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Sustainable Business Opportunities in Asia

June 2017

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June 2017

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Farmers tending pepper in Vietnam. Photo credit: Olam International (Vietnam)

1. EXECUTIVE SUMMARY

Asia's economic transformation in recent decades has been unprecedented in pace and scale. China's economy has grown 10 times as fast as that of the United Kingdom during its industrial revolution and affected 100 times as many people.[1] But headline economic successes such as these mask major fault lines in Asia's development model. The region's future economic growth, stability, and shared prosperity are all under threat from the impact of a swelling list of environmental and social burdens.

Asia is profoundly affected by environmental trends that are challenging resource productivity and future growth worldwide, particularly climate change, loss of biodiversity, and changes in land use. More than 40 percent of arable land in China and India has been degraded due to climate change, local pollution, or topsoil erosion. On the social front, many people across Asia still lack access to basic healthcare, water, and sanitation services. More than 80 percent of Asia's population lives in countries where inequality has risen over the past 20 years.[2] And, in Asia's middle-income countries, the growing burden of non-communicable diseases is eroding gains made with treatments for communicable diseases.

How can Asia's businesses, governments, and leaders of civil society tackle these challenges and maintain the region's economic momentum? This report offers a compelling alternative growth model: pursuing strategies in line with the United Nations' 17 Sustainable

Development Goals, or Global Goals. This model reframes the region's environmental and social threats as growth and development opportunities. It opens up possibilities in 60 sustainable market 'hotspots'. Together, by 2030, across the region they will offer an economic prize worth more than US$5 trillion, and large social and environmental benefits.[3]

The business case for achieving the Global Goals is strong worldwide. But Asia is particularly well placed to reap the collective benefits. It has sturdy, capable businesses with value chains involving millions of enterprises. Many Asian governments are willing and able to shape market activity and investment in a way that achieves broad nation-building goals. In addition, Asian cultures generally value protecting the environment, avoiding waste, and promoting social justice and education. For these reasons, more than 40 percent of the US$12 trillion in business opportunities associated with the Global Goals around the world are in Asia.

Pursuing those opportunities could create almost 230 million new jobs in the region by 2030, equivalent to 12 percent of the Asian labour force. It will spread prosperity in both rural and urban settings, and help to reinvigorate local labour markets, which have not kept pace with the region's economic growth.

Across Asia, business pioneers are already using innovative business models and technology to unlock sustainable opportunities that align with the Global Goals. They are at the forefront of using renewable energy and digital technologies to deliver healthcare and other services. They are leading developers of electric bikes and are poised to shape the electric vehicle market. They are central to the LED lighting revolution. A quiet revolution is leading to the development of more nutritious, safer foods, and agricultural value chains now include methods that make much better use of natural resources. Others businesses can follow the pioneers' lead by incorporating the Global Goals into their core growth strategies, value chain operations, and policy positions, whatever the scale of their business.

Carrying on with business as usual (BAU) will not be enough to deliver all the benefits. Businesses must make sure they create well-paid jobs, conditions, and training. Governments must make sure policies are clear and align with the Global Goals, to avoid the waste, inefficiency, and corruption that ambiguous and contradictory policies encourage in some areas today, e.g. fossil fuel subsidies. And, civil society must ensure that businesses and governments act legally, or lobby for changes in the law and local practices when they fail to combat corruption or protect those hit by rapid and disruptive change.

This report identifies the most significant business opportunities in Asia for pursuing the Global Goals in four industry systems: cities; energy and materials; food and agriculture; and health and well-being.[4]

- **Cities:** By 2030, more than 550 million people are expected to move to cities in the Asia-Pacific region, where they will generate more than 85 percent of gross

domestic product (GDP) and bring the urban share of the population to roughly 44 percent.[5] Reshaping urban housing, infrastructure and mobility systems will unlock opportunities worth US$1.5 trillion in 2030. Among them, finding ways to fill the Asia-Pacific region's affordable housing gap could yield US$505 billion.[6] Improving the design and construction of houses will reduce household operating costs and reshape the world's energy consumption patterns and environmental conditions for years to come. In terms of transport, electric vehicles are projected to reach 35 percent of overall car sales in Asia by 2040.[7] Shared transport business models are particularly promising given the region's rate of urban population growth.

- **Energy and materials:** By 2030, shifting energy and materials systems onto sustainable pathways could generate business opportunities in Asia worth US$1.9 trillion, as well as mitigate local climate risks. The region is expected to account for around 88 percent of the forecast BAU increase in world oil demand – from just under 90 million barrels a day in 2013 to around 109 million in 2035. But Asia is already rapidly shifting to sustainable energy and, as a result, we may see a peak in oil demand by the second half of the 2020s. Asia has installed more renewable power-generating capacity than any other region, a trend that looks set to continue.[8] Wind and solar will account for 35 percent of energy generated in China in 2040, up from 7 percent in 2015.[9] In Southeast Asia, an increase of up to 22 percent is expected over the same period. Related progress on fighting climate change is also large-scale and rapid. Running from 2006 to 2010, China's Top 1,000 Energy Consuming Enterprises Programme encouraged the country's biggest industrial energy consumers to reduce their CO_2 emissions by almost 400 megatonnes – an amount equal to the total emissions of some large nations. The programme contributed as much as 25 percent of the reductions needed to meet China's energy-intensity goal.[10]

- **Food and agriculture:** Cumulative damage to natural resources, combined with increasing local demand for more and different food, has created intense pressure for innovative investment in this area. Agriculture is neglected worldwide, and while it represents 10 percent of global GDP, investment in agricultural technology accounts for only 3.5 percent of global venture capital funds.[11] In Asia, adopting sustainable business models in agriculture and food production, distribution and retailing could produce business opportunities worth US$1 trillion in 2030. Opportunities for improving productivity and expanding production are legion and varied. Reducing the US$260 billion in waste in food supply chains is the largest: up to 37 percent of food is wasted in the region, with up to 90 percent lost post-harvest.[12] Other openings include creating more sustainable growth models for established industries like aquaculture, which is projected to almost double in size in the next 15 years.[13] There will also be opportunities in developing new technologies for projects ranging from the development of innovative microbial fertilisers and new soil regeneration techniques to adding digital features to packaging that guard against counterfeiting.[14]

- **Health and well-being:** Changing population dynamics bring new challenges to Asia's healthcare systems. Increased affluence and less active lifestyles are linked to a rise in the incidence of chronic conditions. More than 190 million people in the region have been diagnosed with type 2 diabetes.[15] A 2014 study shows that 17 percent of boys and 9 percent of girls aged under 19 in rural China were obese, up from 1 percent of children in 1985.[16] And, the population is rapidly ageing. The Asian Development Bank projects that Asia's elderly population could reach 923 million by 2050.[17] These challenges add to existing issues, among them the prohibitive cost of hospital care and absence of feasible insurance products in much of the region, putting operations out of reach for many people. Shifting to more inclusive, affordable healthcare models and developing well-being services tailored to people's changing needs will open up opportunities worth US$670 billion by 2030. Risk pooling to extend insurance and the use of digital technologies to provide services are expected to be the biggest growth areas. Public–private community insurance schemes and microinsurance will be critical to making healthcare affordable and more widely available.

The estimate of a US$5 trillion economic prize for pursuing sustainable business opportunities across these four business systems is conservative. It does not include the additional value that could be released from other sectors critical to sustainable development, including information communication technologies (ICT), education, and consumer goods. Globally, these sectors could add a further 66 percent to the overall US$12 trillion opportunity, identified in the global 'Better Business, Better World' report, while pricing in environmental costs such as climate change could increase the 'real' size of the prize by a further 40 percent.

We estimate that almost US$1.7 trillion is needed annually to develop all the opportunities across these four systems in Asia. At best, the public sector would be able to finance about half of this amount, implying a fourfold increase in private investment. The risk profile of many projects could deter private investors. But this hurdle might be overcome by expanding 'blended financing', where public and philanthropic bodies take on the high risk and more policy-sensitive tranches of an investment, encouraging private investors to fill the remaining gap at lower risk.

Around the globe, the 21st century is acknowledged as the Asian Century, with the region's growing demographic and economic weight shifting the balance of power in Asia's direction. Looming environmental and social challenges threaten to obstruct that trend. By the same token, the Global Goals offer Asia's leaders in business, government, and civil society the chance to consolidate and sustain the region's regeneration. By choosing to pursue the Global Goals, together they can make significant social, environmental, and economic progress in Asia, setting an example for the rest of the world.

Photo credit: Asian Development Bank/Flickr

2. WHY THE UN GLOBAL GOALS MATTER FOR ASIA'S BUSINESS LEADERS

Asia's economic transformation over recent decades has been unprecedented in pace and scale. China's economy has grown 10 times as fast as that of the United Kingdom during its industrial revolution and affected 100 times as many people.[18] But headline economic successes mask major fault lines in Asia's development model. The region's future economic growth, stability, and shared prosperity are threatened by the impact of a swelling list of global environmental and social burdens.

On the environmental front, the world has already 'overshot' four of nine planetary boundaries, with human activity leading to climate change, biosphere damage, changes in land use, and changes in biogeochemical cycles affecting, for instance, water, nitrogen, and phosphorous. It's estimated that more than 40 percent of arable land in China and India is degraded as a result of climate change and erosion.[19] The cost of biodiversity and ecosystem damage could reach 18 percent of global gross domestic product (GDP) by 2050, up from US$2 trillion in 2008, or around 3.1 percent.

On the social front, there remain significant gaps across the region in people's access to basic services such as healthcare, clean water, and sanitation. In many parts of Asia, the

growing burden of non-communicable diseases is eroding gains made with treatments for communicable diseases. World Health Organization (WHO) data shows obesity is increasing in Southeast Asia faster than in either the United States or the United Kingdom. A study by The George Institute for Global Health in 2010 revealed that the Asia-Pacific region is home to 30 percent of the world's smokers, with significant implications for cardiovascular diseases, cancer, and respiratory illnesses.[20] Education systems are failing to give young people access to high-quality education that will equip them for work in the fast-changing economy. According to UNESCO, the Asia-Pacific region is home to 29 percent of the world's out-of-school children of primary school age and 53 percent of its out-of-school adolescents of lower secondary school age.[21]

Many of these burdens, including rising income inequality, are beginning to place constraints on future growth prospects. Asia's rapid economic growth in recent decades has greatly helped to reduce poverty, but it has been accompanied by a widening income gap in many countries. The Asia-wide Gini coefficient (a measure of income inequality) rose at an annual rate of 1.4 percent from 0.39 in the mid-1990s to 0.46 in the late 2000s. Fourteen of 37 Asian economies now have a Gini coefficient of 0.40 or greater (0.40 is widely considered the threshold for 'high inequality').[22]

This report offers a compelling alternative growth model for Asia based on pursuing strategies in line with the United Nations (UN) Sustainable Development Goals, or Global Goals[23] (Exhibit 1). These 17 Global Goals and their 169 component targets – formulated through collaboration with governments, businesses, and civil society – aim to deliver the practical solutions needed to protect the planet's resources and leave no one behind. Setting business strategies and transforming markets in line with the Global Goals will reframe Asia's environmental and social challenges as economic growth and development opportunities. By 2030, this will have opened up an economic prize worth more than US$5 trillion and untold social benefits across the region.[24]

This report is based on research presented in *Better Business, Better World*, published by the Business and Sustainable Development Commission in January 2017. This research identified the 60 most significant business opportunities that relate to pursuing the Global Goals in four industry systems worldwide: food and agriculture; cities; energy and materials; and health and well-being.[25] The research findings and case studies particularly relevant to Asia are presented in this report.

