

East Ventures

Genomics: Leapfrogging into the Indonesian healthcare future

White paper
2023

in collaboration with



redseer
Strategy Consultants



Genomics: Leapfrogging into the Indonesian healthcare future

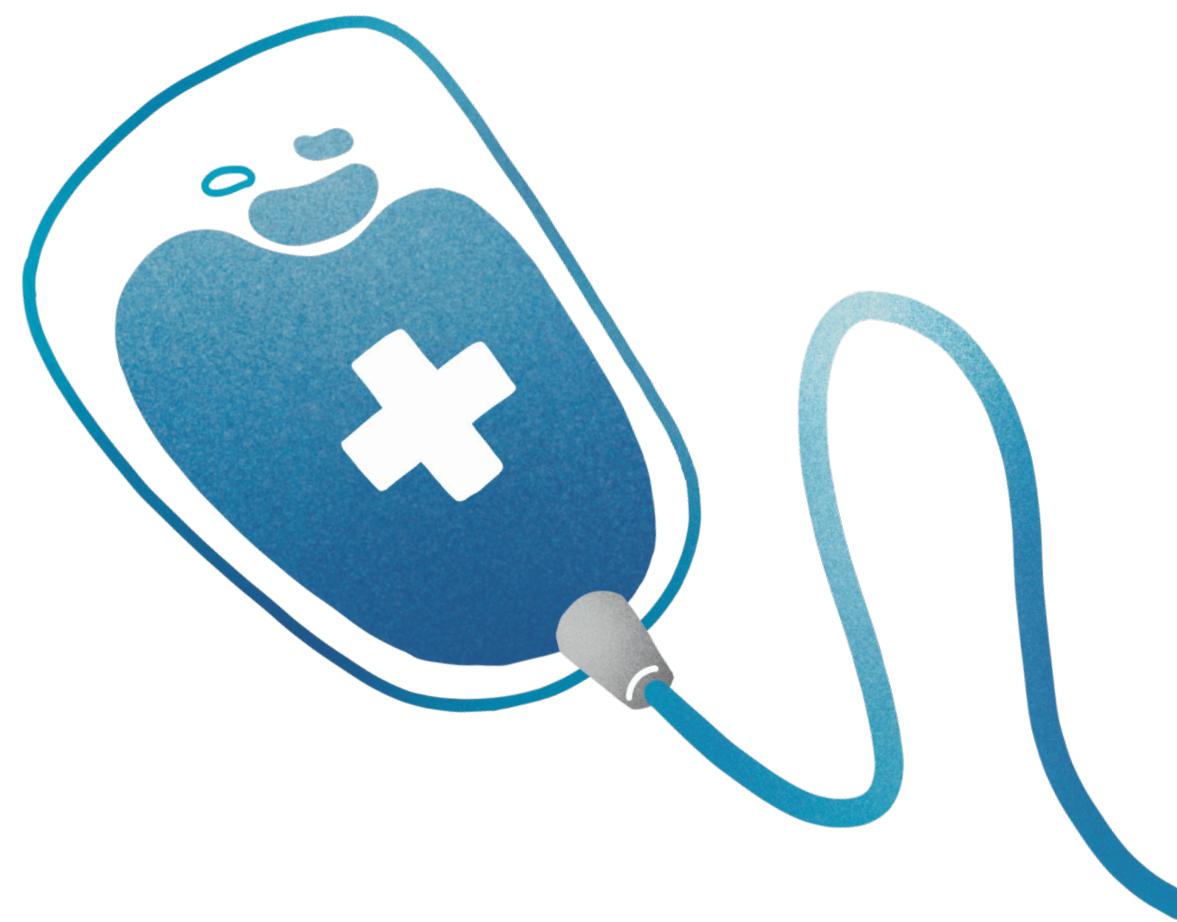
White paper
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East Ventures

www.east.vc

Executive Summary

Indonesian healthcare infrastructure lags behind peers and WHO standards and leaves room for improvement, which combined with systemic illnesses and a population that is set to start aging by 2030 – Indonesia needs to start preparing now:



- Indonesia's population, while currently young, **is expected to age rapidly** and potentially create a burden on the healthcare infrastructure
- The country **needs meaningful infrastructure upgrades**, such as doctors' availability and access to quality beds
- Around 80% of deaths caused by non-communicable diseases are due to five major diseases **which can be addressed by preventive care and precision medicines**
- **Genomics can be an alternative** to help tackle the existing healthcare problems faced by Indonesia and to achieve the essential milestones

Indonesia has just started its genomics journey and is on the right track – and could potentially unlock US\$ 100+ billion worth of economic benefits:



- So far, the Indonesian government has only laid out the **objectives** for their genomics study, which align with their healthcare needs
- While they have established a national body (Biomedical and Genome Science Initiative / BGSi) and have undertaken a few pilot projects with hospitals, **operations need to ramp up**
- The critical next steps to solve for are to create a robust genomics **policy to encourage private participation** and complete their **first genome biobank**
- **Human capital and testing infrastructure** are other critical areas to solve, which can be done by leveraging JVs with international counterparts

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Remarks

Leapfrogging Indonesia's healthcare: The role of genomics in improving medical diagnosis, treatment, and prevention

As the old saying goes, "An ounce of prevention is worth a pound of cure," and this has never been more relevant than in today's world, especially regarding Indonesia's healthcare system.

As we all recall, during the COVID-19 pandemic, Indonesia faced a shortage of doctors, healthcare facilities, test kits, laboratories, and other essential medical materials.

In response to this crisis, East Ventures took action to help people battling the COVID-19 crisis. In March 2020, we supported our Indonesian genomics startup, Nusantics, which shifted the focus of its genome and microbiome research for healthy skin to design first Indonesia's local and licensed test kits for detecting COVID-19, due to the shortage of test kits, through our initiative called **Indonesia PASTI BISA (IDPB)**. We raised US\$ 703,262 and worked with PT Bio Farma to produce and distribute 100,020 RT-PCR test kits throughout Indonesia.

On top of the IDPB Test Kit, there were two other programs of IDPB to tackle the COVID-19 crisis. In May 2020, we initiated IDPB Safeguards Oxygen to provide support for Indonesia's healthcare workers by distributing over 10,000 personal protective equipment ("PPEs") across Indonesia through e-commerce technology. Then in July 2021, we collaborated with our portfolio companies, institutions, and the government to tackle oxygen shortage through IDPB Safeguards Oxygen. We raised US\$ 1,213,354 from 790 individual and corporate donors to donate 1,450 oxygen concentrators to hospitals across Indonesia.

The COVID-19 pandemic has highlighted the inadequacies of Indonesia's healthcare system and infrastructure in handling a crisis of this magnitude. The system still prioritizes treatment over prevention, and as a result, non-communicable diseases are responsible for about 80% of deaths from five major diseases, which cost the government up to IDR 14 trillion last year for treatment.

At East Ventures, we are confident in the potential of genomics technology to revolutionize Indonesia's healthcare system and infrastructure. While genomics-related investment is relatively nascent, East Ventures has demonstrated our confidence in the sector since 2018 through our portfolio of genome sequencing-focused startups like NalaGenetics and Nusantics.

We believe that this technology will be instrumental in improving the medical diagnosis, treatment, and prevention of severe diseases in Indonesia. We will double down on our investments in this sector, as we believe that genomics is leading us to a previously unimaginable frontier – an adaptive and proactive healthcare system.

Our commitment to investing in genomics shows our willingness to take risks and work with stakeholders to accelerate Indonesia's healthcare ecosystem. East Ventures has also been actively supporting the government's Biomedical and Genome Science Initiative (BGSi) development, which aims to integrate

Willson Cuaca
Co-Founder and
Managing Partner at
East Ventures



genomics into health services and bring precision medicine to Indonesia.

Through our **white paper "Genomics: Leapfrogging into the Indonesian healthcare future"**, we aim to share our findings and insights on the potential of genomics in Indonesia and how the government and private sector can collaborate to advance genomics technologies for a healthier Indonesia. The white paper is based on our recent research and study of Indonesia's healthcare system and genomics.

