum.org/agenda/2018/04/india-s-remarkably-robust-and-resilient-growth-story>
⁴ Indian Brand Equity Foundation, Healthcare, February 2019 <https://www.ibef.org/download/healthcare-jan-2019.pdf>
⁵ Soni, Y., 'Healthcare landscape of India: State of India's Healthcare Startups', Inc42.com, <https://inc42.com/features/healthtech-startups-landscape-india/>
⁶ Srivastav, S., 'India Startup Ecosystem: A Global Growth Story in the Making', Inc42, 10 November 2018, <https://inc42.com/features/indian-startup-ecosystem-a-global-growth-story-in-the-making/>

3. Executive Summary

Global demand for medical devices and technologies has never been stronger. This demand is growing faster in developing countries, where hundreds of millions of people are now able to afford healthcare goods and services that until recently were out of reach. Demand is still growing in developed markets, but at a slower pace as many countries struggle to manage budget pressures and ageing populations.

A global market that is growing but constrained by cost pressures in both new and established markets favours innovation that minimises cost while maintaining the quality and functionality in the design of new medical devices and technologies. The ‘frugal innovation’ process is increasingly being used to achieve cost minimisation without compromising quality or functionality.

Australian medical device and technology businesses need to understand the trends shaping the global market for their products in order to remain internationally competitive. Australian organisations have a long history of engaging in global collaboration in the research and development of medical technologies and in exporting medical devices developed and manufactured domestically. They are well placed to take advantage of new opportunities that are emerging in a global market increasingly driven by cost-minimisation.

India is both a global centre of frugal innovation as well as one of the largest emerging markets for medical devices and technologies.

This report identifies three major areas of opportunity for Australian medical device and technology companies in the Indian market:

- 1 Australian medical-device producers and medical-technology developers are strongly positioned to export into India's expanding hospital networks.
- 2 Australian small to medium enterprises (SMEs) can adapt their medical device and technology offerings through Indian start-up incubators.
- 3 Australian universities and other research institutions can partner with Indian institutions and companies to develop and commercialise their technologies.

4. Introduction

A historic boom in demand for healthcare from developing countries is shaping the global medical device and technology industries.

As developing countries expand their share of the global healthcare marketplace, the cost-effectiveness of medical devices is becoming more important. This trend is clear in the developed world too, where government health spending is struggling to keep up with the demands of demographic changes such as ageing populations.

Low-cost healthcare solutions have never been more in demand. Developing countries, like India, are leaders in ‘frugal innovation’ (see page 7 for more detail). They draw on long traditions of innovation under severe resource constraints.

Indian companies and foreign companies with operations in India are harnessing the country's expertise in frugal innovation. These companies are using frugal innovation techniques to create new medical devices and technologies for the fast-growing Indian market, as well as the global market.

Australian producers of medical devices and technologies are well-positioned to participate in and capitalise on the growing global market for frugal innovation. The Australian medical devices industry is mature, with a well-established regulatory system, and consists of over 500 mainly small to medium sized enterprises. The total Australian medical device market was estimated to be worth \$6.6 billion in 2018.⁷

This report provides an overview of the market conditions affecting the medical device and technology industries worldwide, and the increasing importance of frugal innovation in product development. The report has a specific focus on India, both as a growing market for medical devices and technologies and as an emerging centre of innovation and production. The final section identifies three areas of opportunity for Australian businesses and organisations to expand their exports and build partnerships to develop new products in the Indian market.

7 Export.gov (United States Government), 24 July 2018, <https://www.export.gov/article?id=Australia-Medical-Devices> All values in US dollars converted to Australian dollars at 2018 average of \$US0.75

What is frugal innovation?

Frugal innovation is the creation of new or improved goods, services or processes at the lowest possible cost without compromising quality. Cost minimisation is achieved by delivering the functions promised without any additional expenditure on optimising the product.

Frugal innovation can be applied beyond the design and manufacturing of goods. Principles of frugal innovation are also used in the design and delivery of services and to the simplification of business models. Indian healthcare enterprise Narayana Health has used innovative approaches to space and resources in its hospitals, including the adoption of production chain methodologies, to radically decrease the cost of cardiac surgery while maintaining success rates comparable to high-income countries⁸ (see case study on p.13 for more detail).

Common characteristics of products or services created with frugal innovation include:

Portability. Manageable size and battery power makes it possible to take devices closer to consumers in rural areas.

Defeaturing. Simplification of function reduces costs and the level of training required to operate devices.

Leap-frog technology. Products and services which take advantage of mobile and digital technologies, such as mobile telephones, that have arrived in market before fixed infrastructure has caught up.

Service flexibility. Products that can serve multiple functions whilst simplifying operating technology (such as a diesel engine that can be used for both hospital and farm equipment)



Products and services which take advantage of mobile and **digital technologies**, such as mobile telephones, that have arrived in market before fixed infrastructure has caught up.

⁸ Commonwealth Fund, 'Expanding access to low cost, high quality health care', 9 November 2017, <<https://www.commonwealthfund.org/publications/case-study/2017/nov/expanding-access-low-cost-high-quality-tertiary-care>>

5. A rapidly evolving global market

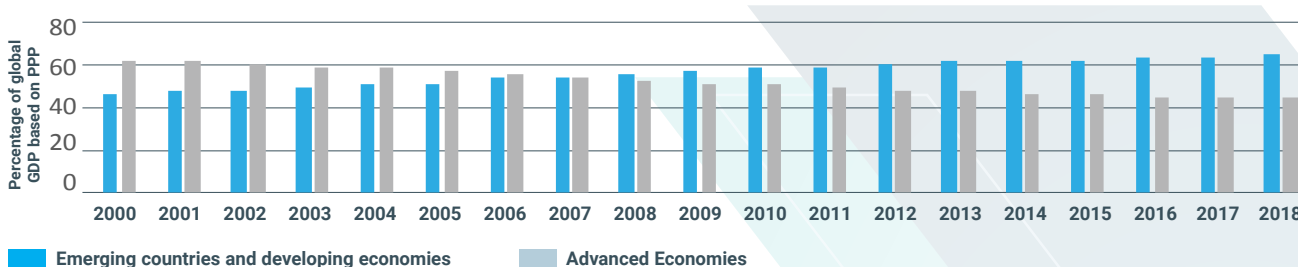
Around the world, more people are able to access affordable, high-quality healthcare than ever before. This is due mainly to rising incomes, particularly in developing countries, and new technologies, which make healthcare more accessible and affordable. While these drivers are increasing supply to a growing customer base, governments are also seeking to contain the expansion of health spending, particularly in wealthy countries that are experiencing sluggish economic growth. This section explores how these trends are shaping global demand for medical devices and technologies.

5.1 Developing world markets are driving demand

Medical device and technology industries have been primarily concentrated in high-income countries, where products were traditionally designed, manufactured, traded and used. The highest growth markets for medical devices and technologies are now, however, located in the developing world.⁹ These markets are growing quickly both in terms of absolute size and their proportion of total global consumption.

The growth of medical device and technology markets is largely a function of rising spending power. Between 2000 and 2018, developing countries' share of global GDP almost doubled to 40 percent in absolute dollar terms. The shift is even more striking in purchasing power parity (PPP) terms, which shows the developing world overtaking advanced economies in 2007.¹⁰

Figure 1: Developing country/Advanced economy GDP, 2000-2018, percentage of global GDP based on PPP



Source: International Monetary Fund Data Mapper

Rising incomes and growing public investment in health infrastructure and insurance schemes are driving the shift in the global market for healthcare products and services towards developing countries, especially in China and India. Over the past two decades, hundreds of millions of people in the developing world have increased their incomes enough to qualify as middle class.¹¹ With new spending power, these middle-class consumers seek medical care of the same quality enjoyed by the middle classes in developed countries.

Demand for high-quality healthcare is expected to grow strongly alongside demand for other goods and services in this sector. It is forecast that in the period between 2015 and 2030, global middle class spending will increase by \$39 trillion (an increase of 84 percent on 2015), with \$37 trillion of this increase expected to be spent in developing countries.¹²

Rising incomes, government spending on health infrastructure and public insurance schemes have also created a new class of healthcare consumers. These consumers do not have high enough incomes to qualify as middle class but can afford basic medical goods and services that were previously out of reach.¹³

Medical device and technology companies can expect their traditional export markets in the developed world to form a decreasing share of the global opportunity. As global consumption of healthcare products and services shifts towards the developing world, exporters of medical devices and technology need to be aware of developments in these markets.

⁹ Commonwealth Fund, 'Expanding access to low cost, high quality health care', 9 November 2017, <https://www.commonwealthfund.org/publications/case-study/2017/nov/expanding-access-low-cost-high-quality-tertiary-care>

¹⁰ International Monetary Fund data, found at <https://www.imf.org/external/datamapper/NGDPD@WEQ/OFEMDC/ADVEC/WEQWORLD>

¹¹ Middle class' defined by Karas is a per capita income of between \$13 and \$133 per day. See Karas, H., 'The Unprecedented Expansion of the Global Middle Class', Brookings Institute, https://www.brookings.edu/wp-content/uploads/2017/02/global_20170228_global-middle-class.pdf

¹² Karas, H., 'The Unprecedented Expansion of the Global Middle Class', Brookings Institute, https://www.brookings.edu/wp-content/uploads/2017/02/global_20170228_global-middle-class.pdf

¹³ Pralahad, D., 'The new fortune at the bottom of the pyramid', Strategy+Business, Spring 2019, <https://www.strategy-business.com/article/The-New-Fortune-at-the-Bottom-of-the-Pyramid?gko=c5f11>

Figure 2: Healthcare spending, selected developed and developing countries

	per capita (\$ international*)	percent GDP
Australia	4708	9.25
UK	4192	9.76
US	9507	17.07
India	267	3.66
China	731	4.98

*An international dollar buys a comparable amount of goods and services that one US dollar buys in the United States

Sources: OECD, World Bank, World Health Organisation

5.2 Health budget constraints are pushing prices down

Although demand for healthcare is growing around the world, intensifying pressure on national health budgets due to factors such as slow growth and ageing populations is diminishing the profitability of medical goods and services. This is particularly the case in austerity policy-driven countries such as the United Kingdom, where public health expenditure is growing too slowly to keep up with an ageing population.¹⁴