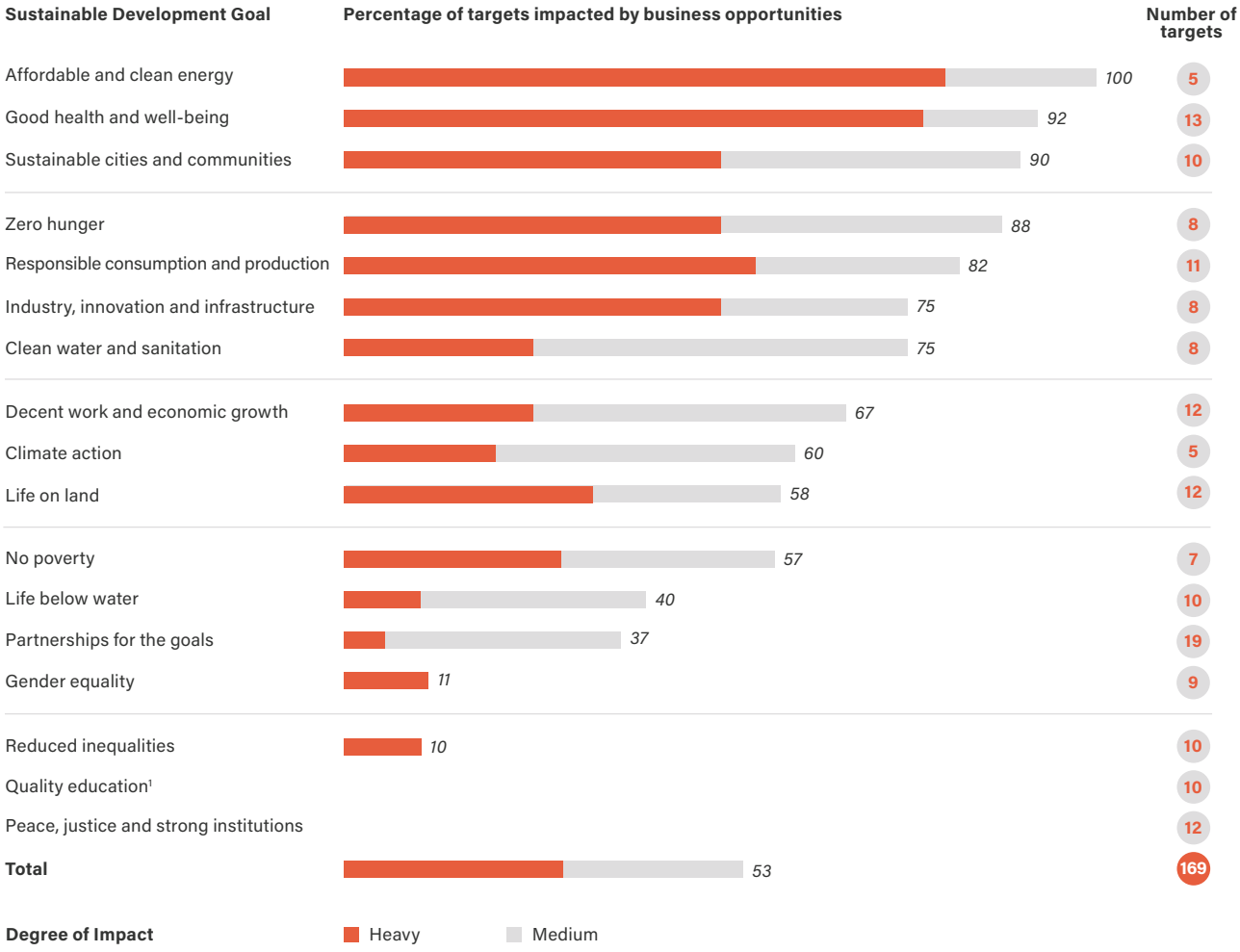
EXHIBIT 1
The 17 Global Goals

Across Asia, many business pioneers are already using innovative business models and technologies to unlock sustainable opportunities that are in line with the Global Goals. They are at the forefront of developing renewable energy and using digital technologies to deliver healthcare and other services. They are the leading developers of electric bikes and are poised to sweep the electric vehicle market. They are central to the LED lighting revolution. Businesses of all sizes can choose to follow the lead of pioneers and incorporate the Global Goals into their core growth strategies, value chain operations, and policy positions.

If businesses do not choose to embrace the Global Goals, the costs of the global burdens described above will continue to grow. This will result in less stable and less equitable societies, an irreversibly damaged environment, and higher political risk. Increased volatility will weaken business conditions and further curtail growth. Governments will be forced to enact strong regulations to try to avert the worst effects of the compounding social and environmental burdens. For these reasons, the private sector cannot afford to ignore the Global Goals. Similarly, the world cannot afford to let the private sector ignore them. Our analysis of the impact of the Global Goals in the four industry systems we studied shows that private sector activity in these areas alone will be crucial to achieving more than half of the 169 Global Goals targets worldwide (Exhibit 2).

EXHIBIT 2

The business opportunities significantly impact more than half of the 169 SDG targets



Source: Literature search; AlphaBeta analysis

[1] Not directly impacted as this analysis covered only four systems: food and agriculture, cities, health and well-being, and energy and materials.

Efforts to achieve the Global Goals in Asia will create 230 million jobs in the region, especially in medium-sized and small enterprises. The following sections of the report detail some of the major market opportunities for sustainable business-led growth in Asia.

Photo credit: Scania Group/Flickr

3. THE MAJOR MARKET OPPORTUNITIES CREATED BY ACHIEVING THE GLOBAL GOALS IN ASIA

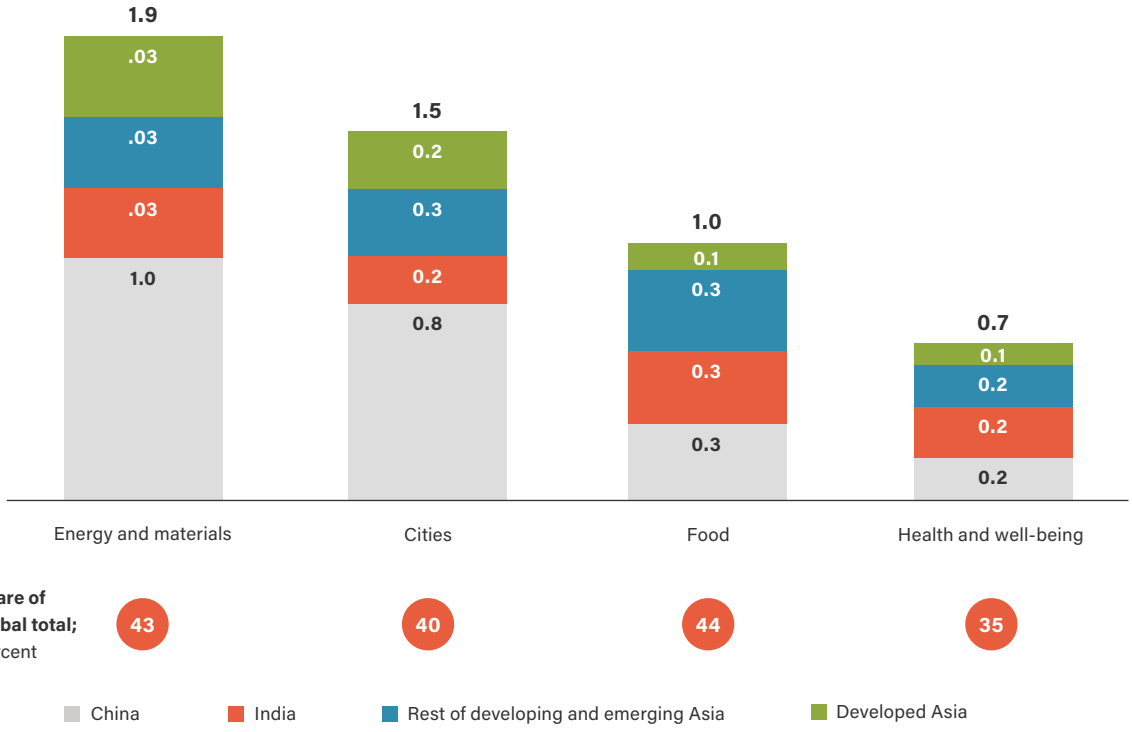
The Asian opportunity

The Business and Sustainable Development Commission has previously identified US$12 trillion in annual business opportunities that will open up for the private sector if it delivers the Global Goals in four systems: food and agriculture; cities; energy and materials; and health and well-being.[26] The potential for change is greatest in Asia, which represents more than 40 percent of this global opportunity, for a potential total prize of more than US$5 trillion. Around US$2.3 trillion worth of the opportunities will be found in China, US$1.1 trillion in India, US$1.1 trillion in developing and emerging Asia, and US$0.7 trillion in developed Asia, which covers Australia, New Zealand, Japan, and South Korea (Exhibit 3 – see Box 1 for an explanation of the methodology).