It provides a comprehensive understanding of how genomics can improve the healthcare system in Indonesia and serves as a guide for stakeholders in taking the necessary steps to improve our healthcare system and infrastructure for the future.

Remarks

Congratulations on the launch of the highly-anticipated white paper titled "Genomics: Leapfrogging into the Indonesian healthcare future."

Indonesia has rich genomic diversity that spans over 17,000 tropical islands, divided by the Wallace and Webber lines, separating flora and fauna on the Sunda Shelf with the further east of Indonesia. The sheer amount of genomic variation in this country is staggering, and it presents unique challenges as well as opportunities, including in the field of medicine.

The state of healthcare in Indonesia today still lags behind its peers in terms of healthcare expenditure and life expectancy. With a rapidly aging population, immediate planning and action are necessary to ensure access to effective and efficient medical treatment for all. This is where the field of genomics and precision medicine comes into play, offering a transformative approach to diagnosing and treating patients that takes into account the unique genetic makeup of each individual.

The need for innovative solutions to our healthcare challenges has never been greater, and this white paper represents a major step forward in our quest to revolutionize the healthcare industry in Indonesia and beyond.

This white paper is the result of a collaborative effort between leading experts in the fields of genomics, healthcare, and public policy. It provides a comprehensive overview of the current state of genomics in Indonesia, as well as practical recommendations for how it can be integrated into the healthcare system to improve patient outcomes. It also highlights the urgent need for action to harness the full potential of this exciting field. Furthermore, the data and analyses contained in this paper demonstrate the tremendous economic impacts that genomics could have on Indonesia, potentially unlocking billions of dollars worth of value.

However, we must recognize that Indonesia is still in the early days of genomics, and we must work together to create a roadmap that guides the development of this field. To achieve this goal, we must assemble four key pillars: policy/governance, infrastructure, funding, and human capital. These pillars are crucial to ensure that the benefits of genomics and precision medicine are realized and that the necessary investments are made to support the growth of this important field.

I would like to extend my sincere gratitude to all of the individuals who contributed to this white paper, including representatives from industry, academia, and government. Your dedication to improving healthcare in Indonesia is an inspiration to us all.

Let us all join together to leverage the power of genomics and precision medicine to leapfrog Indonesia's healthcare and improve the lives of millions of people.



Budi G. Sadikin
Minister of Health
of the Republic of
Indonesia



01

Indonesia's Healthcare Landscape



Indonesia's Healthcare Landscape

Indonesia lags its peers in terms of healthcare expenditure and life expectancy — and with a rapidly aging population, immediate planning is of utmost importance

Indonesia, the world's fourth most populous country, faces various healthcare challenges. The country's healthcare system is underfunded and understaffed, lagging behind peers and World Health Organization (WHO) standards. The young Indonesian population will start aging rapidly, and the population above the age of 55 is expected to reach ~60 million by 2030, growing by ~32% from 2022. The healthcare infrastructure needs to evolve rapidly to cater to the growing healthcare needs of the population.

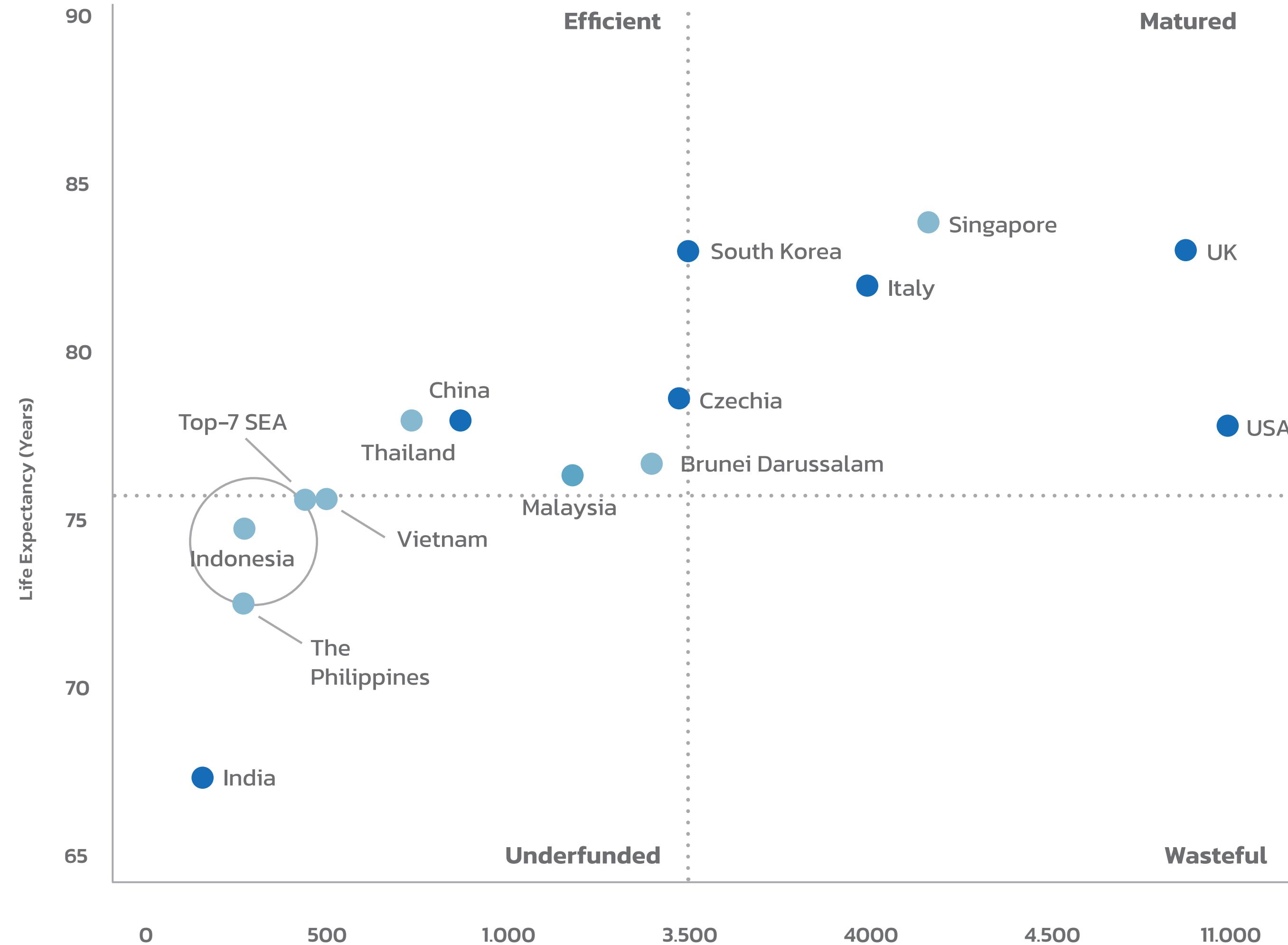
Indonesia has been making progress, and healthcare expenditure is rising at a healthy rate of ~5% between 2016 and 2021. However, compared to other SEA countries, Indonesia still spends less on healthcare, by ~26%. While there is a need to build infra, the same is capital intensive and takes time to show results. Indonesia should take a wholistic approach with a prevention-first approach by driving investments towards solving the prevalent healthcare issues at the root cause of current healthcare challenges and improving overall public health. Further, even the public perception towards healthcare is changing in Indonesia, with spending on preventative healthcare growing by ~22% CAGR between 2016 and 2021. In 2021 alone, US\$ 500 million was spent on medical checkups and immunization in Indonesia.





Indonesia is lagging in terms of life expectancy and healthcare spending, compared to its comparable SEA benchmarks and global average...