The flow-on effects of the tightened government healthcare spending are significant. For example, vendors of medical devices in the developed world are accepting thinner margins as hospitals, their major buyers, contend with stagnant or shrinking budgets.¹⁵

In contrast to the reduction in healthcare spending in many developed countries, developing countries are increasing their health spending at an average of 7.5 percent or three percent above the global average.¹⁶ This spending, however, is mostly invested in expanding coverage. Spending on health per capita in developing countries is still far below developed country levels and cannot support high margins for vendors of medical devices and services.¹⁷

¹⁴ Anandaciva, S., 'NHS myth-busters', The Kings Fund, 20 November 2017, <<https://www.kingsfund.org.uk/publications/nhs-myth-busters>>

¹⁵ KPMG, 'Medical Devices 2030: Making a power play to avoid the commodification trap', <<https://assets.kpmg/content/dam/kpmg/xx/pdf/2017/12/medical-devices-2030.pdf>>

¹⁶ KPMG, 'Medical Devices 2030: Making a power play to avoid the commodification trap', <<https://assets.kpmg/content/dam/kpmg/xx/pdf/2017/12/medical-devices-2030.pdf>>

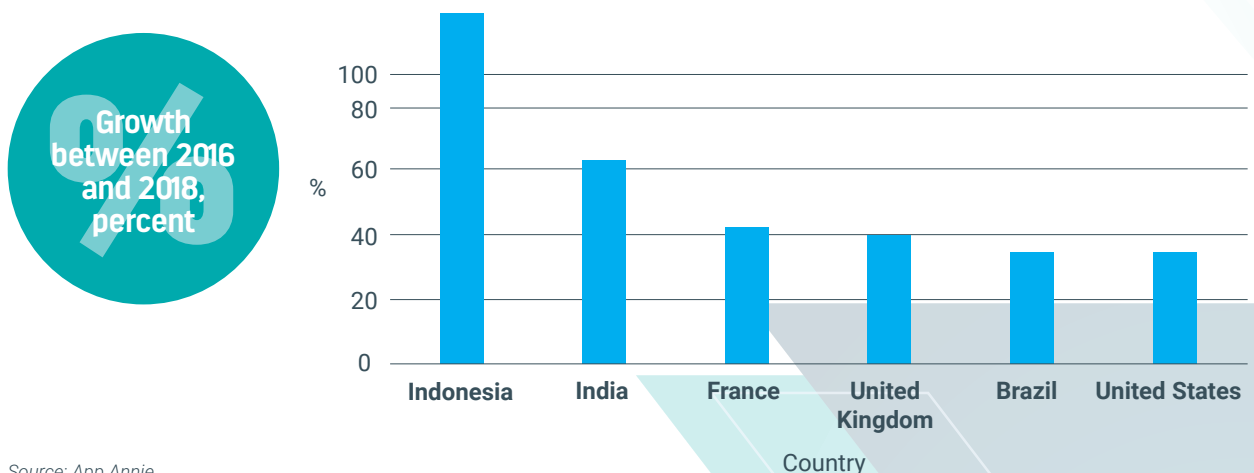
¹⁷ KPMG, 'Medical Devices 2030: Making a power play to avoid the commodification trap', <<https://assets.kpmg/content/dam/kpmg/xx/pdf/2017/12/medical-devices-2030.pdf>>

5.3 Technology is changing the nature of the industry

New developments in information and communication technologies are constantly disrupting how businesses relate to customers, governments to citizens, and people to each other. In the healthcare sector, the adoption of new technologies is creating new efficiencies, which allow health care providers to reduce costs and expand their offerings

The rapid global uptake of smartphones is one of the largest factors expanding access to healthcare services. Smartphone applications are enabling patients to access medical information and to collect and share their own medical data. Smartphone-enabled innovations in telehealth and streaming video are also creating better platforms for online consultations, which has expanded the breadth and quality of services available to people in remote areas.

Figure 3: Growth in spending on health and fitness apps, between 2016 and 2018, selected countries, percentage increase



Source: App Annie

Internet of Medical Things (IoMT)

Mobile communications technology innovation is also enabling medical devices to collect data and upload it to the internet. This “Internet of Medical Things” (IoMT) is driving innovation across the sector. Emergency services, for instance, are improving survival rates by fitting out ambulances with medical devices that monitor patients’ vital signs and transmit data en route to the hospital, allowing emergency room personnel to better prepare for the patient’s arrival.¹⁸ The IoMT is also transforming preventive healthcare. Wearable heart monitors communicating with smartphone applications both help patients better assess their own conditions and allow general practitioners to monitor patient progress.

Artificial intelligence

Artificial intelligence (AI) is transforming diagnostics. Advanced software is helping to identify patterns that could indicate cancer or diseases such as tuberculosis, helping specialists make faster and more accurate diagnoses. In combination with other technologies AI is changing the way breast cancer, for instance, is detected and treated in India. For the first time, women with low incomes in remote parts of the country are receiving early diagnoses and smartphone-enabled treatment plans.¹⁹

The IoMT, AI and other new technologies are also interacting with the roll-out of ever more sophisticated electronic medical records systems. This roll-out is creating significant opportunities for producers of medical products and services.

As healthcare becomes increasingly data-driven, software and information technology companies are more able to compete in the same space. To remain competitive, established medical device firms will need to respond to changing expectations both of businesses to which they sell and their end consumers, who are increasingly expecting interactions with producers throughout the lifetime of the product.²⁰

18 Saha, H.N. et al. 'Monitoring patients' health with smart ambulance system using Internet of Things', Institute of Electronics and Electronics Engineers, 16 August 2017, <<https://ieeexplore.ieee.org/document/8079568>>
 19 D'Cunha, S., 'How this Indian startup is using AI to improve detection of breast cancer at a low cost', Forbes, 21 August 2018 <<https://www.forbes.com/sites/supamadutt/2018/08/21/how-this-indian-startup-is-using-ai-to-improve-detection-of-breast-cancer-at-a-low-cost/#54e0bea9d3be>>
 20 KPMG, 'Medical Devices 2030: Making a power play to avoid the commodification trap', <<https://assets.kpmg/content/dam/kpmg/xx/pdf/2017/12/medical-devices-2030.pdf>>



Frugal innovation



INVOLVES THE REENGINEERING
OF TECHNOLOGICALLY -OPTIMISED
PRODUCTS AND SERVICES TO DELIVER
ONLY THEIR CORE FUNCTIONS

6. The rise of frugal innovation

The rise of new markets in developing countries and intensifying cost constraints in developed countries are changing the way medical devices and technologies are designed. These trends strongly favour the minimisation of cost. This section outlines how cost-minimised frugal innovation is shaping innovation in the world's fastest growing markets for medical devices and technologies.

6.1 Frugal innovation is driving innovation in the developing world

The innovation process for medical devices, medical technologies and many other sectors has been traditionally driven by multiple priorities. Controlling costs has always been important for the development of new products, but it has not been the only factor. Particularly in developed markets, buyers have been willing to pay more for products and services which deliver outcomes beyond basic functionality. This focus on technical optimisation, which drives innovation in luxury industries, can also be discerned to a lesser extent in the development of medical devices and technologies.²¹

Innovation in the developing world, by contrast, has been much more narrowly focused on creating products and services that deliver necessary functions at the lowest possible cost.²² To achieve these cost savings, the frugal innovation process has often been used.

Frugal innovation involves the reengineering of technologically-optimised products and services to deliver only their core functions (see box below). Producers of medical goods and services around the world are responding to a growing but more cost-constrained global market by investing in this kind of cost-minimising innovation. This is playing out in three main ways:

- 1 Enterprises of all types in developing countries are using cost-minimised innovation to design products and services to meet growing local demand.
- 2 Multinational corporations are investing in research and development in developing countries to design cost-minimised medical goods and services.
- 3 Cost-minimised products originally designed for the developing world are finding markets in the developed world.

²¹ Parthasarathy, B., 'Reversing the flow of Ideas: frugal innovation for India and beyond', Australian Institute of Indian Affairs, March 2013, <https://www.aii.unimelb.edu.au/wp-content/uploads/2019/01/NEW10489-Chanakaya-Paper-Balaji-Parthasarathy-V6.pdf>

²² Tiwari, R., 'India's potential as a lead market for frugal innovation and the role of socio-cultural context factors' Working Papers 94, Hamburg University of Technology (TUHH), Institute for Technology and Innovation Management, 2016, <https://ideas.repec.org/p/zbw/tuhtim/94.html>

CASE STUDY: Narayana Health

Narayana Health is a pioneer in low-cost cardiac care. It is an example of how frugal innovation in business processes can deliver efficiencies to enable access to the world's lowest cost heart surgery without compromising quality.

RETHINKING THE HOSPITAL

Two million people need heart surgery in India every year, but only 90,000 operations are performed.²³ Cardiac surgeon Devi Shetty saw this gap and founded Narayana Health in 2001 to address it. Narayana Health is now one of India's largest hospital chains, with 31 tertiary hospitals across 19 cities. It conducts 30 percent of India's heart surgeries.

Shetty's production-line approach to surgery creates efficiencies that allow Narayana Health to deliver heart operations for less than \$1500, (around a quarter of what it costs in other Indian private hospitals).²⁴ Narayana Health charges patients on their ability to pay, so that wealthier patients subsidise those most in need. The company has achieved its aim of substantially improving accessibility to heart surgery by spreading costs in this way. It has achieved this without compromising quality of outcomes. A recent study found coronary bypass mortality rate thirty days after surgery was 1.4 percent, which is 0.5 percent lower than the average in the United States.²⁵

Narayana Health professionals have highly specialised roles, with most doctors and nurses each only performing a single, specific task. This means a surgeon can complete an operation and then move very quickly to perform the same procedure on a fully-prepped patient. As a result, Narayana Health can perform many more operations per operating theatre per day than a traditional hospital.