EXHIBIT 3

The business opportunities identified in four systems alone will be worth over US$5 trillion by 2030 in Asia

Size of incremental opportunity in 2030[1]
US$ billions; 2015 values



Source: Literature search; Alphabeta analysis

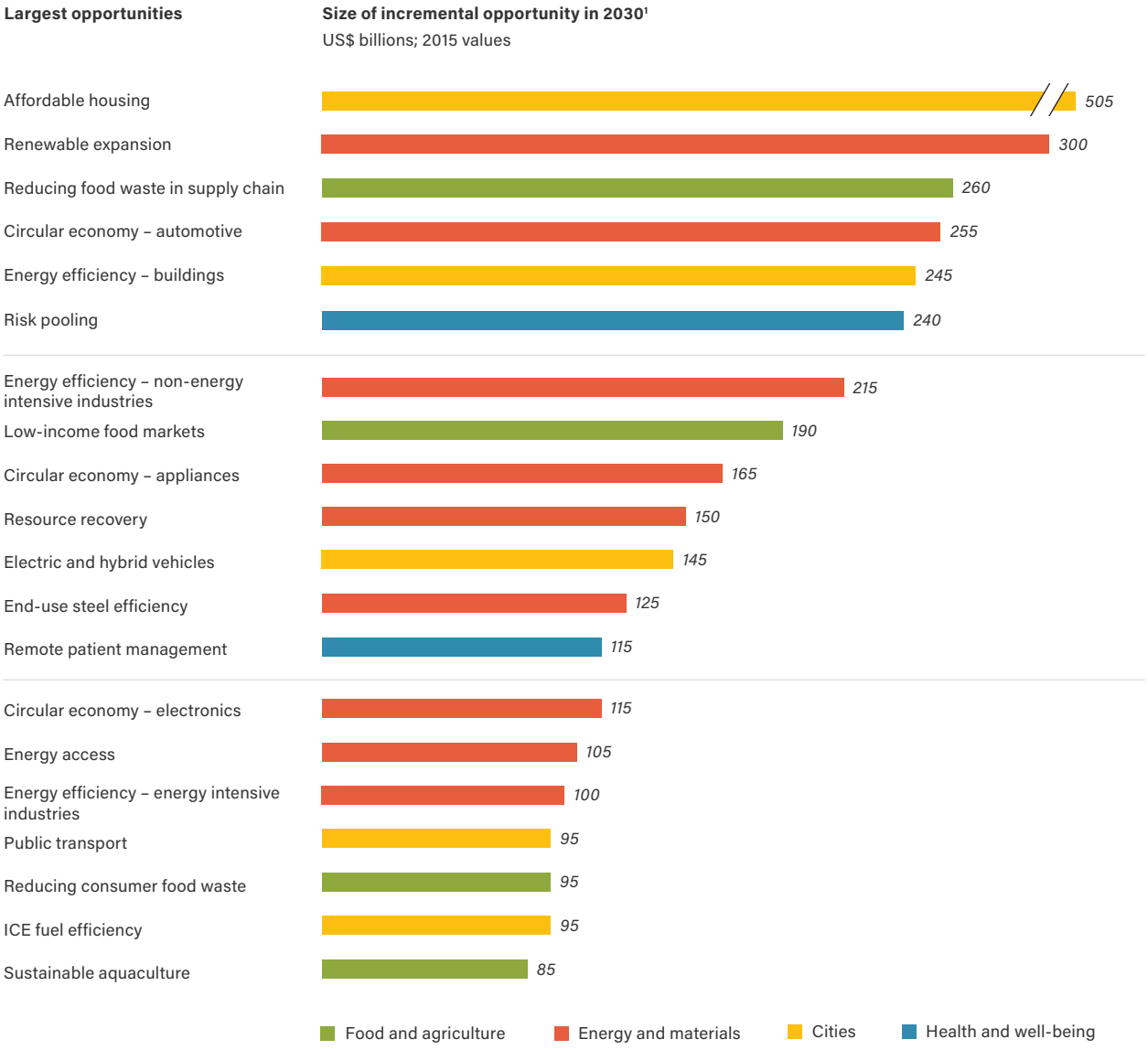
[1] Based on estimated savings or projected market sizings in each area. Only the high-potential opportunity is shown here. Rounded to nearest US$100 billion.

[2] Rest of developing Asia includes Central Asia (e.g., Uzbekistan), South Asia (e.g., Bangladesh), Southeast Asia (e.g., Laos), and North Korea.

The 20 largest opportunities account for more than 70 percent of this prize (Exhibit 4). These are: (1) affordable housing; (2) renewable expansion; (3) reducing food waste in the value chain; (4) circular models in automotive; (5) improving energy efficiency in buildings; (6) risk pooling in healthcare; (7) improving energy efficiency in non–energy intensive industries; (8) low-income food markets; (9) circular models in appliances; (10) resource recovery; (11) electric and hybrid vehicles; (12) end-use steel efficiency; (13) remote patient monitoring; (14) circular models in electronics; (15) energy access;[27] (16) improving energy efficiency in energy-intensive industries; (17) public transport; (18) reducing consumer food waste; (19) fuel efficiency in internal combustion engines; and (20) sustainable aquaculture.

EXHIBIT 4

The 20 largest opportunities account for over 70 percent of the total US$5 trillion prize in Asia



Source: Literature search; AlphaBeta analysis

[1] Based on estimated savings or projected market sizings in each area. Only the high-potential opportunity is shown here. Rounded to nearest US$5 billion.

Distribution of these business opportunities varies across Asian countries and subregions (Exhibit 5). In China and the rest of developing and emerging Asia, affordable housing presents the largest business opportunity, reflecting a large unmet need. In India, risk pooling in healthcare presents the biggest opportunity, reflecting the populations' low health insurance coverage today. In developed Asia, creating closed loop systems in automotive and appliances presents the biggest opportunities, partly reflecting the manufacturing power of Japan and South Korea.

EXHIBIT 5

The main business opportunities vary somewhat across Asia

Source: Literature search; AlphaBeta analysis

[1] Rest of developing Asia includes Central Asia (e.g., Uzbekistan), South Asia (e.g., Bangladesh), Southeast Asia (e.g., Laos), and North Korea.

In the following chapters, we explore some of the high-potential opportunities in each of the four systems.

Box 1. Quantifying business opportunities linked to Global Goals

To understand the business opportunities, we focus on 'industry systems', which we define as areas of economic activity with common value drivers. For example, the food and agriculture industry system embraces all the economic activities that deliver value while providing food to consumers, from fertilisers to farm production, logistics, and retail. We focus on industry systems rather than traditional business sectors because the generally narrower definition of business sectors fails to capture the dynamic changes in the business landscape that pursuing the Global Goals could trigger, particularly in related value chains. Based on criteria including economic impact, geographical relevance, and importance for achieving the Global Goals, we prioritised the following four industry systems:

- Cities (including vehicles and transport-related sectors, housing, construction, and utilities).
- Energy and materials (including mining, oil and gas, renewable energy, power generation, and durable goods).
- Food and agriculture (including food production, fertilisers, distribution, and retail).
- Health and well-being (including pharmaceuticals, primary and secondary care, gyms, and prevention and well-being).

Our research team engaged extensively with industry and academic experts from each industry system, and consulted industry reports and academic literature to identify and estimate the size of the major opportunities for the private sector. They established that these opportunities will be worth at least US$25 billion globally by 2030. Some of the benefits of implementing the Global Goals, such as increased workforce participation through gender equality, are diffused across the economy. We focused instead on areas that generate specific opportunities for business. The opportunities we identified are based on existing commercialised technology, though we note that many important opportunities that relate to the Global Goals will arise from technologies that are not yet known or are embryonic in their development.

The 'size of the prize' figures value the annual opportunity in 2030, calculated in 2015 US dollars rounded to the nearest US$5 billion. The figures are based on estimated savings (e.g., the value of land saved from improving smallholder yields) or market size (e.g., food market demand from low-income consumers who move out of extreme poverty). In each case, we have measured the incremental size of the opportunity in a Global Goal versus a business-as-usual (BAU) scenario. For example, the opportunity to improve smallholder farm yields is calculated as the productivity improvement expected from implementing the Global Goals above that expected in a BAU scenario. The Global Goals scenarios are based on achieving all relevant Global Goals targets and staying on track to keep the rise in the average global temperature at or below 2 degrees Celsius by the end of the century. But they do not build in pricing of carbon or other externalities (except forest ecosystem services, where carbon pricing is a principal revenue source). The BAU scenarios are derived from existing policies and policy announcements. Where possible, we have used multiple sources for each opportunity to generate a range of values. The sizings are estimated from a bottom-up microeconomic perspective and do not take into account interaction and general equilibrium effects.

A. Cities

Challenges in cities

By 2030, 60 percent of the world's population will live in cities, up from about 54 percent today – adding more than 1 billion people to cities over the next 15 years.[28] Over the next two decades, nearly all the world's net population growth is expected to occur in urban areas, with about 1.4 million people – close to the population of Stockholm – added each week.[29] Asia is at the heart of this transformation. By 2030, more than 550 million people are expected to move to the cities in the Asia-Pacific region, where they will create over 85 percent of GDP and bring the urban share of the population to roughly 44 percent.[30]

Urbanisation is a crucial driver of economic growth: no country has ever climbed from low-income to middle-income status without a significant population shift into cities.[31] The reasons include the scale benefits to economies from larger cities, as well as the higher wages that people typically receive as they shift from farming to jobs in urban manufacturing and services. However, urbanisation also poses challenges to the value chains supporting mobility, infrastructure, and housing (Exhibit 6).

EXHIBIT 6
Challenges facing cities towards 2030

Value chain	Global current size US$ billions[1]	Challenges
Mobility	4,000 (automotive)	▪ Congestion in Asia can cost as much as **5 percent** of national GDP, by measures such as lost time, wasted fuel, and increased cost of doing business. ▪ Up to **5 percent** of prime city land is used for parking in Indonesia. ▪ Urban air pollution is projected to become the **top** environmental cause of premature mortality by 2050.
Infrastructure	2,065	▪ Investment of **US$50 trillion** is required globally to build transport systems, telecommunications networks, and water and waste infrastructure, as well as increase energy efficiency over the next 15 years. ▪ Cities account for around **70 percent** of global energy use and energy related GHG emissions. They are also more exposed to the risks of natural disasters, particularly rising sea levels. ▪ Urban sprawl increases costs – it can **double** land used per housing unit, increase the costs of providing utilities and public services by **10–30 percent**, and increase motor travel and associated costs by **20–50 percent**.
Non-residential buildings	2,497	▪ **10–15 percent** of building material is wasted during construction; and **60 percent** of buildings unoccupied during office hours.
Residential buildings	2,997	▪ Over **107 million** urban households currently live in sub-standard housing in China, India, Indonesia, Bangladesh, and the Philippines. There is an affordability gap of **US$295 billion** in Asia.