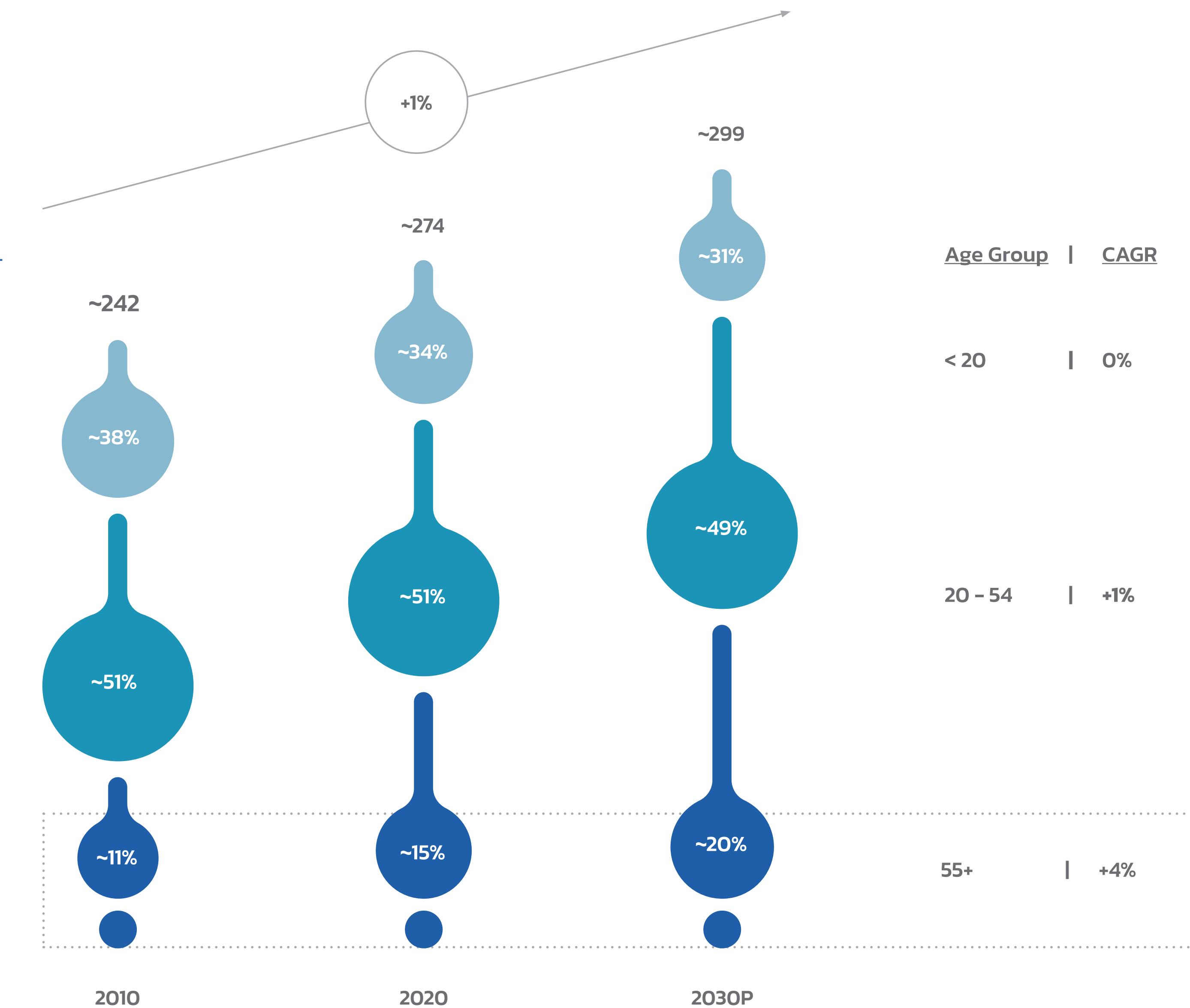
Effectiveness of Healthcare Spending by Country 2020





... with a population expected to age rapidly, preventative healthcare measures are critical

Population Growth by Age Group – Indonesia
Mn, 2010–2030P



Note(s): The chart classification is based on the world's average for the HC spend and Top-7 SEA countries for the life expectancy

Source(s): World Bank, Country Economy, CEIC, BPS, WHO, Government Sources, Secondary Research

Preventive care can drive effective healthcare outcomes

– genomics stands out as a potential solution

Indonesia has one of the highest rates of deaths caused by Non-Communicable Diseases (80%), 7% higher than the global average. Cardiovascular diseases, along with cancer, diabetes, and respiratory disorders, are the leading causes of these deaths. Indonesia also has one of the highest rates of tuberculosis in the world.

The country also has a high incidence of child mortality rate, ~2X that of its neighbor, Malaysia. Respiratory infections, e.g., Pneumonia, have become one of the most significant causes

of children's deaths. The death rate of Indonesia's <5-year-old is alarming (5 deaths per 10k population), higher than Thailand, Malaysia, and Singapore combined.

The country is also seeing a rise in the cases of Antimicrobial Resistance¹, inhibiting the effectiveness of medical treatments. The Ministry of Health recognizes it as a critical area of concern.

Genomics could hold the key to tackling the health concerns of Indonesians as it will enable early detection and provide targeted treatment of diseases.

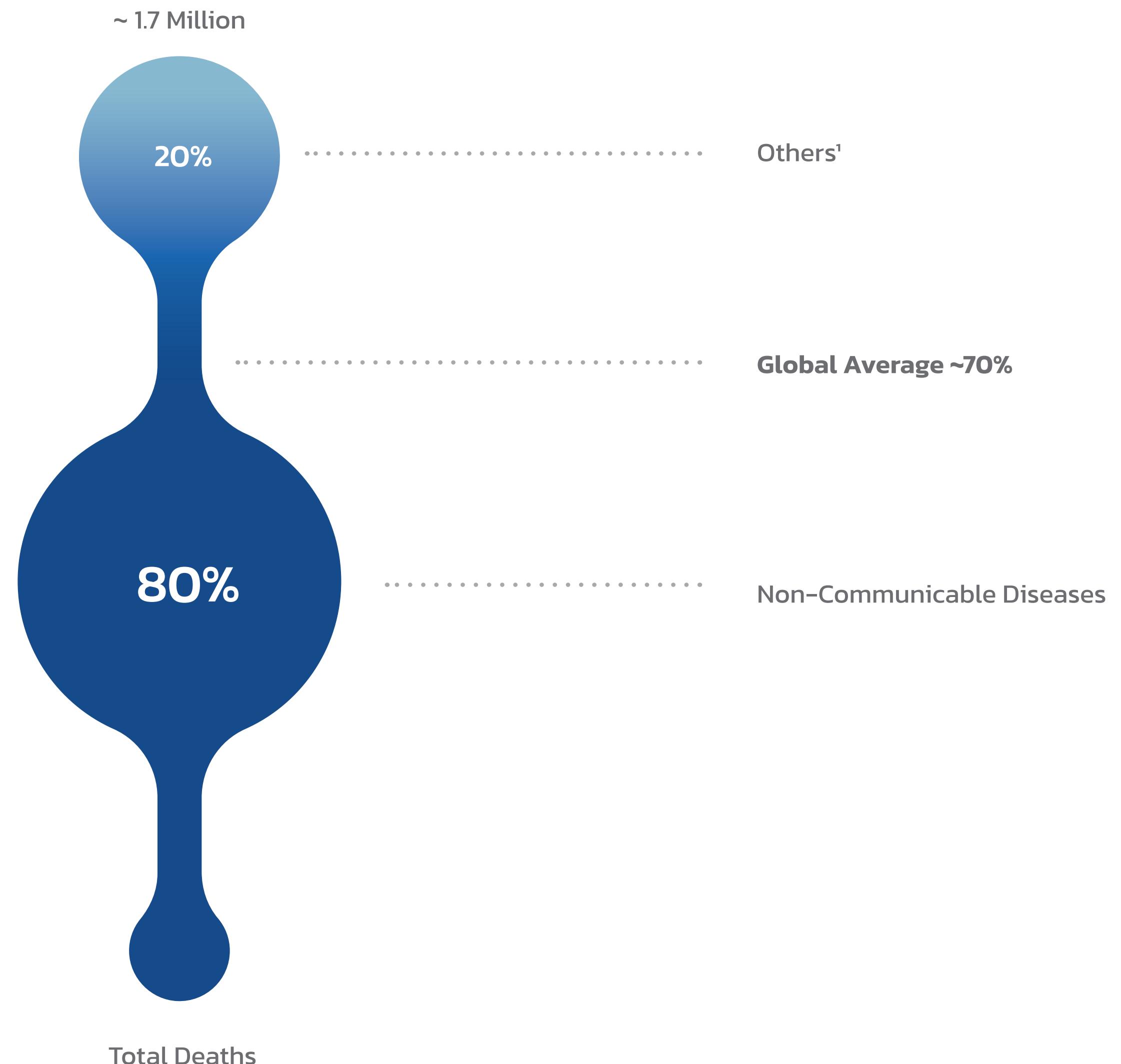




Deaths due to non-communicable diseases and child mortality are at the alarming stage compared to benchmarks, which could have been preventable