But this isn't the only way Narayana Health keeps costs down. Centralised purchasing across a large network, for instance, allows for economies of scale. A 4-hour course teaching family members how

to treat a recovering patient reduces the need for post-operative nursing. Hospitals are designed to minimise unused space and are built with lowest-cost materials. Business processes are rigorously reviewed, with detailed profit statements produced every day to assist systems analysts.

There is no point in me talking about all the advances in heart care or cancer care if 90 percent of the world's population cannot afford it.” –Dr Devi Shetty²⁶

DEPLOYING NEW TECHNOLOGIES

Narayana Health's innovative business practices create demand for new technologies to increase the responsiveness of the hospital system. For instance, Dr Shetty explains²⁷ that communication failure is a major cause of fatalities and complications in a hospital environment. Often an x-ray sent to a doctor's desktop computer will be out of date once they have had time to download it. The introduction of 'real time' mobile devices saves physicians' time and allows them to intervene quickly if patients experience sudden deterioration. Narayana Health is continuing to invest in data-driven systems to increase the efficiency and accuracy of delivery in their hospitals.

TARGETING DEVELOPED MARKETS

Narayana Health is proving that business processes developed to minimise costs in extremely cost-constrained developing markets have applications in wealthier markets. In 2014, Dr Shetty established Health City Cayman Islands, which is located near enough to the United States that it can attract American patients while being outside its regulatory sphere. This allows it the flexibility to choose payment structures, locations and partnerships which can deliver procedures at 60 to 70 percent of the cost in the United States.²⁸



²³ Abra, P., 'Devi Shetty aims to offer heart surgeries at RS 65000', Economic Times, 26 December 2012 <https://m.economictimes.com/devi-shetty-aims-to-offer-heart-surgeries-at-rs-65000/articleshow/17768149.cms>

²⁴ Abra, P., 'Devi Shetty aims to offer heart surgeries at RS 65000', Economic Times, 26 December 2012 <https://m.economictimes.com/devi-shetty-aims-to-offer-heart-surgeries-at-rs-65000/articleshow/17768149.cms>

²⁵ Govindarajan, V., and Ramamurti, R., 'Reverse Innovation in Healthcare: How to make value-based delivery work', Harvard Business Review Press, Boston 2018, p.212.

²⁶ Fixing Healthcare Podcast, Episode 7, https://fixinghealthcarepodcast.com/wp-content/uploads/2019/02/FHC_Episode_7_Shetty_Transcript.pdf

²⁷ Fixing Healthcare Podcast, Episode 7, https://fixinghealthcarepodcast.com/wp-content/uploads/2019/02/FHC_Episode_7_Shetty_Transcript.pdf

²⁸ Govindarajan, V., and Ramamurti, R., 'Transforming Health Care from the Ground Up', Harvard Business Review, July-August 2018, <https://hbr.org/2018/07/transforming-health-care-from-the-ground-up>

6.2 Large local firms in developing countries are leaders in cost-minimised innovation

There is a long history of using frugal innovation to design cost-minimised products and services for local markets. This ranges from small community organisations improvising products from materials at hand to large national conglomerates. The largest firms, such as Hai'er in China or Tata in India, are able to leverage their large-scale production capacity and distribution networks to create cost-minimised products for both national and global markets.

Large local corporations in developing countries call on a deep knowledge of local consumer preferences to inform their design processes. As their head offices, research and development facilities and factories are all located in or near their target markets, they are well placed to develop, test and launch products in short cycles. This gives them an edge on international companies, even those producing in-market, that can be slowed down by additional levels of management in distant head offices.²⁹

Closeness to the market also gives large local corporations important advantages in distribution and sales.³⁰ These companies can rely on well-established relationships with distributors and finely-tuned sales incentives that are best gained from long-term engagement. Triviron, an Indian producer of imaging and diagnostic equipment, is an example of a developing-world company that had an initial focus on purchasing technology from overseas firms, but has steadily moved all its research, design and manufacturing to India to take advantage of both local expertise and the fast-growing local market.³¹

6.3 Multinational corporations are investing in developing-world markets

The largest global conglomerates have recognised that growth in sales of medical devices and technologies will mostly come from the developing world. Multinational corporations like Siemens and General Electric (GE Healthcare) have invested substantially in research and development and manufacturing operations in these markets.

Much of multinational corporation investment in developing countries is targeted at leveraging developing-world expertise in frugal innovation to develop products for fast-growing emerging markets.³² Many multinationals have established research and development facilities in developing markets specifically for this purpose.³³ For example, Siemens created a fetal heart rate monitor that uses microphone technology to monitor foetuses where much more expensive ultrasound technology is usually applied. German engineers collaborated with Indian developers to adapt microphone technology to the specific needs of Indian users.³⁴ Similarly, GE Healthcare's electro-cardiogram machine (see case study on p.15 for more detail) has dramatically reduced the cost and availability of testing for heart problems.

6.4 Developing markets have become a springboard to developed world markets

Cost-minimised products originally designed for developing-world consumers are becoming more attractive to hospitals and other purchasers of medical devices and technologies in developed markets as they try to contain costs.³⁵ Companies making cost-minimised products for the developing world are also factoring wealthier markets into their strategies.

Multinational companies have recognised that investing in research and development in developing countries has more advantages than just proximity to the world's fastest growing markets. They are also tapping into local expertise to reengineer products that can then be sold globally. For example, Tata Elxsi, a contract design company subsidiary of Indian giant Tata, has long-established relationships with Japanese and European medical device firms to create cost-minimised devices such as stethoscopes and diagnostic devices.³⁶

29 Rarick, C., 'The Competitive Advantage of Local Firms in Developing Economies: The Case of Bajaj of India', Purdue University Northwest, January 2004, https://www.researchgate.net/publication/237497149_The_Competitive_Advantage_of_Local_Firms_in_Developing_Economies_The_Case_of_Bajaj_of_India

30 Rarick, C., 'The Competitive Advantage of Local Firms in Developing Economies: The Case of Bajaj of India', Purdue University Northwest, January 2004, https://www.researchgate.net/publication/237497149_The_Competitive_Advantage_of_Local_Firms_in_Developing_Economies_The_Case_of_Bajaj_of_India

31 Sang, R., 'Making healthcare accessible and affordable', Asia One, August 2019, <https://www.triviron.com/uploads/featurestories/Asia-One-POY-Magazine-Dr-Velu-1-Aug.pdf>

32 Tiwari, R., 'India's potential as a lead market for frugal innovation and the role of socio-cultural context factors' Working Papers 94, Hamburg University of Technology (TUHH), Institute for Technology and Innovation Management, 2016, <https://ideas.repec.org/p/zbw/tuhtim/94.html>

33 Tiwari, R., 'The role of offshore R&D in strengthening competitive advantage: chances and challenges in India', Hamburg University of Technology doctoral series 2007, <https://pdfs.semanticscholar.org/a80b/1ebb81b9017876f11f882865f2037f12aed5.pdf>

34 Insead Knowledge, 'Frugal Innovation: A new business paradigm', 2009, <https://knowledge.insead.edu/node/2375/pdf>

35 Govindarajan, V. 'How reverse innovation can change the world', Knowledge@Wharton, 29 March 2012, <https://knowledge.wharton.upenn.edu/article/vijay-govindarajan-how-reverse-innovation-can-change-the-world/>

36 Tata Elxsi website, 'Next Gen Wireless Stethoscope', <https://www.tataelxsi.com/industries/healthcare/medical-devices-engineering-services/casestudies/wireless-stethoscope.html>

CASE STUDY: GE Healthcare

GE Healthcare is a subsidiary of GE, one of the world's largest corporations. GE Healthcare has invested heavily in research and development in India. While GE Healthcare's involvement in India began as a way to understand and access the large domestic market, India has now become a centre of innovation in its global supply chains.

INVESTING IN INDIA

GE Healthcare's involvement in the Indian healthcare market began in the 1960s, when it started exporting medical devices to India. The Indian market at that time was much smaller – and GE Healthcare's involvement and approach in India has changed to suit the market conditions.

In the early 1990s, GE Healthcare began manufacturing in India. It had already established a partnership with Indian technology firm Wipro in 1989 and had committed to collaboratively designing products for the Indian market in India. In 2000, GE Healthcare signalled the seriousness of its commitment to the Indian market by opening the John F. Welch Technology Centre in Bangalore. India is today an important centre in GE Healthcare's global R&D and supply chain ecosystem. Its healthcare technology centre with 2000+ employees and over 600 patents filed to its credit is GE Healthcare's largest research and development facilities outside of the USA. GE Healthcare is also a strong advocate of 'Make in India' with three manufacturing facilities in the country.

GE Healthcare's long-term commitment has established the company as a major contributor to indigenous innovation in India's medical devices market. Products developed for the Indian market range from sophisticated technologies, such as CT and PET CT scanners, to simpler technologies such as ECGs, baby warmers and Phototherapy devices based on a simple heating technology.

DESIGNING TO MINIMISE COST AND MAXIMISE EASE OF USE

The MAC 6400 electro-cardiogram machine was one of GE Healthcare's most celebrated products designed in India specifically for the domestic market. The MAC6400 electrocardiogram machine incorporated a number of features to increase its usability and overcome challenges specific to the Indian market. For example, to cope with inconsistent or non-existent power supplies, the device was battery-powered; to reach more patients, it was light-weight and easy to move; to keep costs down and make it more serviceable, it was made of commercially-available components, such as thermal printers used for bus ticket machines.

GE Healthcare's ECG machine was first launched in 2007 and went through several iterations over time. During this period, GE has learnt to be closely attuned to the changing behaviour and preferences of end-users.

In an early version, developers sought to make the product more affordable by removing high-end technology that helped to interpret patient results. But the end users of these products, who were largely healthcare workers in rural areas with limited experience managing heart conditions, were less likely to know how to interpret the machine's readings. GE Healthcare responded to this discovery by making the product easier to use for minimally trained healthcare workers. This involved adding a feature that could detect whether the patient was having a heart attack. While the MAC 6400 is no longer in use, it has been replaced by a newer version of the product – the MAC 600.