Source: Literature search; AlphaBeta analysis

- **Mobility:** Rapid growth in car ownership is causing significant congestion in cities across Asia. For example, in China, the number of private motor vehicles rose from 285,000 in 1985 to 123 million in 2014.[32] Congestion is already close to unbearable in many cities and can cost as much as 5 percent of national GDP in lost time and wasted fuel, as well as increasing the cost of doing business, according to the Asian Development Bank.[33] In Indonesia, research suggests that the total time-related cost of commuting in cities is currently IDR 498 trillion (US$37 billion) per year, which could increase by 41 percent in 2020.[34] This congestion has an economic cost not only in lost time and fuel but also in land lost to parking. In Indonesia, more than 40,000 hectares of space is used for parking privately owned vehicles, accounting for 5 percent of land in Indonesian cities.[35] Some 6,645 hectares of this is prime commercial land. This has an implied annual rental value of more than IDR 95 trillion (US$7.2 billion), which could be captured if the land was released for more productive uses. In China, there is an estimated shortage of 50 million car spaces.[36] Congestion also has health implications. In China and India alone, almost 3 million premature deaths each year are attributable to ambient air pollution.[37] Urban air pollution is projected to become the top environmental cause of premature death by 2050.

- **Infrastructure:** Growing cities will require large investments in infrastructure that has a lighter environmental footprint. Ensuring access to clean water and sanitation remains a challenge in the fast-growing cities of the developing world, with almost 20 percent of urban dwellers still lacking adequate sanitation facilities.[38] Cities are responsible for around 70 percent of global energy use and energy-related greenhouse gas (GHG) emissions.[39] Many cities are also highly exposed to natural disasters and growing environmental risks, particularly rising sea levels. A UN assessment found that more than 70 percent of the world's major cities, many of them in Asia, are already highly vulnerable to flood-related mortality and economic losses.[40]

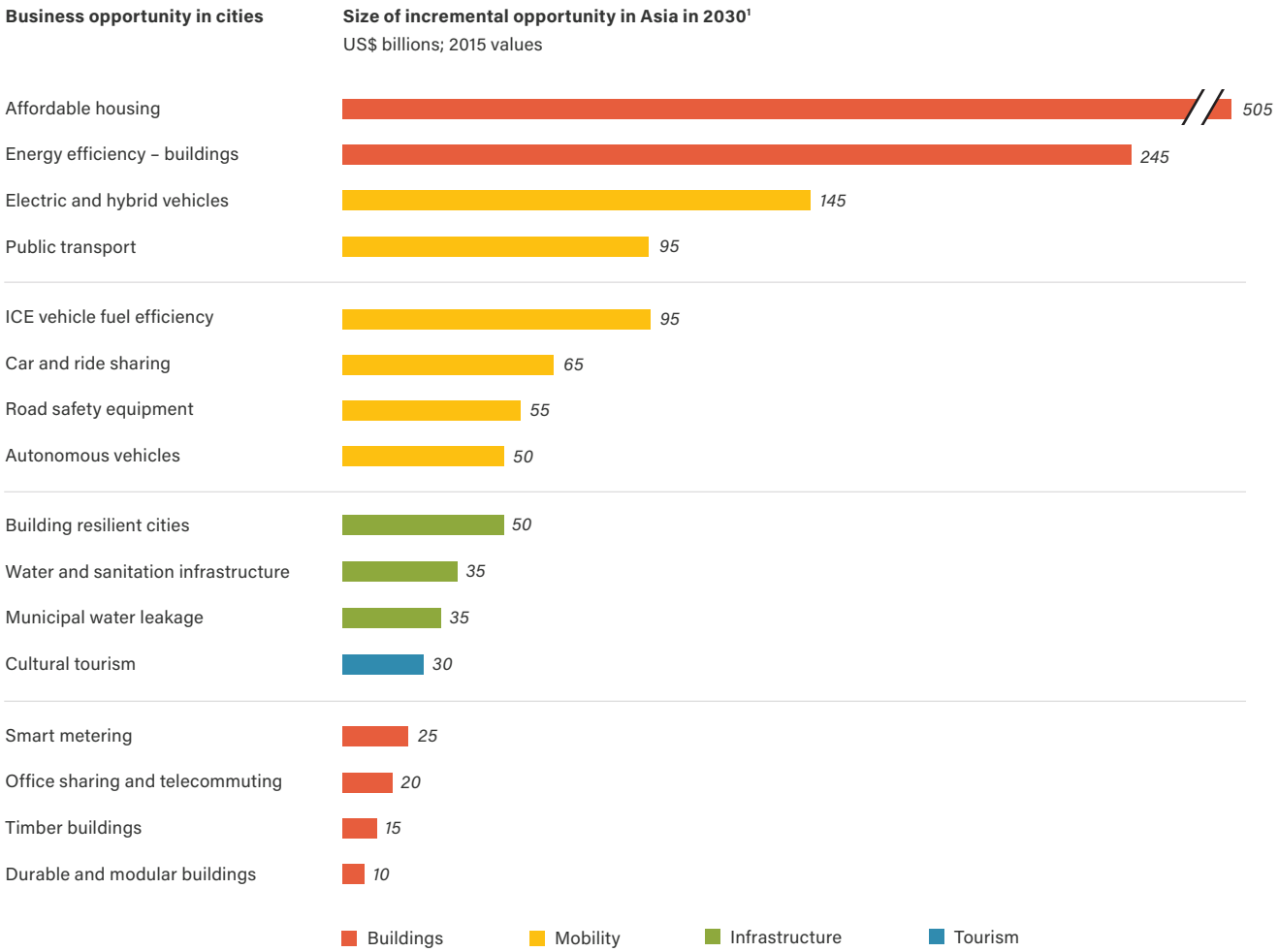
- **Housing:** The growth of cities can run counter to social inclusion, particularly as housing becomes increasingly expensive. By 2025, one-third of the urban population, or 440 million urban households, could lack affordable, adequate housing.[41] More than 107 million urban households currently live in substandard housing in China, India, Indonesia, Bangladesh, and the Philippines.[42]

Business and investment opportunities emerging from sustainable development in cities

The UN's Global Goals agenda proposes to shift city development onto a sustainable pathway. This shift will have a big impact on the value chains supporting mobility, infrastructure, and housing in Asian cities, leading to a number of disruptive business opportunities, which together will be worth US$1.5 trillion in 2030 (Exhibit 7).

EXHIBIT 7

The largest business opportunities in Asian cities could have a value of US$1.5 trillion in 2030



Source: Literature search; AlphaBeta analysis

[1] Based on estimated savings or projected market sizings in each area. Only the high-potential opportunity is shown here. Rounded to nearest US$5 billion.

The following section discusses a few of these key opportunities in further detail.

- **Supporting affordable housing (US$505 billion):** In the Asia-Pacific region, there is a US$295 billion gap between income available for housing and the annualised market price of a standard unit.[43] This disparity is set to grow as the number of households needing affordable, adequate housing increases. Turning this gap into an opportunity will depend on three broad initiatives.

The first is in 'inclusionary' housing development to increase the supply of affordable housing. This gives developers planning concessions in return for providing affordable housing units. For example, in return for a density bonus from the government, which allows the developer to increase the floor space on a plot of land and therefore its potential revenue, the developer sets aside a certain portion of each project for affordable units to be sold or rented to lower-income residents. Several Asian cities (including Mumbai and Chengdu) have granted commercial development rights to private sector partners in return for them building affordable housing on a specified percentage of the total land under development.[44]

The second initiative is lean construction to lower the costs of building. This includes adopting industrial techniques such as prefabricating components off-site and assembling them on-site, and standardising major operations like structural design and finishing elements. In India, private players such as Xrbia use on-site manufacturing techniques and prefabricated components to shorten construction times. My Dream Home, a social enterprise in Cambodia, aims to provide quality and affordable housing to locals who cannot afford traditional houses. The company uses abundant, sustainable, local materials to construct Lego-like interlocking bricks that take less cement, labour, and time to fit together than traditional bricks.[45] These low-cost construction techniques can target low-income consumers even more accurately when they include affordable financing packages. For example, Intellecap and Nuvoco, both based in India, have collaborated on a programme called Rumahku that provides sustainable, climate-resilient housing for Indonesia's urban poor. The programme uses lean design and construction to reduce the ongoing operating costs of energy, water, and sanitation, and can be supported by microfinance.[46]

The third initiative is low-cost property management to reduce the running costs of housing. Techniques include retrofitting units with more energy-efficient appliances, and integrating repair and maintenance services to provide a 'one-stop shop'.

Asian governments are taking a number of different approaches to support affordable housing. Singapore has been a leader (see Box 2). At a December 2016 pilot land auction in Nanjing in China, developers competed to maximise affordable housing once they reached a target price.[47] In Indonesia, the government has subsidised mortgages for low-income earners and eased administrative requirements.[48] In South Korea, the government has encouraged owners of multiple properties to rent them out by reducing the associated taxes.[49] However, there are still many challenges, including building height limits, which reduce potential residential density; regulatory bottlenecks that prevent new properties being built; and reduced land availability.

Box 2. The Singapore public housing story

When Singapore's Housing and Development Board (HDB), the public housing agency, was created in 1960, less than 9 percent of Singaporeans lived in government housing. Today, more than 80 percent of Singaporeans live in units built by the HDB, and 9 out of 10 HDB-dwellers own their homes – one of the highest levels among market economies in the world. How has Singapore achieved this? The following factors were crucial.

- **Allowing access to retirement savings:** Singaporeans may use part of their retirement savings to buy a home, which has in turn led to one of the highest home ownership rates in the world.
- **Offering innovative financing:** The HDB provides concessionary loans at rates that, over the course of the term of the loan, are often below market rates. This makes it easier for Singaporeans to finance their homes. At the same time, the government provides tiered subsidies to encourage Singaporeans to own their own homes. These subsidies are tied to factors such as income levels and proximity to other family members (to encourage strong familial ties).
- **Adopting lean construction practices:** The HDB has encouraged the use of technology to raise productivity and lower the costs of construction. This means using precast components, 4D simulation to reduce errors, and automation on construction sites to improve efficiency. The regulatory burden has also been minimised. For example, Singapore has automated construction permit procedures, eliminating paper processes.[50]
- **Minimising upkeep costs:** HDB properties are managed by town councils that control common property in public housing and publicly owned commercial properties within their jurisdiction. Councils also supervise the maintenance of HDB flats, and have the scale to pursue cost-saving measures – such as adopting energy-efficiency standards,[51] which can also enhance asset values. The HDB also achieves economies of scale by building thousands of homes in a single project.
- **Enhancing assets:** The government regularly upgrades housing estates by repainting apartment blocks, installing new elevators, and building new amenities such as markets and sports venues. This helps boost home values and ensures they continue to rise over time, which in turn supports more wealth transfer between generations, making it easier for the next generation to own homes as well.
- **Introducing property market 'cooling' measures:** Singapore's strong economic growth has led to a sustained rise in housing prices, triggering concerns about affordability. The government has introduced property market cooling measures to guard against speculation in the housing market from foreign buyers. These include restrictions on foreign purchases and additional stamp duties on second-time home buyers.