Indonesia's Deaths by Cause '000 deaths, 2021

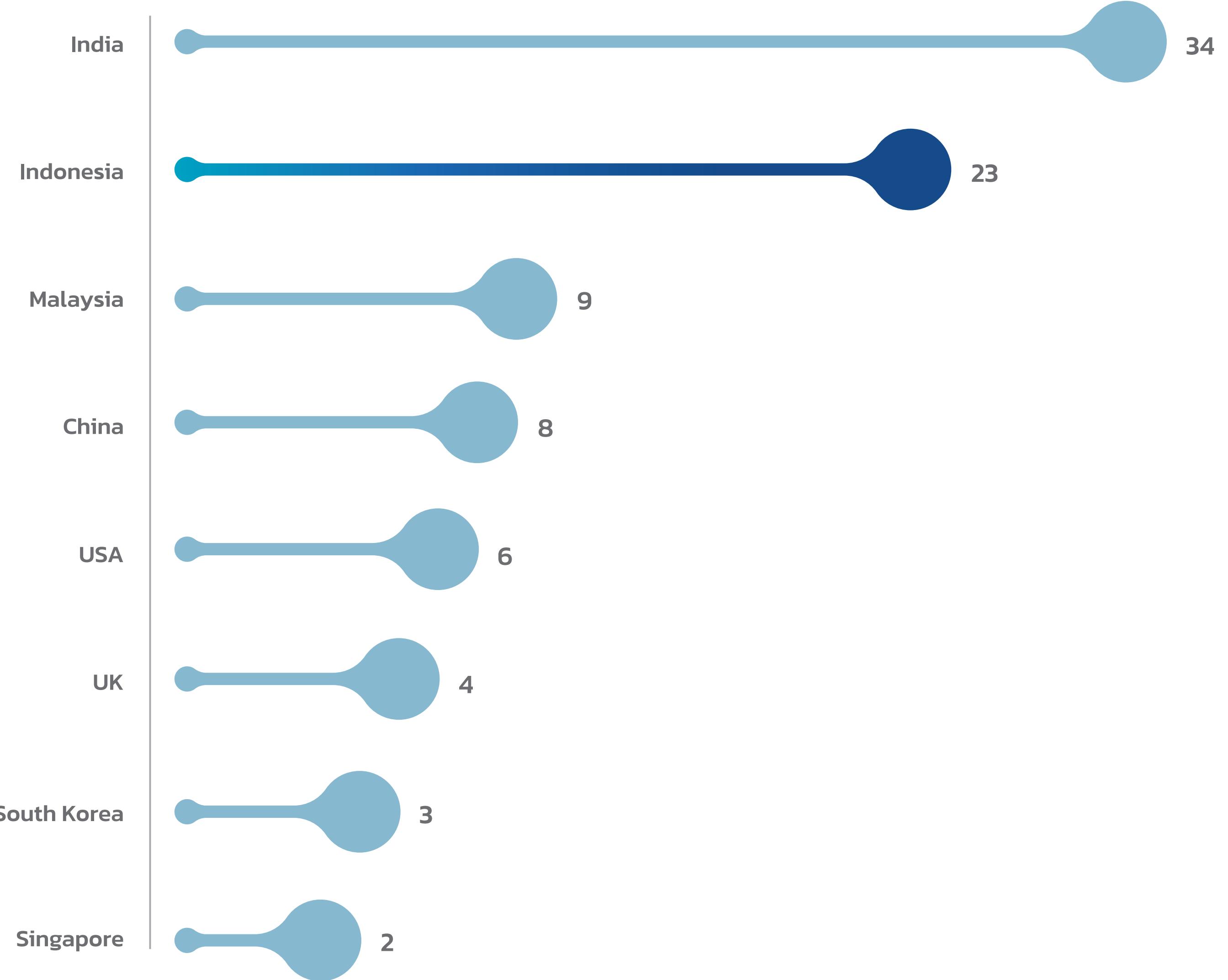
¹According to WHO, AMR occurs when bacteria, viruses, fungi, and parasites change over time and no longer respond to medicines, making infections harder to treat and increasing the risk of disease spread, severe illness and death. As a result of drug resistance, antibiotics and other antimicrobial medicines become ineffective, and infections become increasingly difficult or impossible to treat



Note(s): 1. Others include injuries, communicable diseases, nutritional deficit, etc.

Source(s): World Bank, IHME, Secondary Research, Redseer Analysis

Child Mortality Rate – Indonesia deaths per 1,000 live births, 2019²

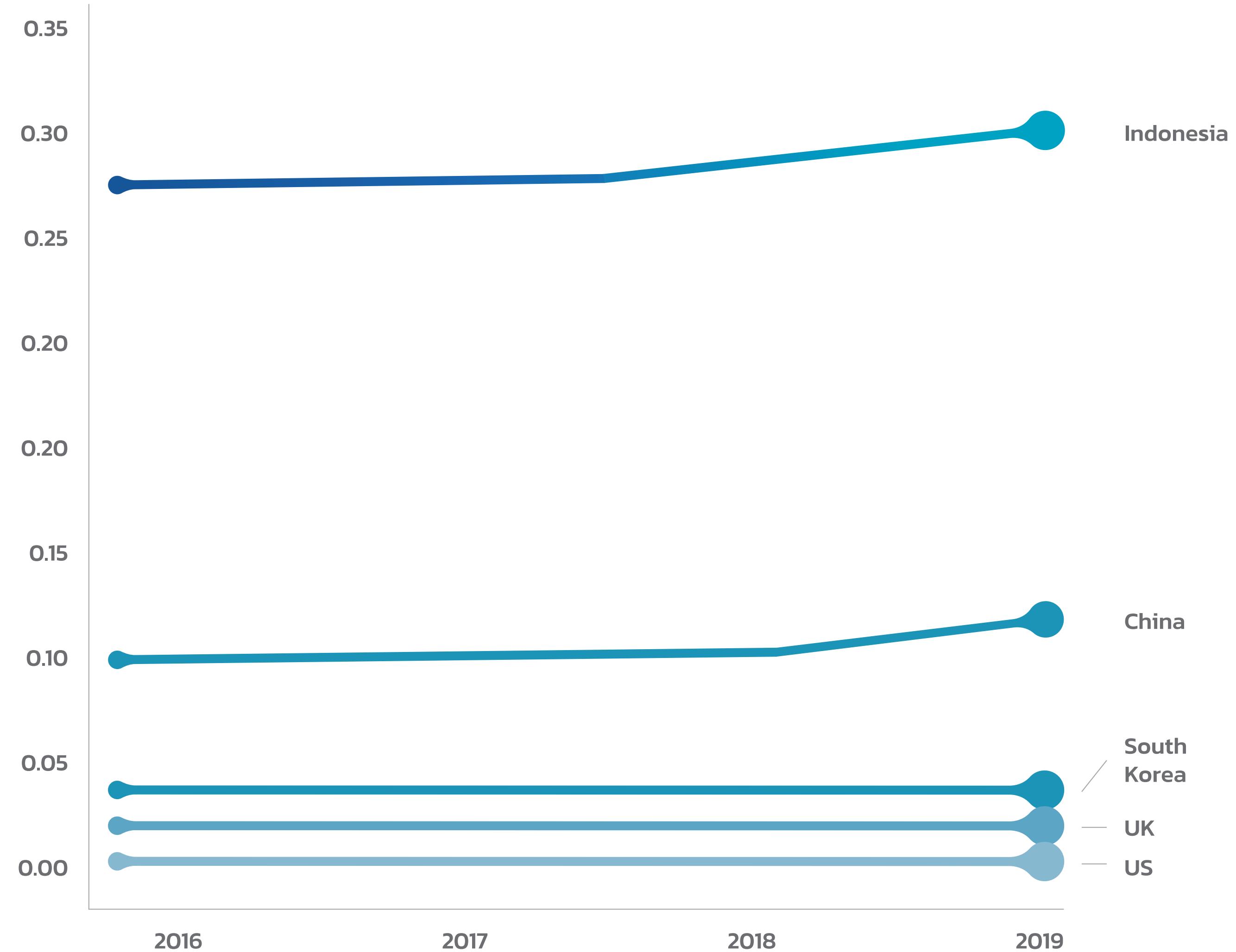


² Data from 2019 are selected to eliminate the anomaly caused by COVID-19 Pandemic