INNOVATING FOR INDIA AND THE WORLD

GE Healthcare's investments in research and development in India is a commitment to producing for one of the world's largest, fastest-growing markets. However, these investments are also made with other markets in mind. Given the fast growth of healthcare markets in the developing world, high-quality, affordable medical devices developed in India can also be exported to other developing markets.

India's large pool of highly-educated engineers and the capacity to test products quickly in a very large, highly diverse market makes the country attractive as a destination to design, test and launch frugal innovations. Indian-made GE Healthcare medical devices can now be found all over the developing world due to their low-cost, high-value proposition. GE Healthcare's Lullaby Warmer Prime baby warmer, for instance, was designed at GE Healthcare's Bengaluru facilities specifically for the Indian market, but quickly found export markets in Africa and South America.³⁷ Another example is GE's Revolution ACTs CT scanner – the first 'Made in India' CT. With over 1500 installs across India, South Asia, ASEAN, Asia-Pacific and Latin American markets, it has revolutionised the way trauma, stroke and other conditions are managed in the developing world.

37 Sharma, E., 'GE launches new low cost infant warmers', *Business Today*, 13 December 2013, <https://www.businesstoday.in/sectors/pharma/ge-launches-new-low-cost-infant-warmers/story/201463.html>

7. India's medical device and technology market

The lack of established healthcare infrastructure in many developing countries also creates opportunities for innovation in business processes. Some of these new approaches to healthcare business practices are being exported to developed markets.

For example, Narayana Health has streamlined payment structures in its Cayman Islands hospital targeting American patients (see case study on p.13 for more detail). This is just one example of new approaches to healthcare administration pioneered in the developing world being integrated into a business model targeting a developed market. Frugal business innovations have the potential to create process efficiencies more widely, including in the context of the Australian healthcare system.

India is one of the world's largest and fastest-growing markets for healthcare goods and services. The country has a long tradition of innovation in medical devices and technologies, particularly frugal innovation, and is emerging as a global centre of research and development in medical devices and technologies.

Exporters and designers of medical devices and technologies need to be aware of India both as a source of demand and as a supplier to its domestic market and the world. This section details the main drivers of demand for medical devices and technology in India; the importance frugal innovation plays in meeting this demand; the changing role of the Indian industry in global supply chains; and the growing importance of start-ups.

7.1 Rising income and government spending is driving Indian demand for healthcare

India formally provides universal public healthcare. However, it is poorly resourced compared to developed countries and other developing countries, such as China.³⁸ The public health system is focused on primary-care clinics, with a limited number of secondary and tertiary public institutions in key cities. Most Indians must rely on the private sector for advanced medical care.

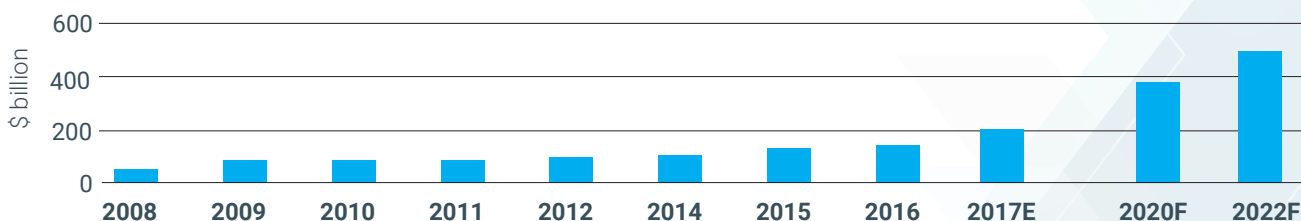
Both public and private spending on healthcare in India is rising quickly from a low base. The sector has grown from \$60 billion in 2008 to \$213 billion in 2017 and is expected to more than double 2017 levels by 2022.³⁹

Rising incomes are a major driver of increased spending on healthcare in India. In 2019, India was one of the world's fastest growing large economies. Over the past decade, per capita GDP has grown at an average of 5.5 percent per year and is now comparable to Uzbekistan.⁴⁰

The growing middle class is leading to higher consumption. Total consumer spending is predicted to quadruple between 2019 and 2030. As tens of millions of Indians enter the middle class every year, they spend three to four times more than they previously did on healthcare goods and services. By 2030, 25 percent of Indians are expected to meet the developed world definition of middle class - a household income of over \$53,000 - creating one of the world's largest middle-class markets.⁴¹

The growth of healthcare spending in India is not just confined to the middle class. Hundreds of millions of Indians who do not yet qualify as middle class are also spending more on healthcare. This is a consequence of rising incomes, but also increased government spending, albeit from a very low base. In 2017, the Indian Union Government⁴² introduced a healthcare insurance scheme to cover medical expenses up to \$10,000 for serious illness for India's 100 million lowest income-earning families.⁴³ This improvement in access to healthcare is expected to drive demand for medical devices and technologies that are designed to minimise cost.

Figure 4: India healthcare spending, 2008-2020F, \$billion



E = estimate, F = forecast

Source: Frost and Sullivan, LIS Financial Services, Deloitte, Aranca Research

38 Global Burden of Disease Health Financing Collaborator Network, 'Past, present, and future of global health financing: a review of development assistance, government, out-of-pocket, and other private spending on health for 195 countries, 1995–2050', The Lancet, 25 April 2019, [https://www.thelancet.com/journals/lancet/article/PIIS0140-6736\(19\)30841-4/fulltext](https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(19)30841-4/fulltext)

39 Indian Brand Equity Foundation, Healthcare, February 2019, <https://www.ibef.org/download/healthcare-jan-2019.pdf>

40 Gupta, P, 'This is the story of India's GDP growth', World Economic Forum, 13 April 2018, <https://www.weforum.org/agenda/2018/04/india-s-remarkably-robust-and-resilient-growth-story>

41 Ojha, N.P, 'How India will consume in 2030: 10 mega trends', World Economic Forum, 7 January 2019, <https://www.weforum.org/agenda/2019/01/10-mega-trends-for-india-in-2030-the-future-of-consumption-in-one-of-the-fastest-growing-consumer-markets/>

42 India is a federation of states. In this report, we refer to the national or federal government of India as the 'Union Government'

43 Bryant, M, 'India seeks to lure medtech to growing market', Medtechdive, 13 February 2019, <https://www.medtechdive.com/news/india-seeks-to-lure-medtech-to-growing-market/547345/>

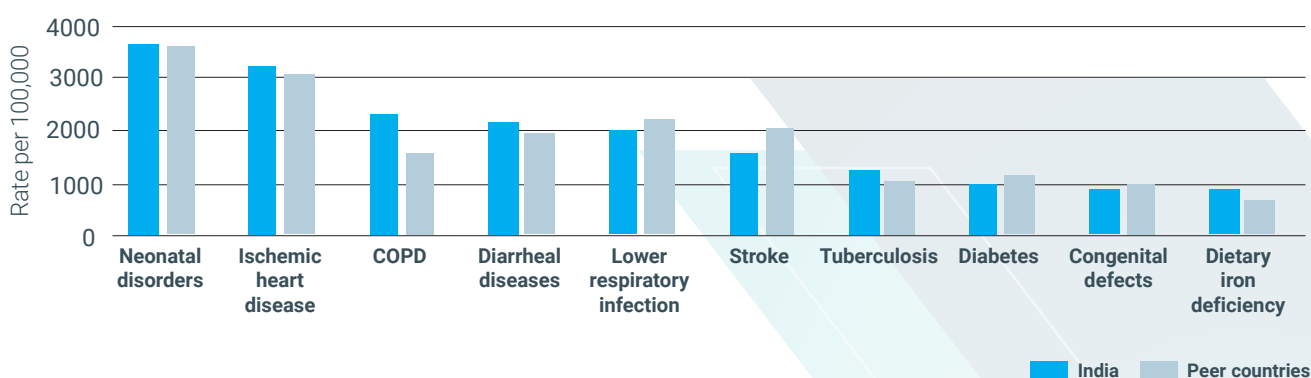
7.2 Cost pressure has driven the evolution of India's medical device and technology industries

Despite rising spending and rapid economic growth, India is still a low-income country with immense healthcare challenges. Healthcare spending is rising from a very low base. India's public spending on healthcare was only 1.4 percent of GDP in 2018⁴⁴ – significantly lower than Australia's at 6.4 percent or China's 2.9 percent (the global average is 6 percent).⁴⁵

The Indian Government's comparatively low spending on healthcare is reflected in the medical device market. India spent \$4 per capita per year in 2015 on medical devices, which is significantly below the global per capita spend of \$63. Developed world countries like the United States and Germany spend \$553 and \$417 on medical devices, respectively.⁴⁶ The Indian medical devices sector is worth approximately \$8 billion. This is less than a quarter of the size of the industry in China, which has a comparable population to India.⁴⁷

India suffers from high rates of infectious diseases, growing prevalence of non-communicable lifestyle diseases, and high infant mortality. Incidence of heart disease in India is increasing alongside other diseases associated with sedentary lifestyles, such as type 2 diabetes. However, the Indian medical system is faced with severe human capital shortages. For example, India needs to increase the current number of practicing cardiologists (4000) by 22 times (88,000) to meet current patient demand.⁴⁸

Figure 5: Causes of death and disability, India and comparable countries, age-standardised rate per 100,000



India's lack of screening facilities has been a major barrier to reducing its relatively high mortality rates from cancer and infectious diseases. Advances in diagnostic technologies has made frugal innovation in this field much more effective. TrueNat, for instance, is a portable point of care diagnostic tool created by Molbio Diagnostics, a Goa-based firm, that detects tuberculosis at much lower cost than conventional smear technologies.⁴⁹ Deployment of this kind of cost-effective diagnostics is central to the Union Government's campaign to eradicate tuberculosis by 2025.