- **Building energy efficiency (US$245 billion):** The building sector currently accounts for around one-third of total energy consumption and more than half of electricity demand.[52] The way buildings are designed and constructed affects not just the operating costs, but also the world's energy consumption patterns and environmental conditions for many years to come. More than half of the world's new construction is taking place in Asia.[53] China is constructing more than a quarter of the world's new buildings, and India's built-up areas have more than doubled in the past five years.[54] At the same time, studies estimate that China and India could cut current building energy consumption by 25 percent through cost-effective improvements in energy efficiency.[55]

  Two main strategies offer the biggest opportunities: temperature control and electricity. The first involves improving heating and cooling by retrofitting existing buildings and installing more efficient technology in new buildings. An alternative is to expand the use of district heating and cooling systems instead of installing individual heating and cooling systems in each building. Second, switching to efficient lighting, appliances, and electronics can reduce energy demand. The additional step of using cogeneration to link district electricity with heating and cooling supply could improve efficiency by up to 90 percent.[56]

  These opportunities suggest a number of business models, from developing energy-efficient building components through to providing energy services. Among the latter, there is potential for specialised energy services companies and utilities that provide funds for upfront investment and deploy their expertise in identifying and capturing energy-efficiency savings. Energy performance contracts (EPCs) can help overcome capital constraints by tying loan payments to the property or utility meter, instead of to the homeowner. While the US and Europe are currently leading in this area, energy service companies (ESCOs) that provide end-to-end power-efficiency services for owners of homes and businesses are just emerging in Asia.

  Policy levers that support this approach include enacting building codes that require energy efficiency in new constructions, and implementing labelling and voluntary standards to raise awareness and help homeowners get the full value of energy improvements when they sell their properties. Some countries in Asia have also supported change by retrofitting government buildings. In Singapore, for example, the public sector has led the use of EPCs for building energy retrofits, with ESCOs guaranteeing energy performance for public agencies over a contract period of three to five years.

Box 3. India's LED push

Lighting accounts for approximately 20 percent of total power consumption in India, with most lighting needs met by inefficient incandescent or compact fluorescent light (CFL) bulbs. The government's UJALA (Unnat Jyoti by Affordable LEDs for All) scheme aims to lower energy use and carbon emissions by replacing inefficient bulbs with LED (light-emitting diode) bulbs.[57]

Under the programme, the government buys large volumes of LED lamps from private manufacturers through competitive tenders, which has caused LED prices to drop by about 15 percent over two years. The government then passes on these savings to consumers.

The programme aims to save 20 gigawatts of energy by 2019 (enough electricity to meet Chile's total power demand), by replacing 770 million incandescent bulbs with LEDs. According to government estimates, the programme will cut annual electricity bills by as much as 400 billion rupees (US$5.9 billion).[58]

- **Promoting electric vehicles (EVs) and hybrid vehicles (US$145 billion):** According to Navigant Research, global EV sales will grow at a rate of 10 percent a year from 2019, reaching a value of more than US$318 billion by 2030. In Asia, EV sales are projected to reach US$144 billion by 2030.[59] Assuming an average vehicle lifespan of 15 years, the current total global passenger vehicle fleet will turn over completely by 2030, creating an opportunity for a huge increase in EV and plug-in hybrid electric vehicle (PHEV) sales. Electric and hybrid vehicles could comprise 62 percent of new light-duty vehicle sales in 2030, though that estimate depends on significant and continued falls in battery prices.[60]

  Along with innovation in battery technology to improve range and reduce cost, the expansion of charging infrastructure has also stimulated demand for EVs in Asia. In China, national government investments increased the total number of charging points to about 110,000 in 2015, up from only 8,000 in 2011.[61] Government regulations that aim to curb car emissions are also driving demand for EVs. China's Institute for Health Metrics and Evaluation ranks outdoor air pollution as one of the greatest contributors to disease and death worldwide, responsible for an estimated 3 million premature deaths every year, especially in urban areas. Scientists estimate that vehicles account for about 15 percent of manmade greenhouse gas emissions.[62, 63, 64]

  EVs and hybrid vehicles raise a range of business opportunities, including for suppliers of components such as cathodes, and charging infrastructure providers. Retailers, shopping centres, hotels, fast-food outlets, car parking providers, and all kinds of businesses with off-street parking could offer charging services.

Various policy levers have been used to encourage the adoption of EVs and hybrid vehicles, including tightening emissions regulations on vehicles, providing research and development (R&D) grants, and supporting charging infrastructure providers. In Korea, for example, the public payphone network operator kt linkus and the Korean Ministry of Environment have formed a partnership to transform payphone booths into rapid charging stations for electric vehicles. They plan to set up a large network of urban quick-charging stations by converting 20 public phones into EV stations each year.[65]

Box 4. China's EV drive

China is already ranked as the world's single largest EV market, and the greater Asia-Pacific region is forecast to be the world's fastest growing EV market by 2022.[66] Sales of electric, plug-in hybrid, and fuel-cell vehicles in China reached 517,000 in 2016, representing about 1.8 percent of all cars sold in the country.[67] This was more than double the number in Europe (221,000) and almost four times sales in the US (157,000).[68]

It has been estimated that by 2020, six of the top 10 lithium-ion battery makers could be Chinese.[69] China's CATL is currently the world's largest battery maker, followed by Elon Musk's Tesla Motors and Japan's Panasonic. Currently, Shenzhen-based BYD is the largest maker of electric cars and buses, dominating the field.[70] This company, backed by Warren Buffett's Berkshire Hathaway Inc., has been the world's top seller of plug-in electric vehicles since 2015. Sales of its 'new energy' passenger vehicles (electric and plug-in hybrids) increased by more than 65 percent last year to approximately 86,000 units, leading the global electric passenger vehicle market.[71]

China's central government is implementing a suite of initiatives to promote electric vehicles, including offering subsidies for buyers (of up to 44,000 yuan, or roughly US$6,400, per vehicle), and financial rewards for companies that break government-set milestones for battery capacity or unit sales. The government is also funding local charging infrastructure projects such as charging stations, and encouraging local governments and public institutions to raise the percentage of EVs they purchase.[72] For example, Beijing has announced plans to replace its entire 70,000-strong taxi fleet with EVs within the next five years.[73] Shenzhen has also declared that all new taxis will be electric.[74]

Box 5. The rise of the e-bike

An electric bicycle, also known as an e-bike or booster bike, is a bicycle with an electric motor that riders can use to boost their pedal power. These take a variety of forms and vary significantly in the amount of pedal power they use. But to be defined as an e-bike rather than a scooter or motorbike, the rider's pedal power alone must be enough to move it forward.

While EVs may receive more media attention, e-bikes dwarf them in current scale of demand: about 700,000 electric cars were sold worldwide in 2016 compared to roughly 35 million e-bikes.[75] The e-bike first became popular in China, where the government made developing e-bikes a priority R&D objective in 1991. China remains the world's largest market for e-bikes, accounting for approximately 85 percent of global demand,[76] while the Asia-Pacific region as a whole accounts for approximately 95 percent of global demand.[77]

In China, the vast majority of e-bikes use lead acid batteries, whereas in Europe the majority use the more expensive nickel–metal hydride (NiMH) or lithium ion (Li-ion) batteries. Cost is a primary driver of these differences, given that Li-ion batteries currently cost roughly 20 times more than a lead acid battery. However, the cost differential is falling rapidly as Li-ion battery production accelerates.

The demand outlook for e-bikes will stay strong, with an annual growth of 6 percent forecast to 2021.[78] China is likely to remain the dominant market, although growth there may stagnate due to market saturation. Of the 30 million e-bikes sold in the last year in China, 25 million were replacements for worn out bikes.[79]

The competitive landscape is also likely to change significantly, particularly in China, given current industry fragmentation (Shanghai alone produces more than 40 e-bike brands) and the entry of new players. Major motorcycle manufacturers (such as Zongshen and Dayun) are entering the e-bike industry as demand for motorcycles shrinks. Looking ahead, we are likely to see new models targeting specific customer segments, such as off-road e-bikes, as well as businesses that provide the supporting infrastructure. For example, Gogoro, based in Taiwan, offers its e-scooter customers a battery-swapping network.

From a regulatory standpoint, countries differ in their approach to licensing these bikes. In the US, there are conflicting regulations at the federal, state, and local levels. In some countries, including China, cities place limits on the operation of e-bikes depending on their power rating. China has supported e-bikes by ceasing to issue new licences for power-assisted bicycles that produce new emissions, as well as providing other forms of support for manufacturers.

- **Car sharing and ride sharing (US$65 billion):** Evolving mobility options are set to significantly change the automotive industry and private-vehicle ownership patterns. According to a study by McKinsey & Company, most cars sit idle 90 percent of the time – or more.[80] More car sharing could mean more intensive use of each vehicle while reducing the number of cars on the road.

Photo credit: mcbrown/Flickr

Car-sharing services have grown at roughly 35 percent a year in the US, reaching 1.6 million members in 2014. The future pace of growth for this opportunity in Asia will depend on whether supporting regulations are developed; how the technology and products evolve to facilitate ease of use for customers; and whether capital investment is available for the necessary infrastructure, such as for purchasing car fleets.

Given the growing urban population, shared mobility (including bike sharing: see Box 6) offers particularly big opportunities in Asia. In Indonesia for example, shared mobility could not only address congestion, but also lower the cost of mobility, reduce environmental damage, and possibly increase digital financial inclusion (see Box 7 for further details). A range of different segments and business models are emerging within the ride-sharing market. For example, China's state-owned Shouqi Group, which owns car-sharing provider Gofun, offers luxury hybrid vehicles equipped with air purifiers to combat smog. New partnerships are also being developed as car sharing grows. For instance, Australia's GoGet has partnered with Sydney property developers to tie its shared cars to new apartment complexes, cutting down on the number of parking lots needed for private cars. Other business models are targeting cargo, rather than

passengers. For example, Sendle in Australia uses a smartphone app to bring shippers, carriers, and buyers together with real-time information on prices, load details, and delivery routes, enabling them to optimise their use of available capacity. A final opportunity, still nascent, links shared mobility solutions to digital financial inclusion. Ride-hailing apps Grab and Go-Jek (based in Singapore and Indonesia, respectively) have developed digital payment apps that also provide a place to store cash for everyday payments.