**Similarly, compared to benchmarks,
Indonesia is one of the countries with
high AMR deaths**

Antimicrobial Resistance (AMR) Issue
Deaths per 1 million, 2019²



² Data from 2019 are selected to eliminate the anomaly caused by COVID-19 Pandemic

A close-up photograph of a surgeon's hands wearing white gloves, performing a precise procedure on a patient's skin using a small surgical instrument. The background is a blue surgical drape.

02

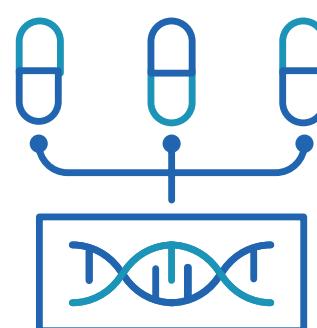
Genomics – a Solution to Indonesia's Healthcare Woes



Genomics – a Solution to Indonesia's Healthcare Woes

Genomics is the study of the genome, which is the complete set of genetic information present in an organism. This includes the sequencing and analysis of DNA, as well as the study of genetic variation and inheritance. Genomics plays a vital role in fields such as medicine, agriculture, and biotechnology, as it can be used to develop new treatments and therapies, improve crop yields, and create new products and technologies. While the field is in nascent stages, its' applications are evolving rapidly, which can transform the healthcare ecosystem.

Genomics could change the status quo of current medical practices



Drug Development

By studying the genetic makeup of diseases, researchers can identify new targets for drug development, which can lead to the creation of more effective and specific treatments



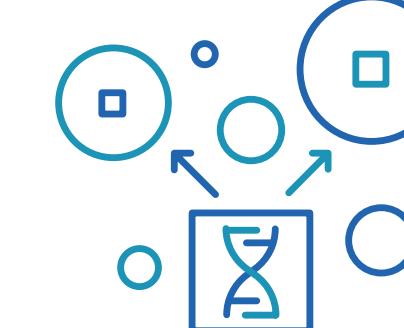
Predictive Medicine

Identifying genetic markers associated with disease risk can help predict which individuals may be more likely to develop certain diseases, allowing for earlier intervention and prevention



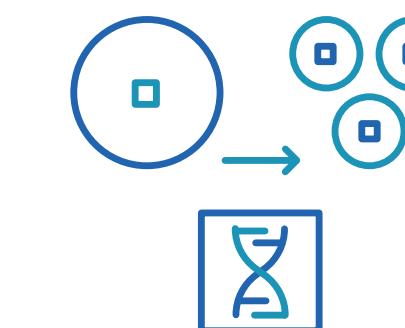
Diagnostics

Genomics testing can identify genetic markers associated with certain diseases, allowing for earlier and more accurate diagnoses



Gene Therapy

Genomics enables the identification of specific errors encoded in our DNA which enables us to design strategies to correct them



Cancer Treatment

By studying the genetic makeup of cancer cells, researchers can identify specific mutations and targeted therapies that can more effectively treat cancer



Personalized Medicine

Doctors can tailor treatments and therapies to their specific needs by studying an individual's genetic makeup, leading to effective and efficient care

Advanced Research

Improved Diagnostics

Improved Treatment

While genomics provides various benefits, there are some ethical matters regarding the data ownership and consent of how the data points are obtained and accessed. These can be mitigated by establishing clear regulatory principles by the central government.

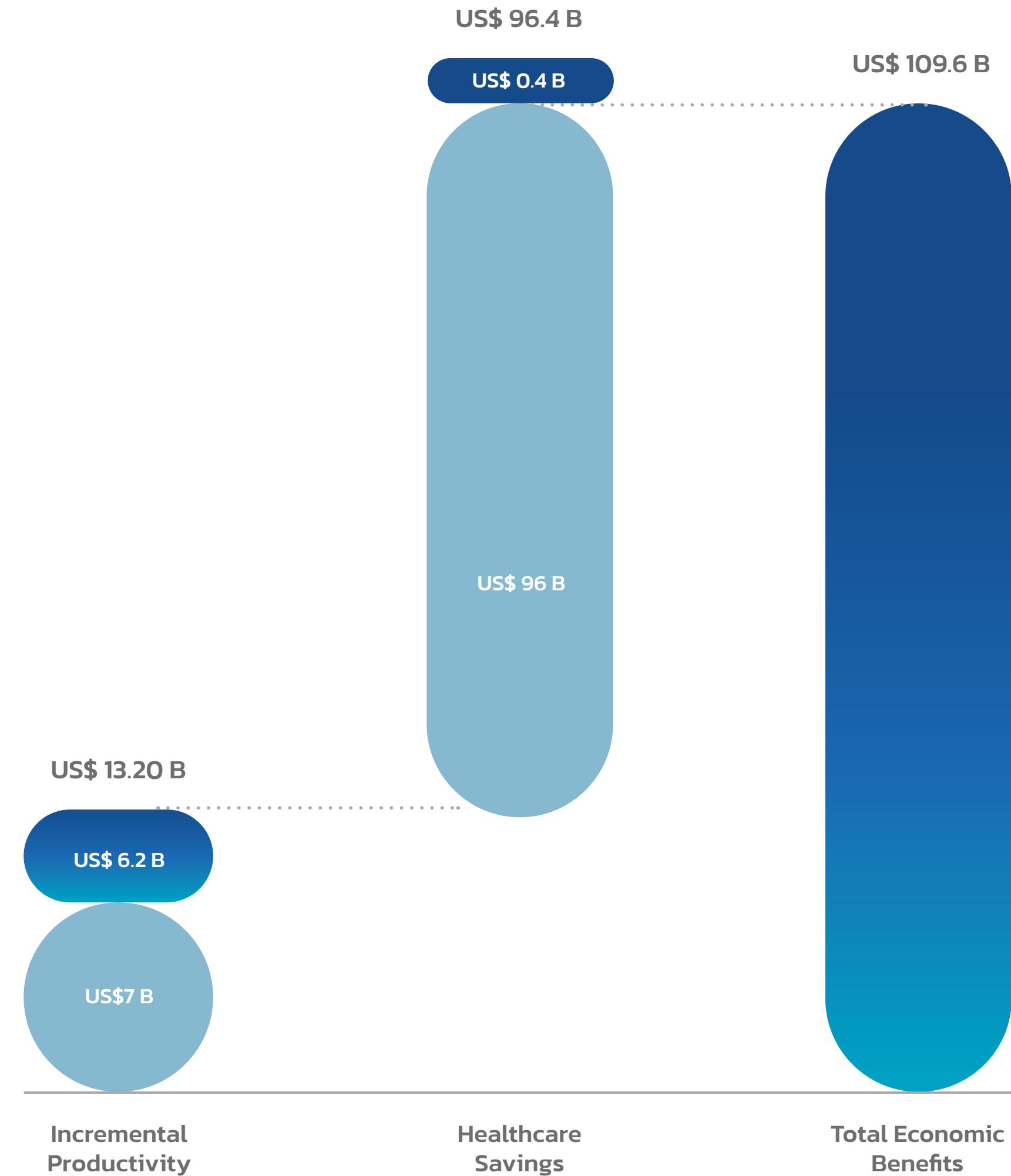


Genomics could potentially unlock US\$ ~110 billion worth of economic impact in Indonesia

Economic benefits from genomics studies Across phases, US\$ billion

- Immediate (Phase 1)
- Potential (Phase 2 onwards)

Genomics has the potential to bring significant economic benefits to Indonesia, in addition to healthcare benefits. Developing a genomics landscape in Indonesia can lead to incremental productivity for patients whose diseases are detected early and who do not have to exit the workforce. Additionally, it can also help drive down overall healthcare costs because of early detection and targeted treatments.