Infant mortality in India is also well above global averages and other developing countries.⁵⁰ One of the reasons is a lack of neonatal care available to the lowest income segments of the population. GE Healthcare developed the Lullaby Baby Warmer to address part of this problem. Cost constraints and limited hospital infrastructure in remote areas mean that many families in rural India do not have access to incubator machines. The Lullaby Baby Warmer is a portable solution that provides all the functions to moderate a baby's body temperature. It achieves this at very low cost and can be powered by batteries, allowing it to reach parts of the country that lack reliable mains power.⁵¹

44 Deloitte, Sustainable Strategies for a Healthy India, <https://www2.deloitte.com/content/dam/Deloitte/in/Documents/life-sciences-health-care/in-lshc-health-in-india-noexp.pdf>

45 OECD, Health Spending, 018, <https://data.oecd.org/healthres/health-spending.htm>

46 Deloitte, 'Medical Devices: Making in India – A Leap for Indian Healthcare, March 2016, <https://www2.deloitte.com/content/dam/Deloitte/in/Documents/life-sciences-health-care/in-lshc-medical-devices-making-in-india-noexp.pdf>

47 <http://www.makeinindia.com/article/-/sector-survey-medical-devices>

48 Parry, N., 'Heart disease is on the rise, but cardiologists in short supply', The News Minute, 12 July 2018, <https://www.thenewsminute.com/article/heart-disease-rise-cardiologists-short-supply-R4637>

49 Lee, D., 'Rapid, point-of-care diagnosis of tuberculosis with novel TrueNat assay', Plos One, 2 July 2019

50 Press Trust of India, 'India had the world's highest child mortality rate in 2015, shows Lancet Study', Business Standard, 16 May 2019, https://www.business-standard.com/article/pti-stories/india-had-world-s-highest-child-mortality-rate-in-2015-lancet-study-119051500263_1.html

51 Jensen, J., 'India's babies get 'bullet-proof' incubators', CNN Health, 26 August 2015, <https://edition.cnn.com/2015/08/25/health/india-bulletproof-incubator-premature-babies/index.html>

7.3 India still imports most medical devices, but it is making more for its own market and for the world

India imports approximately 80 percent of the medical devices it uses (by value). In 2018-19, these imports were worth \$7.9 billion. India's imports of medical devices are heavily skewed to high-value devices, such as diagnostic equipment and instruments. But most of the syringes, needles, catheters, bandages and other low-value, high volume medical devices are produced domestically. Domestic production is highly fragmented, consisting of over 800 firms, most of which have annual turnover of less than \$10 million.⁵²

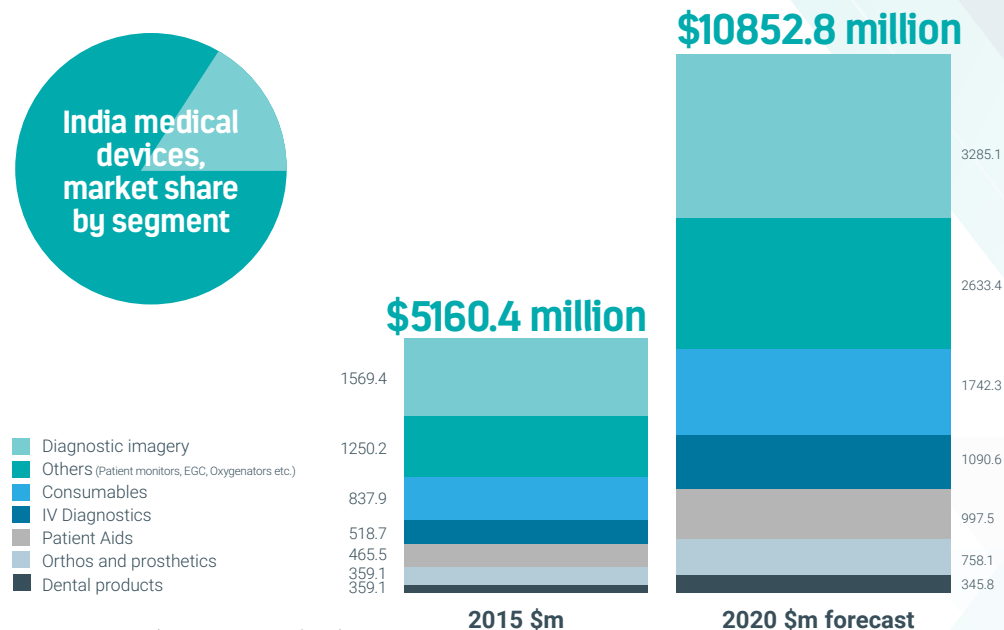
Rising domestic demand for medical devices has attracted international investors. Nearly all the top 40 global producers of medical devices have a presence in India. Some of the largest global corporations, such as GE, Philips and Roche Diagnostics have established research and development facilities in India in order to design devices specifically for the Indian market.

India is becoming a more important part of global supply chains for medical devices as both international and domestic investment grows. Multinational corporations that have invested in research and development in India have recognised that frugal innovations designed for the Indian domestic market are also in demand in other markets—both developing and developed. As a consequence, global corporations increasingly view India as a global hub of innovation and manufacturing as well as a very promising market in itself.⁵³

Policy changes in India are also encouraging investment and facilitating greater participation in global supply chains. Until recently, Indian tariffs on imports of unfinished materials for medical devices were higher than those for finished products, making importing some medical devices cheaper than manufacturing them domestically.⁵⁴ The removal of this distortion, along with the implementation of investment incentives as part of the government's "Make in India" initiative, is encouraging investment in the industry.⁵⁵

Changes in Indian trade and tax policy can also have a destabilising effect on the growth of the domestic medical-devices industry. The Association of Indian Medical Device Industry, for instance, attributes a surge in imports of medical devices in 2018-19 to GST reforms that made imports cheaper. The Association claimed this damaged the growth of sales of domestically-produced medical devices.⁵⁶ Shifting policy on price controls can also be disruptive for international companies seeking to establish stable export channels in India. Price controls introduced on stents in April 2019, for instance, saw a surge in demand for heart procedures which involve stents.⁵⁷

Figure 6: India medical devices, market share by segment



Source: Make in India (Union Government of India)

52 Deloitte, 'Medical Devices: Making in India – A Leap for Indian Healthcare', March 2016, <https://www2.deloitte.com/content/dam/Deloitte/in/Documents/life-sciences-health-care/in-lshc-medical-devices-making-in-india-noexp.pdf>

53 Govindarajan, V., '3 Reasons Global Firms Should Keep Investing in India', Harvard Business Review, 16 February 2018, <https://hbr.org/2018/02/3-reasons-global-firms-should-keep-investing-in-india>

54 Association of Indian Medical Device Industry, Aimed Annual Report 2016, <https://aimedindia.com/comments/activities/details?k=aimed-annual-report-2016-1269046772>

55 SKP Group, 'The medical device industry in India, 2016', https://www.skpgroup.com/data/resource/skp_the_medical_device_industry_in_india.pdf

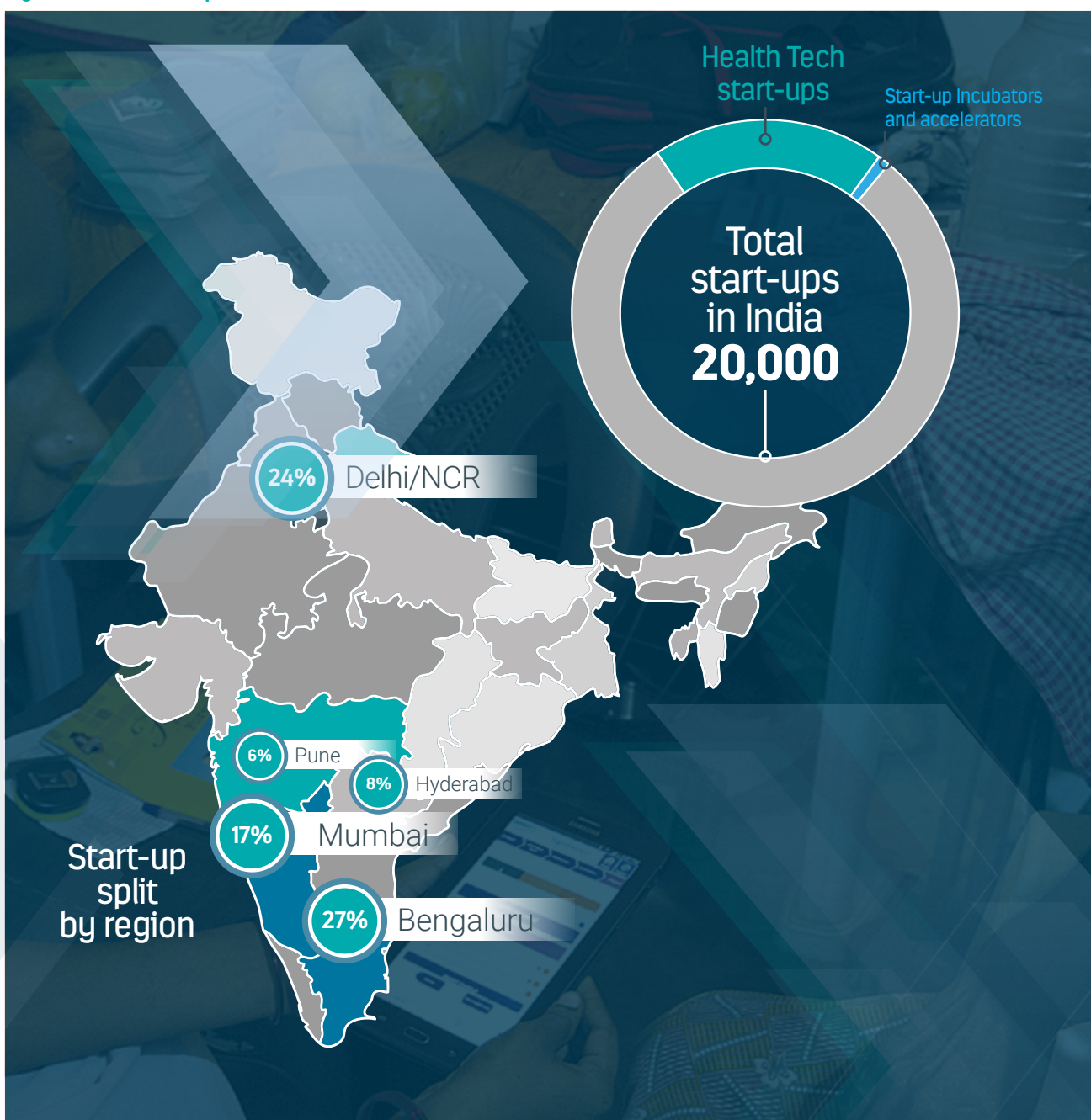
56 Business Today, 'BT Buzz: Make in India flops for medical devices; domestic firms shutting shops to import', Business Today, 24 July 2019, <https://www.businesstoday.in/bt-buzz/news/bt-buzz-make-in-india-flops-for-medical-devices-domestic-firms-shutting-shops-to-import/story/365885.html>

57 Chaudhary, S., 'More patients opted for stents after prices were slashed: study', Livemint, 18 April 2019, <https://www.livemint.com/news/india/more-patients-opted-for-stents-after-prices-were-slashed-study-1555611883274.html>

7.4 Domestic innovation will also be driven by the emerging healthcare start-up ecosystem

The healthcare start-up ecosystem in India is in its infancy, raising just \$672 million in the period between 2014 and 2018.⁵⁸ This is a very small amount when considered against the \$39 billion raised by healthcare start-ups globally in the first half of 2019.⁵⁹ However, this investment in India's healthcare start-up ecosystem has already had a significant impact in developing the innovative solutions to some of India's most pressing healthcare challenges. For example, BeatO, a Delhi-based company, was able to raise \$3.9 million in venture capital to develop a diabetes care management tool which uses a smartphone-based glucometer. This allows patients to keep track of their glucose levels and connect to doctors for real time guidance.