Box 6. The bike-sharing opportunity

Bike-sharing services have taken China by storm. More than 30 players are vying to be the 'Uber for bikes' in China, offering mobile apps that allow users to unlock bikes parked on the street, ride to their destination, and pay a fee based on the distance travelled. Fees range from just 0.5 yuan to 5 yuan, depending on the brand and type of bike rented. BigData predicts that the total number of bike-sharing users could rise from almost 50 million in 2017 to 107 million by 2019.[81]

In March 2017, active users of bike-sharing services in China doubled in one month, to 20 million. Competition is intense, and firms have been able to raise significant funds to fuel future growth. Mobike raised more than US$300 million in its latest funding round in early 2017. Another firm, ofo, raised US$450 million in its March 2017 financing round.

On April 28, 2017, Mobike reported that more than 6 million active users together clock 20 million rides a day. According to the Sootoo Institute, Mobike's app reached about 6 million downloads in the first quarter of 2017, more than the combined downloads of nine other rivals, including ofo. In total, some 57 million people have downloaded the Mobike app.

Mobike says it is operating in 52 cities including Beijing, Shanghai, Guangzhou, Shenzhen, and Singapore, and had about 3.65 million bikes on the road as of March 2017. It has branched out beyond bicycles and recently started to offer its car-lending service on the popular instant messaging platform WeChat, which has almost 900 million users.

Ofo has reportedly connected more than 1 million bicycles with over 20 million registered users across almost 40 cities in China, the United States, Britain, and Singapore.[82]

Box 7. The shared mobility opportunity in Indonesia

Recent research by AlphaBeta has shown how shared mobility options could create significant benefits in Indonesian cities by 2020.[83] Based on a 2020 scenario in which all personal travel has shifted to shared modes, including public transport and ridesharing, the results showed that in 33 major cities in Indonesia, time-related commuting costs could be reduced by IDR 138 trillion (around US$10 billion) by 2020, with 71 million fewer vehicle trips on Indonesian roads. In this scenario, income-generating opportunities could be provided for almost 7 million Indonesians in shared mobility services, and CO_2 emissions and air pollution from vehicles could be reduced. This would result in carbon emissions reductions equivalent to saving 415,000 hectares of land from deforestation.

There may also be some surprising benefits to the more peripheral activities of parking and digital financial inclusion. In Indonesia, AlphaBeta estimates that over 40,000 hectares of prime commercial and residential land is currently set aside for parking, representing about 5 percent of total land area in cities. The 6,645 hectares of commercial land (including retail, office, and on-street parking) currently allocated to parking in 33 Indonesian cities has a potential annual rental value of IDR 95 trillion (US$7.2 billion), and could be released for more productive uses. Financial inclusion could be boosted by shared mobility. Only 8 percent of Indonesians used a debit card in the last 12 months. Online ride-sharing services could promote financial inclusion by providing a means for drivers to establish bank accounts and become accustomed to performing transactions online; 39 percent of Uber driver-partners in Indonesia agreed or strongly agreed that they are more financially active since joining Uber. This could have significant income benefits for these Indonesians; international evidence suggests a potential boost to incomes of anywhere between 5 percent and 30 percent due to increased financial inclusion. The results of the 2020 scenario analysis provides even more support, estimating that 400,000 Indonesians could be brought into the financial system through online ride-sharing services.

The report showed there is a critical window of opportunity for Indonesian city leaders to rethink transport options and capture these benefits. The size of Indonesia's consuming class could increase by more than 90 million people by 2030, and expenditure on transport could reach US$30 billion by 2030 (up from US$13 billion in 2011). In these circumstances, it is critical to design efficient transport choices before Indonesian cities become 'locked' into high-congestion pathways. Capturing this opportunity requires drawing on relevant best practices from other Asian countries, including creating a clear regulatory framework for ride-sharing services; integrating ride-sharing services with public transport options; and rethinking parking policy, including minimum parking requirements for buildings, and parking fee caps.

B. Energy and materials

The challenges in energy and materials

Slower demand growth for energy and materials combined with more diverse and flexible supply creates new challenges and opportunities in this area, including the potential for new forms of partnership between extractive companies and resource-rich countries.

The challenges are a primary concern to Asia for several reasons. First, much growth in the global demand for resources will come from Asia. Notably, the region will account for 88 percent of the expected global growth in demand for oil, from just below 90 million barrels a day in 2013 to around 109 million barrels a day by 2035.[84] Perhaps surprisingly, not all this demand growth will come from China and India. The Association of Southeast Asian Nations (ASEAN) – which includes Brunei, Cambodia, Indonesia, Laos, Malaysia, Myanmar, the Philippines, Singapore, Thailand, and Vietnam – forecasts an increase in members' energy demand of 80 percent through to 2035, a growth rate faster than China's and an absolute increase equivalent to Japan's current total energy demand.[85] Second, Asia is home to a large share of the world's energy and mineral resources, so natural resources represent a large share of government revenues. For example, more than 80 percent of Brunei's government revenues come from petroleum.[86] Exhibit 8 summarises the challenges and changes transforming specific value chains in this industrial system.

EXHIBIT 8
Challenges facing the energy and materials system

Value chain area	Current value US$ billions	Challenges
Extraction	5,400	▪ Continued uncertainty over climate regulation affects capex in energy and creates stranded asset risk – over **US$300 billion** of assets could be affected. ▪ Resource recovery rates are less than half of economically feasible rates. ▪ Water access could significantly constrain output given that **32 percent** of copper mines and **39 percent** of iron ore mines are in areas of moderate to high water scarcity. ▪ Almost **half** of new copper projects are in countries whose political systems pose high business risks.
Production	12,450	▪ Consumers are increasingly concerned with social issues in supply chains, e.g. privacy issues due to the traceability of mobile phone use.
Generation	1,880	▪ Fossil fuel subsidies exceed **US$500 billion** annually. The cost to some Asian countries can be over **4 percent** of GDP.
Retail / consumer	>1,000	▪ **512 million** people in developing Asia lack access to electricity.
Disposal and recovery	860	▪ Extended producer responsibility (EPR) is increasingly being regulated – over **30** US states now have at least one EPR law in place.

Source: Literature search; AlphaBeta analysis

- **Extraction:** The extractives sector faces several regulatory and production challenges. Climate regulation could put returns on capital invested in energy at risk, affecting US$300 billion of potentially 'stranded' assets worldwide by 2035.[87] Pricing of carbon and water would significantly alter cost curves for major resources and fuels. For example, pricing water to reflect its 'shadow cost' – the economic value of the water if put to its best alternative use – could increase iron ore costs by 3.3 percent across the industry.[88] Regulators' increasing interest in reducing the more than US$400 billion in fossil fuel subsidies worldwide could significantly reduce demand by increasing end-user prices. In addition, while the world is not running out of energy or mineral resources, production is shifting to more remote locations that have weak infrastructure, high political risk, and greater input constraints. Lack of water could also significantly constrain output, given that 32 percent of copper mines and 39 percent of iron ore mines are in areas of moderate to high water scarcity. This increases the risk of supply disruptions and makes supply even more inelastic.

- **Production:** Manufacturing processes will be transformed by the emphasis on adopting sustainable patterns of production to reduce waste and improve energy and resource efficiency, as set out in the Global Goals. Circular models based on recycling and remanufacturing may displace linear production models in the durable goods and automotive industries, driving changes in product design. 'Low-visibility' supply chains will be replaced by more traceable systems that encourage sustainability reporting. Lightweight and high-strength materials will improve production efficiency, reducing waste and energy use. Greater energy efficiency is another major objective of the Global Goals that will lead to process changes across traditionally energy-intensive industries (such as steel and cement) as well as less energy-intensive sectors.

- **Generation:** Asia is home to some of the world's most dynamic and fastest growing economies. As a result, the Asian Development Bank projects that energy demand will almost double in the Asia-Pacific region by 2030.[89] Fossil fuels including coal, oil, and natural gas currently account for 75–80 percent of this growing demand.[90] The expansion of renewable energy could drastically slow down growth in fossil fuel demand. For example, India has committed to having renewables comprise 40 percent of its energy-generating capacity by 2030. Similarly, China will need to increase wind and solar power's share of primary energy consumption to 17 percent by 2030 – up from 4 percent in 2015 – if it is to meet its climate pledges.[91] This could radically reshape generation infrastructure, spurring demand for smarter grids with increased storage capacity and more interconnection to manage the variable output of most renewable energy sources. At the same time, the efficiency of fossil fuel generation will increase as coal plants move to supercritical technology, and combined-cycle gas turbines become the norm. Remaining coal generation will make increased use of carbon capture and storage to reduce emissions.

These shifts will be supported by reforms to rationalise inefficient fossil fuel subsidies in effect across many countries in Asia. Fossil fuel subsidies in India, Indonesia, and Thailand are significant – in 2012 amounting to 2.7 percent, 4.1 percent, and 1.9 percent of GDP, respectively.[92]

- **Retail:** The retail and consumer market will change considerably by 2030. While overall demand may face some headwinds, the consuming class in the Asia-Pacific region is expected to more than double in size by 2030 – from the current 552 million households to roughly 1.2 billion households – stimulating future demand.[93] Despite many customers' increasing affluence, 1.2 billion people globally still lack access to electricity, 512 million of whom are in Asia.[94] In addition, as value chains become more circular in response to the Global Goals, consumers will no longer be end-points but rather important links in a circular chain. Consumer durables will be leased out or sold back to manufacturers and recyclers at the end of their lives. The growth of distributed renewable energy devices such as rooftop solar photovoltaic panels will allow consumers to sell energy back into the grid. Consumers will also become more aware and concerned about the sustainability of the supply chains for the products they consume.