Note(s): 1. For data commercialization and employment generation, numbers pertaining to only phase 1 (immediate economic impact) have been included in the chart

Key Insights

01

Genomics can accrue significant economic benefits to Indonesia apart from the healthcare benefits

02

Development of a genomics landscape can lead to incremental productivity from patients whose diseases are detected early, and they don't have to exit the workforce

03

There are also earnings in the form of new employment generation, monetization of genome databases

04

Lastly, genome sequencing can also help reduce the reactive healthcare spending for patients

05

The rise in investments from private and public markets in companies present across the value chain leads to capital formation. Indonesia would also benefit in the form of FDI and foreign exchange inflow

Source(s): Expert inputs, Desk research

Genomics implementation benefits

Illustrative

Primary Benefits			
A. Economic Benefits	B. Healthcare Benefits	C. Social Benefits	D. Technology Ecosystem Benefits
<ul style="list-style-type: none"> Genomics can help increase productivity for the Indonesian economy by ~\$13.2 billion as early detection of diseases such as cancer, TB etc., will not make people exit workforce Indonesia can immediately earn ~\$1 billion in the form of new employment generation and data monetization opportunities 			<ul style="list-style-type: none"> Genomics can help patients save high costs on healthcare as they spend on targeted treatments for diseases based on DNA studies ~\$96 billion can be potentially saved in the long term by applying genomics on rare diseases as more clinical applications develop Genomics will also help in improving the quality of life and increase life expectancy for Indonesians
Secondary Benefits			
<ul style="list-style-type: none"> Greater awareness levels on ancestry and genealogy for the population. Indonesia is an ethnically diverse country (~1300 micro-ethnic groups), and the information would be useful for the people to trace their ancestry and family heritage The awareness levels towards lifestyle and other genetic-related disease markers would rise significantly. This would help the population take more proactive measures for their health rather than being reactive 		<ul style="list-style-type: none"> Use cases beyond healthcare and medicines such as: <ul style="list-style-type: none"> Agritech (a major contributor to Indonesia's economy) Forensics Development of research talent pool in the country in the form of scientists, healthcare workers, researchers Government can spend more towards the creation of infrastructure away from spending on reactive healthcare 	

Source(s): Ministry of Health, Secondary Research, Redseer Analysis

A close-up photograph of two hands, one light-skinned and one darker-skinned, gently holding a clear plastic test tube with a green cap. The background is a soft-focus view of what appears to be laboratory equipment or a medical setting.

03

Indonesia's Genomics Roadmap



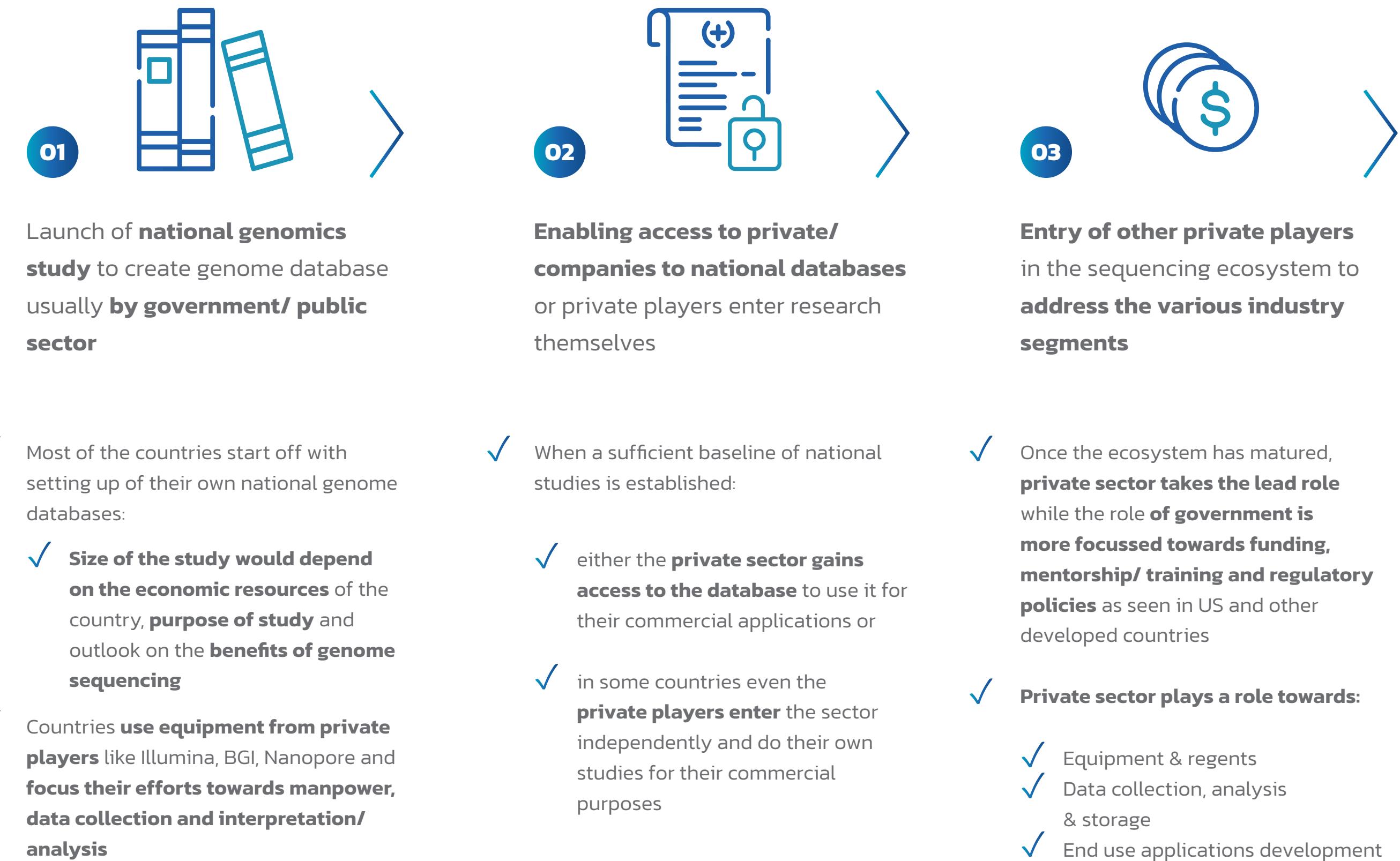
Indonesia's Genomics Roadmap

Indonesia is still in the early days of genomics

As seen across the various genomics roadmaps in multiple countries, genomics applications can be broadly divided into three phases.