Figure 7: India Start-up Fact Box



Source: Startup India (Union Government of India)

58 Soni, Y., 'Healthcare landscape of India: State of India's Healthcare Startups', inc42.com, <https://inc42.com/features/healthtech-startups-landscape-india/>

59 Tuna, Y., 'Amid vast global divergence, healthcare startups raise over 29 billion in 2019', Equal Ocean, <https://equalocean.com/healthcare/20190729-vast-global-divergence-healthcare-startups-raise-over-usd-29-billion-in-2019>

CASE STUDY: The George Institute SMART_{health} initiative

Australian research institute The George Institute for Global Health (The George Institute) has been active in India for over a decade. It has built expertise in both Australian and Indian primary health care delivery and designed programs that can be rolled out in both countries.

One example of their presence in India is the Systematic Medical Appraisal, Referral and Treatment initiative (SMART_{health}). The initiative enables community workers to screen for cardio-vascular disease through an electronic survey, which frees the time of doctors (who are scarce in India). The initiative is an example of Australian technologies enabling frugal innovation of business processes that makes delivery of primary health services more efficient in India.

IDENTIFYING COMMON CHALLENGES

The George Institute was established in Sydney in 1999 with a mission to improve the health of millions of people worldwide. Key goals of its research program are to transform primary health care to support better health for more people and to find better treatments for the world's biggest health problems. Core to the Institute's values is a humanitarian commitment to tackle the health issues affecting high-risk and disadvantaged people, particularly in low- and middle-income countries.

Early in its existence, The George Institute researchers found that only about half of Australians with cardiovascular disease were receiving all recommended medications. To address this gap, they developed an electronic decision support tool for general practitioners to help detect and manage patients at risk of cardiovascular disease. Around the same time, the Institute was establishing a branch in India. Noticing that India was facing similar challenges at an even larger scale, they began a research project leveraging the expertise of their in-country team to adapt the electronic decision support tool for use in rural communities in India.

“You can’t just take an Australian system and put it in India, that’s not what it’s about. You need to contextualise this” – Dr Ruth Webster, Global Head of Medicine, George Health Technologies

EMPOWERING NON-PHYSICIAN HEALTH WORKERS

Non-communicable diseases, like cardiovascular disease and diabetes, are increasingly common in India. However, the Indian health-care system often lacks the resources to effectively detect, diagnose, and treat these conditions. Primary health centres (PHCs) provide

integrated curative and preventive health care to the rural population and are often staffed by one doctor serving 30,000 people or more. They are supported by 14 paramedical and other staff based at the PHCs. At the village level, front line health care workers called Accredited Social Health Activists (ASHAs) are available, who serve around 1000 people each, primarily providing maternity care.

The George Institute recognised the challenge of effectively adapting Australian technologies to India's severely resource-constrained primary healthcare system. They also saw that providing services where health infrastructure was patchy or non-existent created an opportunity to trial new solutions that maximised efficiency. At the heart of SMART_{health} is shifting as many of the tasks that medical practitioners undertake in Australia to community workers with appropriate support and training.

“There is great capacity for these populations to leapfrog past some of the processes we have in Australia to come up with a better system”

– Dr Ruth Webster, Global Head of Medicine, George Health Technologies

The George Institute anticipated that providing ASHAs with training and tools to identify at-risk patients and refer them to medical professionals had the potential to improve access and quality of healthcare in under-resourced rural communities. In 2013, the Institute began a trial in rural areas of the state of Andhra Pradesh to test the effectiveness of SMART_{health}, a tablet-based app built from the electronic decision support technology piloted in Australia. ASHAs could use the app to generate a patient risk profile for cardio-vascular disease based on a series of questions, a glucometer and a Bluetooth-enabled blood pressure reader.



CASE STUDY: The George Institute SMART*health* initiative

The initiative enables community workers to screen for cardio-vascular disease through an electronic survey, which frees the time of doctors (who are scarce in India).



Results of the trial showed that the use of the tablet-based app has been embraced by ASHAs, who have enthusiastically taken on the additional responsibilities the program requires of them. They have successfully screened over 60,000 community members, identifying over 11,000 people at high risk who were then referred to the doctor at the local primary health centre.

FROM CARDIO-VASCULAR DISEASE TO MENTAL HEALTH

Early successes in the cardiovascular disease trial prompted The George Institute to adapt its SMART*health* service model to other chronic conditions. The SMART Mental Health Programme uses the same principles to address significant gaps in mental health treatment in India, where there is approximately one psychologist per two million people. In a trial involving 50,000 people across 40 villages, ASHAs asked their patients a series of questions which they then entered into an app on a mobile device. This app generates advice on the management of common mental disorders, including whether the patient should be referred to a doctor.

FROM INDIA TO THE WORLD

Following on the success of the trials in Andhra Pradesh, The George Institute is testing the adaptability of SMART*health* to other parts of the world. The trial of SMART*health* in Kabupaten Malang in Indonesia has shown that empowering community healthcare workers to provide initial diagnoses and healthcare advice can be applied in communities with similar healthcare needs but substantially different healthcare systems. By identifying at-risk patients and referring them on for medical attention, the program has succeeded in raising the rate of people receiving appropriate therapy for prevention of cardiovascular disease from 1 to 16 percent.

Dr Ruth Webster, who is the clinical lead for scaleup of the SMART*health* app, emphasised that the data collected by the app can also create efficiencies for health organisations across their operations, noting “just giving them the data gave them the capacity to increase the amount of drugs they bought.” The George Institute is also now investigating using SMART*health* for improving the management of HIV in Myanmar, identifying and managing high risk pregnancies in India, and the management of Diabetes in India and Thailand.

8. Opportunities in India for Australian organisations

India's emergence as both a very-large market for medical devices and technology and a global centre of innovation is creating a range of opportunities for Australian enterprises that develop medical devices and technologies. This section outlines key opportunities for Australian organisations to export medical devices and technologies to India, to work with Indian start-up incubators, and to collaborate with Indian academic and industry partners to commercialise innovations in medical technology.

8.1 Australia's medical devices and technology industries are well placed to capitalise on India's growing market

Australia's medical device and technology industries have developed within and alongside Australia's well-established health system, which is internationally recognised as a provider of high-quality care and as a leader in administrative efficiency.

Medical technologies which save lives by detecting diseases earlier and improving treatments make a major contribution to the very high standard of living Australians enjoy. Over the last two decades, Australians have achieved an increase in life expectancy of 4.6 years. Disability rates have declined by 25 percent and there has been a 56 percent decline in hospital bed days.⁶⁰

The Australian medical devices industry is mature, with a well-established regulatory system, and consists of over 500 mainly small to medium sized enterprises. The total Australian medical device market was estimated at \$6.6 billion in 2018.⁶¹

Australian businesses and organisations engaged in the development and production of medical devices and technologies can leverage their experience operating in Australia's health system to build relationships with Indian organisations involved in the development and production of healthcare goods and services.

8.2 Australian exporters of medical devices and technologies can sell to Indian hospital networks

The Indian medical device industry has expanded at 15 percent in 2018 to reach approximately \$8 billion in 2019.⁶² India is expected to continue to import most of the high-value medical devices it uses over the next decade.⁶³ This will create opportunities for Australian exporters, from producers of diagnostic equipment to electronic health record systems specialists, as India builds new hospitals and clinics.

Some parts of India's public health system offer strong prospects for Australian exporters of medical devices looking for buyers of scale. These areas include India's tertiary healthcare sector, which is dominated by public hospitals integrated into elite universities. However, in most instances Indian private health networks present the most attractive entry point for Australian companies to enter the Indian market.

India's under-funded public hospital system cannot meet the demand for high-quality medical care from the country's expanding middle class and wealthy citizens. This has spurred the growth of several major private hospital networks. The diversity of services offered by Indian private healthcare networks makes them attractive as buyers of scale of a broad range of medical devices. Indian private hospital networks deliver world-class surgery at a fraction of the cost of most hospitals in developed countries. The ability to deliver high-quality health care at low cost has created a quickly growing medical tourism market on top of fast-growing domestic demand.⁶⁴

Indian private healthcare networks are pioneering in aged care, a sector where Australia is recognised as world-leading. This is still a small market, but is expected to grow as demographic pressures, growing wealth and changing cultural attitudes make aged-care facilities and services more attractive to Indian families.⁶⁵ For example, Australian manufacturers of mobility devices and specialised furniture for disabled and elderly people are likely to find more opportunities in India as this industry matures.