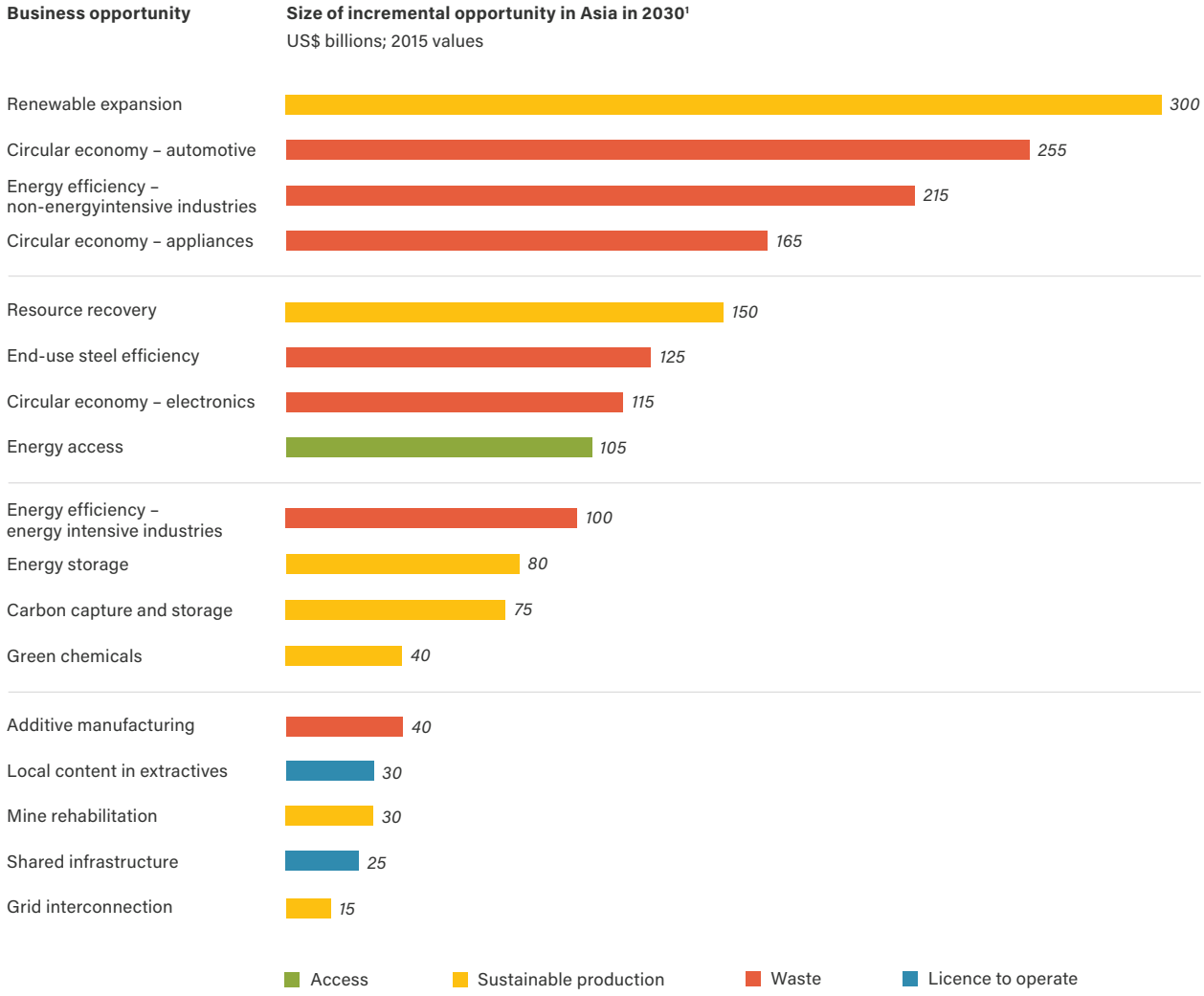
- **Disposal:** Disposal and recovery processes will become a more important part of the value chain. Supply of municipal solid waste may increase by 70 percent to 2025, increasing the cost for governments and using valuable land resources. In response, extended producer responsibility regulations are becoming more widespread, requiring manufacturers to handle the waste generated from their products.

The business and investment opportunities emerging from a sustainable development pathway in energy and materials

The UN's Global Goals agenda proposes meeting these challenges by shifting energy and materials onto a sustainable development pathway. This shift will be transformative, and will have major impacts throughout the energy and materials value chains. It could lead to the emergence of disruptive business opportunities worth US$1.9 trillion in Asia by 2030 (Exhibit 9).

EXHIBIT 9

The largest business opportunities in energy and materials in Asia could have a value of US$1.9 trillion in 2030



Source: Literature search; AlphaBeta analysis

[1] Based on estimated savings or projected market sizings in each area. Only the high-potential opportunity is shown here. Rounded to nearest US$5 billion.

The following section discusses some of these opportunities in further detail.

- **Circularity in the automotive, appliance, and electronics industries (US$535 billion):** Circular business models based on recycling and remanufacturing may displace linear models in the durable goods and automotive industries, driving changes in product design and value chains. The automotive sector will be particularly affected.

There are almost 2 billion registered vehicles globally, a third of which are in China, India, Indonesia, and Japan.[95] By 2008, approximately 2 million vehicles were being disposed of in China every year; at historical growth rates, this will rise to over 20 million vehicles per year by 2020.[96] Some of these end-of-life vehicles (ELVs) will be exported as second-hand products, but the rest will be sent from automobile retailers to auto dismantlers and scrap metal companies to be processed for reusing and recycling.

Collection rates for ELVs are generally very high in countries that have a legislative ELV system setting the target recovery rate at around 95 percent. China, Japan, and South Korea all have legislative ELV recycling systems in place, and India and Vietnam are preparing to.[97]

Recycling ELVs into base materials is energy intensive and results in loss of value. Given that the end of a vehicle's life is typically brought about by the failure of only a small number of 'weakest link' components, it is possible to extend that life significantly by opting instead to refurbish and remanufacture these components. This increases the efficiency of material and energy use, and increases the residual value of the vehicles. Michelin's scheme for billing tyres provides an example of 'weakest link' management. Trucking companies and airlines can choose to be billed based on the number of kilometres travelled, the number of tonnes transported, or the number of landings carried out using tyres supplied and maintained by Michelin. However, there are challenges in shifting to a circular model. Vehicle designs will need to anticipate disassembly, and capital will be required to build centralised refurbishment plants. Consumers may also resist buying refurbished vehicles, though warranties should partly assuage their concerns.

Many domestic appliances, electronics, and industrial machines are also well-suited to circular models. At present, collection rates for these products are lower than for vehicles – generally below 50 percent for appliances and 15 percent for electronics – so the opportunity to capture more material for recycling and refurbishment is high. A washing machine, for example, typically contains 30 to 40 kilograms of steel, and a refurbished machine could reduce material input costs by 60 percent.[98] To ensure that collection and refurbishment capture as much value as possible, business models may need to shift from purchasing to leasing or performance-based arrangements. This will also encourage manufacturers to design products that last longer.

While many of today's circular economy models are in Europe and North America, some are emerging in Asia. In Australia, several commercial appliance recyclers as well as some non-commercial organisations remove waste appliances and offer rebates, sponsored by the government. In the Chonburi Province of Thailand, Fuji Xerox operates a plant that dismantles used information and communication technology

(ICT) appliances. In 2015, the plant disassembled more than 4,000 tonnes of used printers sourced from across Asia, and achieved an extremely high recovery rate.[99]

As in the automotive sector, policy can play an important enabling role here. For example in Japan, the Home Appliance Recycling Law, which came into force in 2001, made it a legal requirement to recycle waste electronics. Appliance manufacturers are now required to finance the recycling of their products.[100] China's Circular Economy Law, passed in 2009, also includes requirements for industries concerning their resource recovery and efficiency,[101] setting targets for the coal, steel, electronics, chemical, and petrochemical industries.

- **Expansion of renewable energy (US$300 billion):** Renewable energy – including solar, hydro, wind, and geothermal energy – can potentially increase energy generation and reduce local pollution while also mitigating global climate change. Renewable energy capacity has surged over the past decade. Between 2006 and 2010, capacity in China, Europe, and the Americas jumped 23 percent a year, while the five years between 2010 and 2015 saw capacity rise by another 20 percent a year.[102] Renewables are also capturing a larger share of new energy investment. In 2015, global investment in renewables amounted to US$286 billion, more than double the US$130 billion committed to new coal and gas generation.[103]

  Asia installed more renewable power generating capacity in 2015 than any other region.[104] China led the world in adding new hydropower capacity, was a leader in biofuel capacity, and set new world records for wind and solar power installations that same year. India also ranked among the top countries for adding solar, hydro, and wind power capacity, and Japan was second only to China for new solar installations. Other countries in the region – including Malaysia, Pakistan, the Philippines, South Korea, Thailand, and Vietnam – have emerged as important markets for more than one renewable power technology.

  Renewables have gained support from policymakers in many areas, especially in the form of market reforms. Many governments in Asia are moving towards transparent and market-based energy-pricing systems. The supply-side economics of renewable generation are also improving, and renewable technology costs are expected to keep falling. From 2010 to 2015, global average costs for new onshore wind generation plants fell by an estimated 30 percent, while the costs for new utility-scale solar PV cells declined by two-thirds.[105] New onshore wind costs are forecast to fall by a further 10 percent by 2020, and the cost of new utility-scale solar cells should decline by an additional quarter.[106]

  Wind and solar have emerged as the most attractive investments among renewable energy technologies, and are expected to attract the bulk of future investment,

especially given the potential for costs to fall further. Penetration rates are expected to rise significantly. In China, for instance, wind and solar will contribute 35 percent of energy generated in 2040, up from 7 percent in 2015.[107] In Southeast Asia, an increase up to 22 percent is expected over the same period.[108]

Two particularly promising areas for solar investment have recently opened up. The first is low-cost residential and commercial solar generation, the growth of which will depend on the availability of low-cost financing for customers, reactions from regulated utilities, and the competitiveness of power tariffs compared with traditional grid pricing. For example, Singaporean company Sunseap designs and installs customised solar energy systems for clients, who pay only an initial deposit and a monthly lease fee based on their energy use. The second area is the provision of peak capacity in large-scale plants. The key to commercialising this area, as with other renewable areas, is to lower deployment costs by using 'lean' techniques such as prefabricated components, automation, and aerial site assessments to speed up design prototyping, and by collaborating with engineering, procurement, and construction companies to share cost-saving ideas (see Box 8 for more on developing clean energy in Asia).

Many countries in the region have access to the immense hydroelectric potential of the Mekong River, which flows through or borders China, Myanmar, Laos, Thailand, Cambodia, and Vietnam. China has already constructed six major dams along the upper portion of the Mekong, while Vietnam, Indonesia, Bhutan, and Laos have announced plans for significant additions to hydroelectric capacity in the Mekong region. The challenge is to ensure that developments along the river do not affect the water supply downstream, or cause local environmental damage or unfair treatment of local communities.