Genomics ecosystem transitions through three broad steps with constructive roles played by private and public sector

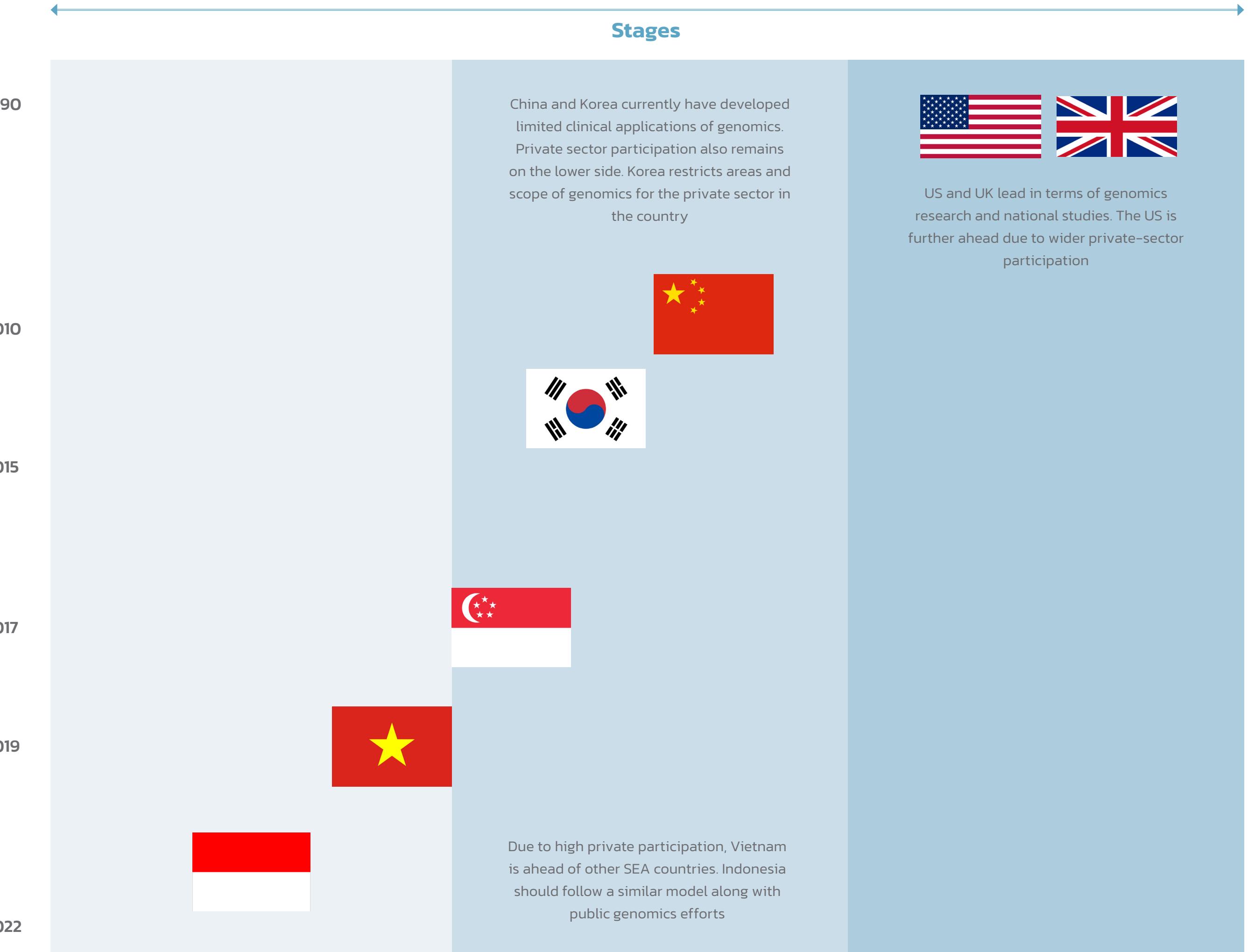
Key steps undertaken to develop a genomics ecosystem in a country





Indonesia is at the very start of its Genomics journey and needs to catch up fast to its peers in SEA

Genome Sequencing Maturity and Age Illustrative



Source(s): Expert inputs, Desk research, Redseer Analysis

Stage 1: Nascent

Stage 2: Growth

Stage 3: Maturity



**While there is a lot yet to achieve,
Indonesia seems to be on the right track**

Key Levers	Current Status
Objectives	Clear plans laid out
Regulatory Framework	Yet to be published, being worked upon
Bio Bank	Plans to sequence 10K data by 2024
Private Participation	Some local companies have started operations
Human Capital	Local universities to develop capabilities and explore partnerships

The government is working closely with public hospitals to promote genomics in healthcare and established the Biomedical and Genome Science Initiative (BGSi) as the leading genomics body of the country, which is responsible for managing the genomics project along with the national biobank and its infrastructure. Some early private players have also emerged in the space, such as NalaGenetics and Nusantics. However, the lack of regulatory clarity is inhibiting the rapid development of genomics in the country, as cited by stakeholders in the space.

Indonesian Genomics Startups Illustrative



Founded in 2016, NalaGenetics provides genetic testing services. The company partners with healthcare providers, laboratories, and patients to provide personalized medications, diet, and screening solutions.

// With appropriate support from the government in terms of an initial roadmap and regulatory framework, the private sector in Indonesia can lead the space and establish Indonesia as a genomics hub in the ASEAN region. Robust funding, the latest technology, and the development of clinical/ consumer focussed applications are the areas where the private sector can lead.

Levana Sani
CEO, NalaGenetics



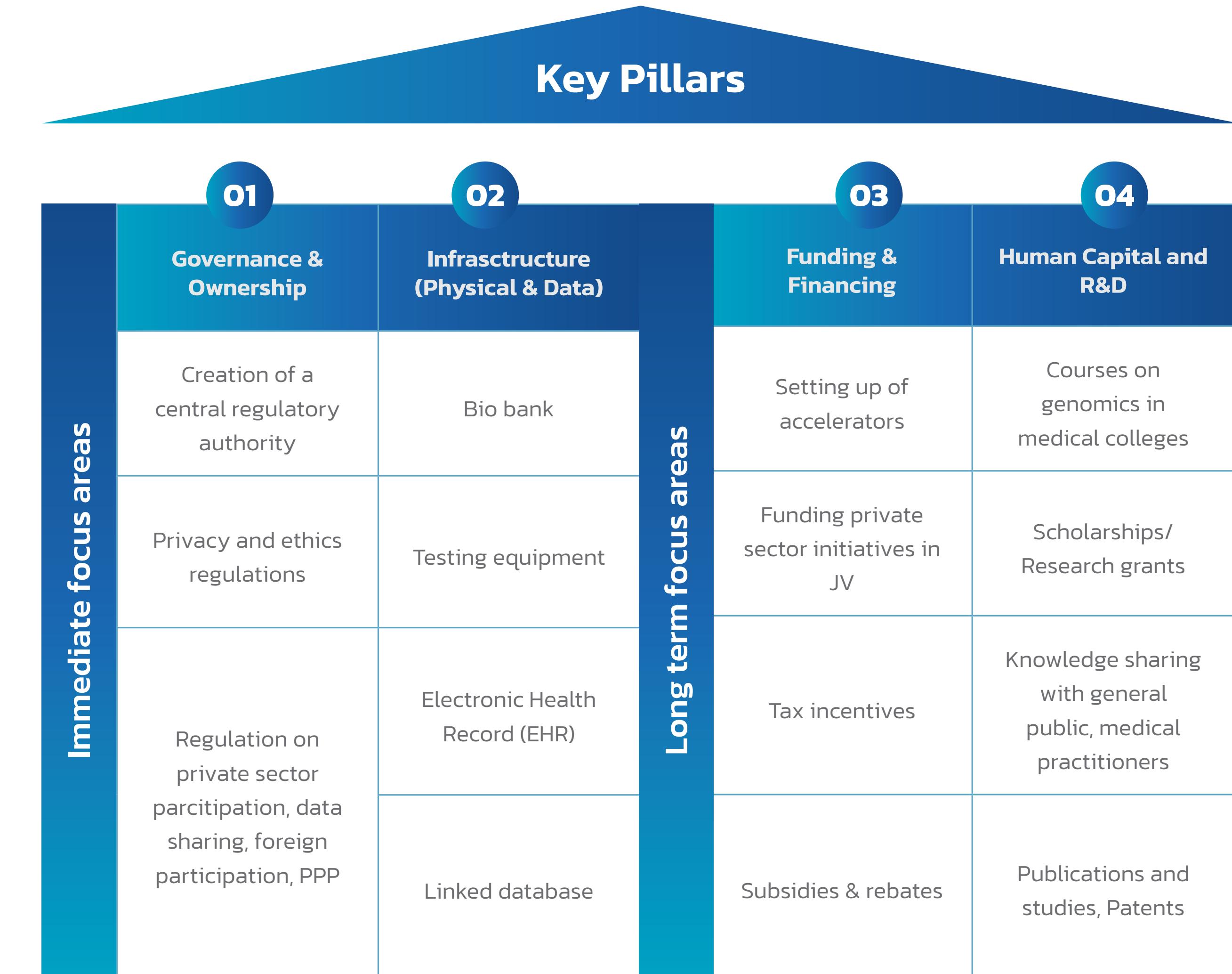
Founded in 2019, Nusantics is a company that provides genomics technology solutions to analyze microbiome profiles. The company undertakes genomics and molecular diagnostics to understand the impact of microbes on human health

// The government efforts on the genomics roadmap would enable greater clarity on policy, faster ethical approvals, and an overall robust regulatory framework making clinical application and research work on genomics efficient in Indonesia. This would enable the private and public healthcare players to unlock the enormous benefits that genomics can provide to the country and its citizens.