⁶⁰ Medical Technology Association of Australia <https://www.mtaa.org.au/industry-statistics>

⁶¹ Export.gov (United States Government), 24 July 2018, <https://www.export.gov/article?id=Australia-Medical-Devices>

⁶² SKP Group, 'The medical device industry in India', 2016, https://www.skpgroup.com/data/resource/skp_the_medical_device_industry_in_india.pdf

⁶³ Prakash, P., 'Indian medical devices industry: Outlook for 2019', *Express Healthcare*, 2 January 2019, <https://www.expresshealthcare.in/blogs/guest-blogs-healthcare/indian-medical-devices-industry-outlook-for-2019/408205/>

⁶⁴ Nishith Desai, 'Investment in Healthcare Sector in India' http://www.nishithdesai.com/fileadmin/user_upload/pdfs/Research%20Papers/Investment_in_Healthcare_Sector_in_India.pdf

⁶⁵ Austrade, *Export Markets: Healthcare to India*, <https://www.austrade.gov.au/australian/export/export-markets/countries/india/industries/healthcare-to-india>

Figure 8: India's major private healthcare networks

Company	Services
Apollo Healthcare	Hospitals (25 hospitals in India, 2 overseas), clinics, pharmacies, insurance products
Fortis Healthcare	Hospitals (22 in India), clinics, research institutes
Narayana Health	Hospitals (23 in India, 1 overseas), clinics, specialty heart centres
Shalby Multispecialty Hospitals	Hospitals (11 in India)

There are strong prospects for Australian exporters of medical technologies in India, both in private and public healthcare networks. Developing electronic health records systems, for instance, is a major priority of Union Government health policy, and is an area where India is looking for solutions beyond its borders.⁶⁶ Information and communications technology systems which can connect rural and remote areas to city-based medical facilities is an area where Australia excels and India has great need. Australian companies are already on the ground in India working with public-health organisations to develop telehealth and data collection services in parts of the country existing healthcare infrastructure struggle to service. Phenix Health, a Queensland telehealth company, has built a strong relationship with a hospital in New Delhi to develop and deliver telehealth services for remote communities.

8.3 SMEs can build relationships with Indian start-ups to enter the Indian market

Large multinational companies have recognised the need to be close to the market in order to succeed in India. They have made major investments in bricks and mortar research and development centres to create products specifically for the Indian market. These kinds of investments are likely beyond the resources and expertise of small to medium size enterprises (SMEs). Australian SMEs seeking to create products for the Indian market can instead build relationships with Indian health technology start-up incubators to overcome the problem of small scale. Bangalore Bioinnovation Centre is an example of an Indian healthcare-focused business incubator open to working with foreign companies to develop products for the Indian market (see case study on p.25)

India has a growing number of start-up incubators with a track record of working with foreign companies to develop healthcare technology solutions for the Indian market.⁶⁷ Social Alpha in Bengaluru, for instance, has assisted foreign companies to raise funds, validate their product strategy and develop and execute an Indian market strategy.⁶⁸ Hemex Health, an American healthcare research firm, is working with Social Alpha as part of the Malaria Quest, Tata Trust India Health Fund's strategy to end malaria transmission in India by 2030.⁶⁹

⁶⁶ Srivastava, S.K, 'Adoption of Electronic Health Records: A Roadmap for India', *US National Library of Medicine*, 22 October 2016, <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5116537/>

⁶⁷ Srivastav, S., 'India Startup Ecosystem: A Global Growth Story in the Making', *Inc42*, 10 November 2018, <https://inc42.com/features/indian-startup-ecosystem-a-global-growth-story-in-the-making/>

⁶⁸ Social Alpha website <https://www.socialalpha.org/approach-to-incubation/>

⁶⁹ EH News Bureau, 'India Health Fund launches its Malaria Quest', *Express Healthcare*, <https://www.expresshealthcare.in/news/the-malaria-quest-is-aligned-with-ihfs-vision-to-foster-innovations-and-support-innovative-products-and-processes-through-comprehensive-support-to-innovators/412539/>

Bengaluru is India's start-up capital

Bengaluru, or Bangalore as it was known until 2014, is often referred to as India's "Silicon Valley". It is the home of a quarter of India's 7000 tech start-ups and is regarded as the third largest hub of start-up activity in the world after Silicon Valley and London.

Bengaluru, which is India's third largest city, has one of the world's most highly-educated populations, which is a legacy of its concentration of educational institutions and scientific and technical industries such as telecommunications, aerospace and defence.

This allowed it to take off as India's major exporter of information technology services in the early 2000s.⁷⁰

More recently, Bengaluru has been recognised as a global centre of innovation, attracting Indian tech giants such as Infosys and Wipro and global companies including Apple, Hewlett-Packard and Lenovo.

The government of the state of Karnataka, where Bengaluru is located, is also a major investor in entrepreneurial activity in the city. In 2017, the World Economic Forum named Bengaluru the world's most dynamic city.⁷¹



⁷⁰ Saraogi, V., 'How the tech city of Bangalore became the Silicon Valley of India', Elitglobal, 17 April 2019, <http://elitebusinessmagazine.co.uk/global/item/how-the-tech-city-of-bangalore-became-the-silicon-valley-of-india>
⁷¹ Hall, R., 'Bengaluru: What's next for India's tech capital?', The Guardian, 3 July 2018, <https://www.theguardian.com/business-to-business/2018/jul/03/bengaluru-whats-next-for-indias-tech-capital>

CASE STUDY: Bangalore Bioinnovation Centre



Bangalore Bioinnovation Centre is a government-funded start-up incubator to support the development of medical technology companies. It is an example of a government initiative to commercialise promising concepts as part of a broader agenda to support India's emerging biotechnology industry.

MAKING KARNATAKA A GLOBAL INNOVATION HUB

Bangalore Bioinnovation Centre (BBC) was established as a joint initiative of the Union and Karnataka State Government in 2015 as part of broader plans to position Karnataka as a global centre of innovation in medical technology. BBC works with companies that have received the Karnataka state government's idea2POC grants to take promising concepts to market. BBC provides companies with state-of-the-art facilities to develop their ideas. Their mentoring program facilitates connections within industry and government to help participants commercialise their concepts.

SUPPORTING BIOTECH THROUGH GRANTS

BBC's investment in next-generation start-ups is already seeing results. It currently has 40 companies participating in the incubator program. 36 companies have already graduated, including Excel Tech, which is pioneering the non-invasive detection of haemoglobin and VNIR technologies, a developer of non-toxic dyes.

One of the current companies working with BBC is Next Big Innovation Labs. With a \$100,000 grant from the Karnataka state government, Next Big Innovation Labs (NBIL) moved out of their founders' garage into BBC in 2017. Here they have developed TRIVIMA, the first Indian-made customisable 3D bioprinter which can print artificial biological tissue for research purposes.

Co-founders Alok Medikepura Anil, Pooja Venkatesh and Piyush Padmanabhan explain how the company is already printing skulls from CT-scans for maxillofacial

surgeons to use for pre-surgery analysis. Artificial tissue printed by their machine will soon be used in pharmaceutical research, dramatically decreasing the costs for Indian researchers previously reliant on imported technologies.⁷²

NBIL has also completed development of a 3D bioprinted skin product called Innoskin, which can replace the need for animal testing. This product is set to launch in the market in 2020, with Australia as an important market for NBIL, given the federal government's anti-animal testing ban that will go into effect starting July 2020. NBIL has ambitions to build a 3D Bioprinting platform that can one day print complete human organs and allow for direct transplantation into patients. NBIL is also a finalist at MedTech's Got Talent 2019 and is looking forward to establishing a strong presence in Australia.

FOSTERING AN INTERNATIONAL INNOVATION ECOSYSTEM

Business incubators are an efficient way to commercialise innovation. They also provide a clear entry point for international companies to engage with domestic markets. This has benefits for start-ups and the host country, which attracts new investment to support economic development and local employment.⁷³

The Karnataka government recognises the potential of foreign entrepreneurs, including Australian entrepreneurs, in growing its start-up ecosystem. Bangalore Bioinnovation Centre has focused on fostering Indian innovation but attracting participation of foreign entrepreneurs in its program is a high priority. The announcement of a partnership with the Victorian state government to hold a medical technology competition is a recent demonstration of their commitment to build connections with foreign governments, institutions and entrepreneurs.⁷⁴

⁷² Lulla, A.B., 'Biotech startup Next Big Innovation Labs takes a big step with govt grants' yourstory.com, <https://yourstory.com/2017/07/next-big-innovation-labs-biotech-startup-3d-bioprinter-government-grants>
⁷³ Blackburne, G.D., 'The business incubator as international market entry mode', Long Range Planning, February 2019, <https://www.sciencedirect.com/science/article/pii/S0024630116302072#bib57>
⁷⁴ MedTech's Got Talent India website <https://docs.google.com/forms/d/e/1FAIpQLSeqTxaElkK4efbg19B4Ghp8Ft39SM2yetGqW9gCqWbaQcMd9A/viewform>

8.4 There are opportunities to work with Indian universities and companies to commercialise research

Australia and India have a long history of collaboration in research across many disciplines. This is based on the strength of Australian research institutions and India's large cohort of well-qualified graduates, including in medical technologies. In recent years, Australian research institutions have focused on building relationships with Indian universities and corporations for the purpose of developing products for the Indian and other international markets. For example, Monash University and leading Indian university IIT Bombay established the IITB-Monash Research academy in Mumbai in 2008. The Academy works closely with Indian industry to develop cutting-edge research into practical solutions to real world problems. The Academy works across several areas of innovation, including on developing new approaches for drug delivery.⁷⁵

Australian research institutions are also finding opportunities to work directly with Indian industry to commercialise research for the Indian and other international markets. The University of Melbourne established a relationship in 2017 with Tata Consulting Services, an Indian multinational information technology and consulting company owned by Tata Group, one of India's largest conglomerates. The arrangement links University of Melbourne to Tata Consulting Services' Academic Co-Innovation Network, which links top universities with India's elite Institutes of Technology, developers and venture capitalists.⁷⁶

Universities around the world have also worked with smaller Indian companies to develop proprietary technologies that they have then taken to market in India. Medical device company Innacel's collaboration with the University of San Diego and Texas Instruments led to the development of its Fetal Lite fetal heart monitor for the Indian market (see case study on p.27 for more detail).