Sharlini Eriza Putri
Co-Founder and CEO, Nusantics

As the next steps, the government needs to assemble four key pillars (Policy, Infrastructure, Funding, and Human Capital)

The regulatory framework is the first step towards establishing the genomics ecosystem and addressing the primary issue of private players. Regulations should be mindful of the following:



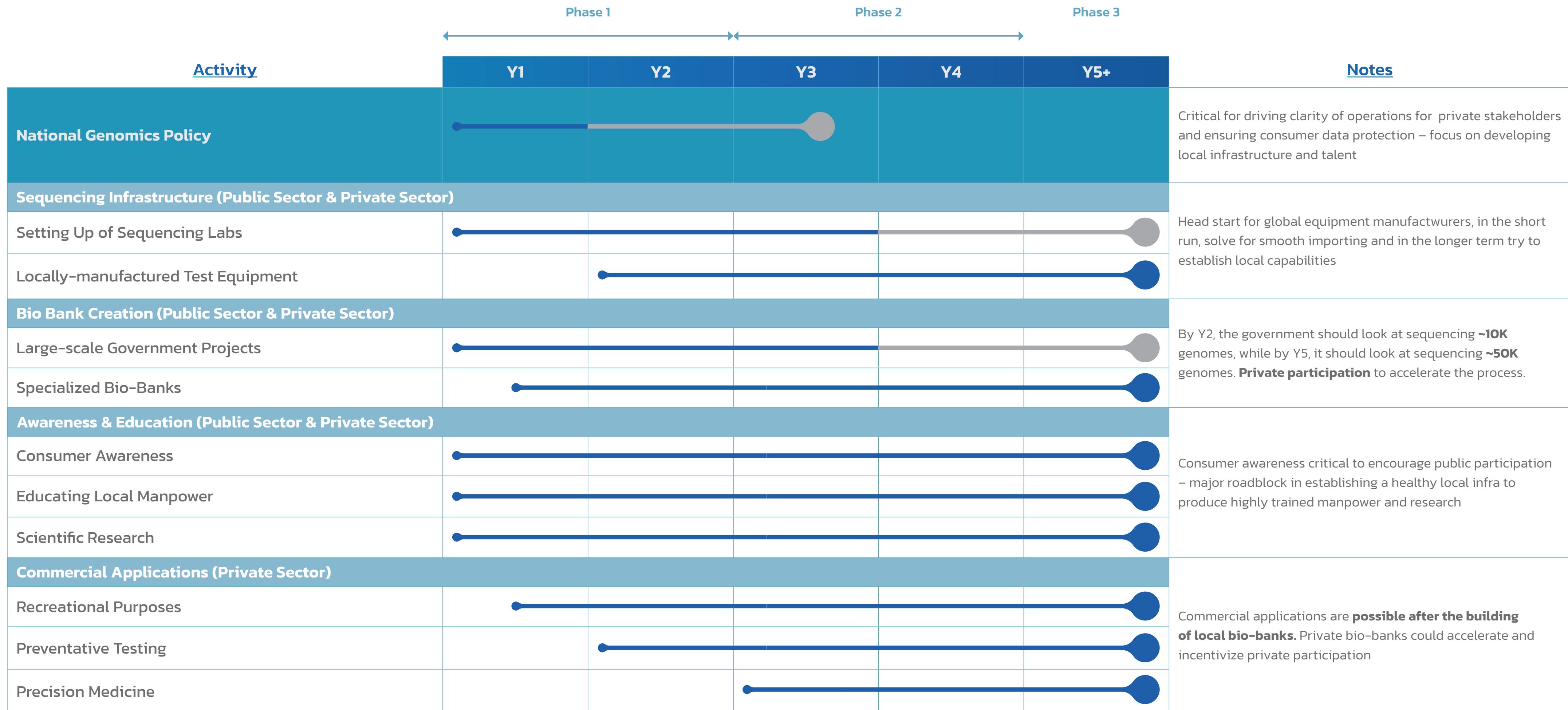
Source(s): Expert inputs, Desk research, Redseer Analysis

...and as the next steps, the focus should be on creating a robust roadmap and policy framework:

	Key Levers	Current Status	Details of Current Plan	Recommendations
01	Governance and Ownership		Regulations on the collection and usage of biological samples exist. Ethical approval needed for clinical trials of genetic data	Regulations required on the following: <ul style="list-style-type: none">• Privacy and ethical use of data• Data management, sharing, storage and processing• Simplification of ethical approvals and other approvals for use of biological samples for clinical testing
02	Infrastructure - Core Technologies		Indonesia has established bio banks and data centers along with other critical sequencing infrastructure such as genome sequencing machines, equipment and laboratories	<ul style="list-style-type: none">• The creation of EHRs is critical to ensure the genomic data and studies can be used for the creation of end-use applications and clinical solutions• Private sector to assist the government in data centers, and setting up of new bio banks while foreign players shall provide sequencing machines and related infrastructure
	Infrastructure - Other Technologies		Very limited participation of government, few private sector players operating in this space	<ul style="list-style-type: none">• The government needs to open the sector to ensure more private and foreign player participation across the genomics value chain, including in analytics, SaaS, equipment, etc.• Support PPP as a viable model for operating in the genomics ecosystem
03	Funding and Financing		No specific funding plans towards the sector	The government needs to actively provide funding solutions , especially in creating an ecosystem wherein the private sector can thrive: <ul style="list-style-type: none">• Expenditure on the creation of critical genomics infrastructure• Providing subsidies and tax incentives to the private sector• Allocation of funds to medical colleges for the creation of human capital
04	Human Capital and R&D		No specific plans for development of human capital	<ul style="list-style-type: none">• Programs and policies for the creation of a talent pool and general awareness• Setting up courses and departments in public medical universities• Investment towards R&D

Genomics Roadmap Timelines

Illustrative





About East Ventures

East Ventures is a pioneering and leading sector-agnostic venture capital firm. Founded in 2009, East Ventures has transformed into a holistic platform that provides multi stage investment, from Seed to Growth stage investments, for over 250 tech companies across Southeast Asia.

As an early believer in the startup ecosystem in Indonesia, East Ventures is the first investor of Indonesia's unicorn companies, namely Tokopedia and Traveloka. Other notable companies in East Ventures'portfolio include Ruangguru, SIRCLO, Kudo (acquired by Grab), Loket (acquired by Gojek), Tech in Asia, Xendit, IDN Media, MokaPOS (acquired by Gojek), ShopBack, KoinWorks, Waresix, and Sociolla.

East Ventures was named the most consistent top performing VC fund globally by Preqin, and the most active investor in SEA and Indonesia by various media. Moreover, East Ventures is the first venture capital firm in Indonesia to sign the Principles of Responsible Investment (PRI) supported by the United Nations (UN). East Ventures is committed to achieving sustainable development and bringing positive impacts to society through its initiatives and ESG-embedded practices.

About Redseer Strategy Consultant

Redseer Strategy Consultants started its journey in 2009. It has emerged as the most reliable, unconventional, and entrepreneurial strategy advisor. With a strong understanding of customers and solid research backed by intellectual property, the company aims to assist passionate leaders who are prepared to take chances, break down boundaries, and create consumer-happy solutions. The company has offices in India, the Middle East, and Southeast Asia. The company has serviced clients in multiple other geographies through its partner networks.

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