Australian research institutions are also creating pathways for Australian entrepreneurs to adapt their products for Indian markets. The George Institute for Global Health and UNSW Sydney have created Health10x. Start-ups selected for the 20-week accelerator program are taken to India for a week to discuss with Indian health officials and industry experts how their products can be taken to market in India.⁷⁷



CASE STUDY: InnAccel

One of their products, the Fetal Lite, is a machine which detects distress in foetuses. InnAccel recognised that monitoring pregnant women more effectively could reduce India's high infant mortality

⁷⁵ IITB-Monash Academy website <http://www.iitbmonash.org/about-the-academy/>

⁷⁶ University of Melbourne website <https://about.unimelb.edu.au/newsroom/news/2017/october/university-of-melbourne-and-tata-consulting-services-signs-mou-to-boost-innovation-ties>

⁷⁷ 'George Institute and UNSW Founders join hands to build an ecosystem for health innovations', The George Institute, 6 August 2019, <https://www.georgeinstitute.org/media-releases/george-institute-and-unsw-founders-join-hands-to-build-an-ecosystem-for-health>

CASE STUDY: InnAccel



InnAccel is a Bengaluru-based medical technology start-up incubator turned medical device producer. Although InnAccel uses its understanding of local market conditions to innovate specifically for the Indian market, it does this with similar overseas markets in mind.

FROM INCUBATOR TO DEVELOPER

InnAccel began as a start-up incubator but soon realised it could develop products in-house. Established in 2014, InnAccel funded start-ups in the ear nose and throat, maternal care and critical care subsectors before making the transition to medical technology developer two years later.

InnAccel applies the Stanford Biodesign Process it used as an incubator to its own product development. This is a three-stage innovation process which focuses heavily on identifying needs before moving on to design and implementation. InnAccel typically spends eight to nine months uncovering gaps in the Indian healthcare market being created by prohibitive costs. As a consequence, they are patenting products in markets with little existing competition.

INNOVATING FOR INDIA

InnAccel's founders stress the importance of being on the ground in their target market when creating new products. CEO Siraj Dhanani explains that "InnAccel incorporates user feedback at every stage of product development. From initial concepts to prototypes to the final product, product users, typically doctors and nurses, give us feedback and help us refine the product. Such user feedback has been extremely critical in creating products that are user-friendly and intuitive."⁷⁸

In its short time in operation, InnAccel has already designed and launched several products that have made an impact in the Indian market. One of their products, the Fetal Lite, is an a machine which detects distress in foetuses. InnAccel recognised that monitoring pregnant women more effectively could reduce India's high infant mortality. To achieve this, it needed to develop a device that could analyse patients at low cost and could be operated minimal training.

"To do frugal innovation, you need to be on the ground" – A Vijayarajan, InnAccel co-founder

InnAccel combined a thorough approach to market research with research collaboration with international partners in the University of San Diego and Texas Instruments. This allowed InnAccel to incorporate the latest insights in design before taking the Fetal Lite to market. InnAccel has applied the same process of research, innovation and product development to devices ranging from ventilators for intensive care patients to portable cribs for transporting premature babies.

ADAPTING FOR WORLD MARKETS

InnAccel is preparing to launch its products in overseas markets and is currently focused on parts of Africa and Southeast Asia where the gaps in the market for medical devices are similar to India's. The company is also considering adapting their products for developed world markets in Europe and North America and is looking to partner with multinational companies as part of its long-term strategy.

⁷⁸ <https://curiousdose.com/2019/06/medtech-startup-InnAccel-is-revolutionizing-the-indian-healthcare-market-with-innovative-medical-devices/>

9. Conclusion

Australian companies and organisations engaged in the development and production of medical devices and technologies are well placed to meet growing global demand for healthcare solutions. Exporters of medical devices and technologies can expect to continue to find markets in both the developed and developing world.

The rising global demand for low-cost healthcare solutions has created new opportunities for medical device and technology sectors. Frugal innovation in design and business processes, and the incorporation of new technologies, is expanding accessibility of healthcare goods and services that were previously out of the reach of large segments of the world's population.

Frugal innovation was pioneered in developing countries but has expanded to provide healthcare solutions to different markets across the globe. In India in particular, there are a diverse range of opportunities to collaborate with local organisations. These opportunities are both a means of accessing the Indian market and a way to incorporate the insights of a frugal innovation approach into the design of products and services for all markets.

In coming decades, Australian businesses that identify and capitalise on opportunities in the fast-growing Indian market, as well as similar opportunities emerging from other developing markets, can play a leading role in the expansion of better and more affordable healthcare around the globe.

10. Useful resources

10.1 List of industry and support organisations

MTPConnect

Website: <https://www.mtpconnect.org.au/>

Phone: +61 3 9905 1753

Email: info@mtpconnect.org.au

Australian Trade and Investment Commission (Austrade)

Austrade Canberra

Levels 1-2, Nishi Building
2 Phillip Law Street, Canberra ACT 2601 Australia

Tel: 13 28 78

Email: info@austrade.gov.au

Austrade New Delhi

Australian High Commission
1/50G, Shanti Path
Chanakyapuri, New Delhi 110021 India

Tel: +91 11 4575 6200

Austrade Hyderabad

Room 317, Taj Deccan,
Road Number 1, Banjara Hills,
Hyderabad Telangana 500034 India

Tel: +91 40 6611 2250

Austrade Bangalore

Room No 1412, The Ritz Carlton
99 Residency Road
Bengaluru Karnataka 560025 India

Tel: +91 80 4914 8000

10.2 Key information resources

Asialink Business, *Country Starter Pack: India*

<https://asialinkbusiness.com.au/research-resources/india-country-starter-pack>

Austrade, *Healthcare to India*

<https://www.austrade.gov.au/australian/export/export-markets/countries/india/industries/healthcare-to-india>

11. About us

MTPConnect

The Medical Technologies and Pharmaceuticals Industry Growth Centre, MTPConnect, was formed in 2015 to champion the growth of Australia's MTP sector. MTPConnect forges stronger connections between research and industry to help maximise opportunities for Australians to not only make scientific and technological breakthroughs, but to see them developed through the proof-of-concept stage and successfully translated and commercialised.

MTPConnect represents and supports organisations, research entities and governments involved in the research, development, manufacturing or market commercialisation of innovative products along the MTP value chain.

In addition to its Growth Centre activities for the Department of Industry, Innovation and Science, MTPConnect operates two programs for the Medical Research Future Fund: the \$45 million BioMedTech Horizons program and the \$22.3 million Biomedical Translation Bridge program.

MTPConnect's Head Office is located in Melbourne. It has hubs at the University of Sydney's Institute of Biomedical Engineering and Technology, the Harry Perkins Institute of Medical Research in Perth and the Translational Research Institute in Brisbane.

For more information visit mtpconnect.org.au.

MTPConnect Priority 6: Position Australia as a preferred partner for international markets

International markets such as the United States, Europe and Asia present a number of unique opportunities for Australian researchers and developers. Certain healthcare markets (e.g. China, South-east Asia) have particular needs arising out of cultural, regulatory, demographic and resourcing differences. These may arise in the clinical setting, for example, due to differences in resources available to meet care needs, or in particular therapeutic areas as a result of regional diseases. Australia can address these needs by understanding these differences and tailoring R&D and product development to meet them. In addition, the increasing integration of many developing markets into the global economy introduces new global biosecurity threats which Australia is well positioned to play a role in managing. Success overseas will not only bring direct revenue to Australia through licensing or distribution deals, but it will also open up new partnerships for research or investment.

Source: MTPConnect, Sector Competitiveness Plan 2019, (June 2019), 21.

Asialink Business

Asialink Business is the National Centre for Asia Capability, mandated by the Australian Government to create an Asia capable workforce in Australia. Asialink Business supports organisations nationally to engage with Asia through capability development programs, research and information, and public forums and events.

Working across all sectors of the economy, we design and deliver impactful solutions tailored to our clients' niche Asian growth needs. Our expertise covers all Asian economies and includes extensive experience in assisting organisations expand into Asia. With national representation across Australia, Asialink Business has a highly-skilled team of Asian market and sector specialists, business practitioners, market intelligence professionals and capability development specialists.

Our commercially focused solutions enable our clients and partners to optimise their business with Asia, by accessing customised insights, skills and networks, including:

- Country, market and industry-specific insights and research
- Market development planning and opportunity assessments
- Cultural intelligence, negotiation skills and relationship building to drive business outcomes
- Executive and leadership training
- Business thought leadership
- Asian stakeholder engagement, business facilitation and events.

For more information visit asialinkbusiness.com.au.

Austrade

The Australian Trade and Investment Commission – Austrade – contributes to Australia's economic prosperity by helping Australian businesses and education institutions as they develop international markets.

Together with partners such as MTPConnect and Asialink Business, Austrade's South Asia team is closely engaged with a network of health sector contacts across the region. Austrade draws on this network to help Australian health businesses understand and take advantage of the emerging opportunities arising from the modernisation of the sector.

For more information visit austrade.gov.au.

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13. List of Interviewees

List of interviewees

- **A Vijayarajan**, Founder & CTO, InnAccel Technologies
- **Alok Medikepura Anil**, Co-Founder, Next Big Innovation
- **Dr Devi Shetty**, Chairman Managing Director, Narayana Health
- **Dileep Mangsuli**, CTO, Wipro GE Healthcare
- **Dr Jagadish Mittur**, Start-up and Innovation Cell, State Government of Karnataka
- **Dr Jitendra Kumar**, Bangalore Bio Innovation Centre
- **Dr R A Mashelkar**, former Director General, Council of Scientific and Industrial Research
- **Rajlakshmi Borthakur**, Founder & CEO, TerraBlue XT
- **Sanjay Kimbahune**, Senior Scientist, Tata Consultancy Services – Research & Innovation Lab
- **Shraddha Chauhan**, Incubator Manager (Medtech), IIT Innovation Hub, IIT Bombay Social Alpha
- **Vikraman Venu**, CEO at IKP EDEN; Vice President at IKP Knowledge Park

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