However, there are still significant barriers to realising the full potential of renewable energy sources. Renewable energy projects require significant upfront investments. Although falling technology costs have reduced the capital needed to invest in new systems, financing these projects is still difficult in the many parts of Asia where financial markets remain underdeveloped. Policymakers and bankers in the region often have limited experience when it comes to assessing the feasibility of and risks involved in renewable energy investments. This lack of experience can make it difficult or impossible to obtain the types of financing required at reasonable prices, because investors perceive projects as high-risk, which raises the risk premium and adds to the cost of funding.

In addition to financing challenges, Asia's renewable energy sector also remains hampered by significant policy hurdles. As noted above, several countries offer legacy fossil fuel and electricity subsidies that distort the true cost of energy. Of the top 25 countries in the world that subsidised fossil fuel consumption in 2012, 10 were in Asia.[109]

Developing Asian countries also accounted for close to a third of global subsidies on fossil fuel consumption in 2012, equivalent to about 2.5 percent of GDP. Artificially cheap oil, gas, and coal discourage the development and deployment of renewable, more efficient, cleaner forms of energy.

Box 8. Developing clean energy projects in Asia

A number of Asian companies are leading the global charge for renewable energy. One of them is Sindicatum, founded in 2005, which develops, owns, and operates clean energy projects in South and Southeast Asia. It has developed and financed 17 renewable energy projects, including solar plants in India and the Philippines.

The company owns a 15-megawatt peak (MWp) solar plant in the Charanka Solar Park in Gujarat, India, and has been operating a 22 MWp solar plant in Luzon, in the Philippines, since March 2016. Sindicatum also operates waste-to-energy projects, such as landfill-gas-to-energy power plants. These facilities convert methane pollution from municipal waste landfills into clean electricity.

Another example is India's Greenko Group, which owns a portfolio of wind, solar, hydropower, natural gas, and biomass assets. The Hyderabad-based company is one of India's largest operators of small hydropower projects, typically defined as those with capacity of 20–100 megawatts (MW). It operates 354 MW of hydropower assets spread across northern and southern India. The company runs wind-power facilities, adding up to 714 MW of capacity with an additional 402 MW in the advanced stages of construction, and it also operates solar, natural gas, and biomass energy generation plants.[110] In March 2017, Greenko raised US$155 million from existing investors Singapore sovereign wealth fund GIC and Abu Dhabi Investment Authority (ADIA), in one of the largest fundraising exercises in India's renewable energy sector. The funds will be used to grow the company's clean energy portfolio – it has over 2.5 gigawatts (GW) of operating capacity and plans to hit 3 GW by the end of 2017.

Another company playing a leading role in renewables in Asia is Japanese conglomerate SoftBank Group. SoftBank has business interests across a wide range of industries but its founder and CEO Masayoshi Son is making a concerted effort to increase generation and access to affordable renewable energy across Asia through his vision for an Asia Super Grid (ASG). The first step was to establish SB Energy Corp, a clean energy business unit set up in the aftermath of the 2011 natural and nuclear tsunami-related disasters in Japan. By 2016, SB Energy operated more than 30 utility-scaled renewable power plants across Japan, including a 48 MW wind farm in Shimane prefecture and a 111 MW solar PV farm in Hokkaido prefecture.[111] In late 2015, SB Energy Corp entered a joint venture with Taiwan's Foxconn Technology Group and India's Bharti Enterprises to develop a 350 MW solar PV farm in Andhra Pradesh, months after Son pledged to invest US$20 billion in solar projects in India.[112] Other ventures include one with the Mongolian investment company Newcom LLC, to build a 50 MW wind farm in Mongolia's Gobi Desert. The venture will contribute to meeting the company's target of constructing 7 GW of wind energy in the country.[113] The ASG vision took a big step forward in 2016, when SoftBank signed a memorandum of understanding with regional power giants Korea Electric Power Corporation, State Grid Corporation of China, and Russian-based Rosseti, to conduct technical economic feasibility studies on creating the required transmission networks in the region.[114]

- **Energy efficiency in non-energy-intensive industries (US$215 billion):** While there have been significant improvements in energy efficiency within energy-intensive industries, progress has been slower in less energy-intensive industries. In these, energy has a smaller share of production costs so enterprises are less aware of efficiency measures and have fewer incentives to invest in them. This is particularly true in small- and medium-sized enterprises (SMEs). Recent measures by government bodies, such as India's Bureau of Energy Efficiency, have attempted to encourage SMEs to undertake energy audits. The International Energy Agency (IEA) estimates that energy-saving initiatives in less energy-intensive industries could reduce final energy consumption by more than 3 percent in 2030. In Japan, two large companies in the non-energy-intensive industries – Canon Marketing Japan and Panasonic Electric Works – embarked on energy conservation projects in the early 2000s. These projects involved implementing simple operational improvements such as better ventilation and lighting controls rather than large-scale additional investment, allowing these companies to reduce energy use by up to 30 percent.[115] Peak demand pricing surcharges can represent 30–70 percent of total electricity spending, so there is a strong incentive for companies to manage these costs.[116] However, awareness and technical capabilities, as well as capital investment requirements, remain real barriers.

  Different business models have been developed to suit industrial customers, residential customers, and the utilities themselves. For example, EnerNOC offers software to identify peak demand and notifies industrial users when opportunities to save costs arise so they can take cost-saving actions. OhmConnect explicitly targets residential customers with a user-friendly app. Opower, now owned by Oracle, works with utilities to reduce usage, drawing on behavioural insights.[117]

  Government policies across Asia are supporting this opportunity in different ways. For example, China's Top-1000 Energy Consuming Enterprises Program (Top-1000 Program) uses a 'sticks and carrots' approach to improve companies' energy performance. If a factory does not meet its goals, its managers and even local officials can be penalised. The government also offers financial incentives and technical assistance to phase out inefficient equipment and processes. From 2006 to 2010, the Top-1000 Program saved almost 400 megatonnes (Mt) of CO_2 emissions, equal to the total emissions of other large nations, and contributed 10–25 percent of the savings needed to meet China's energy intensity goal.[118] Many aspects of this approach can be replicated in other countries. Governments have also introduced higher energy-efficiency standards for key products. For example, the Indian government's Standards & Labeling Programme India provides information about appliance energy consumption, which helps buyers make informed decisions. The programme helped increase the energy efficiency of an average refrigerator or air conditioner purchased in 2014 by 25–30 percent, compared to those sold in 2007.[119]

- **Resource recovery (US$150 billion):** Small mining operations – and many oil and gas fields – leave a significant portion of the resource in the ground. New technologies and increased mechanisation could enhance recovery rates by up to 50 percent in some cases. In oil and gas, higher recovery rates can lengthen the productive life of a field, reducing the urgency of new exploration projects. But while improving resource recovery can provide attractive long-term returns, in the short term it can increase costs. In coal mines in China, cheap labour means that improving mechanisation actually increases the operating costs of extraction by 50–60 percent.[120] As a result, unlocking these opportunities often begins with some form of regulatory requirement, prompted by concerns that have little to do with resource optimisation, such as China's focus on raising safety standards.

  Many innovative technologies are emerging to improve resource recovery and cost efficiency. These include underwater robots that repair pipelines, drones that conduct preventive maintenance on utility lines, and the use of data analytics to better understand resource deposit structures. The McKinsey Global Institute (MGI) has estimated that such technologies (which go beyond resource recovery) could potentially unlock worldwide cost savings of between US$900 billion and US$1.6 trillion by 2035.[121]

- **End-use steel efficiency (US$125 billion):** Steel production is highly energy intensive, consuming 5–7 percent of total final energy worldwide.[122] Improvements in energy efficiency have been significant – producing one tonne of steel today requires on average 40 percent less energy than it did in 1980. However, the rate of improvement is slowing.[123] An alternative, complementary approach is to improve material efficiency through light-weighting (using higher-strength steel); using more scrap and recycled metal; and extending the life of steel components. In construction, substituting higher-strength steel can reduce the weight of building components by up to 30 percent. Australian firm BlueScope Steel deploys higher-strength steel products and 'dematerialisation' so successfully that it now uses fewer raw materials to build comparable structures. For instance, a roof that used to be 0.55 millimetres thick can now be replaced by higher-strength steel only 0.42 millimetres thick.[124] The automotive industry is already focused on weight reduction because of its fuel efficiency benefits. Further improvements of 20–25 percent could be achieved by optimising designs.

  Given low awareness of higher-strength steel in emerging markets, government standards could stimulate interest in this opportunity. It is particularly significant in Asia because of the growth in construction driven by rapid urbanisation. Ambitious targets set by some governments in Asia are driving progress in this area. For example, for the Chinese government to reach its Green Development Targets for the domestic steel industry over the coming years, the country may need to import more than 30 million tonnes of ferrous scrap per year (compared to 2 million tonnes imported into China in 2015).[125] Another interesting regulatory approach is the revised Green

Star Design launched by the Green Building Council of Australia in 2014.[126] This includes an 'As Built' tool, which offers construction companies a credit for providing a life cycle assessment of the environmental impact of a building, in the form of an environmental product declaration (EPD). Introducing these standards has encouraged many steelmakers to create EPDs presenting life cycle assessment results for each stage of their products' lives in the circular economy. The Australian Steel Stewardship Forum is also developing an independently verifiable steel certification programme, called Responsible Steel.[127] This scheme aims to improve sustainability performance throughout the steel value chain.

- **Energy access (US$105 billion):** Currently, 'bottom of the pyramid' energy users spend an estimated US$37 billion on inefficient energy sources such as kerosene and candles, which are more costly than clean alternatives. But while pioneering private sector companies have developed low-cost energy systems such as solar lanterns, biogas, and micro-hydro systems at the household or village scale, the private sector currently only accounts for only 18 percent of total investment in extending access to energy for poor and remote consumers.[128] One key to scaling this opportunity will be developing flexible payment mechanisms that recognise the circumstances of the poor. In Bangladesh, for example, Grameen Shakti finances home solar installations for a small upfront cost, then monthly payments over three years. Off-grid solutions will be another key to scaling energy access in Asia, where solar power will be ideal in many places that lack access to an electric grid – for example, in delivering solar power to agricultural irrigation systems, telecommunications towers, remote industrial sites such as mines, and military field sites. Phoenix Solar Pte Ltd, a Singapore-based company established in 2006, provides off-grid solutions to rural villages and industrial applications such as lighthouses in remote locations across Asia.[129]

- **Energy storage (US$80 billion):** Energy storage[130] is critical to ensuring full access to the benefits of clean, resilient energy supply for local communities that rely on renewable energy sources like solar power, which cannot continuously generate electricity. This is especially pertinent for rural areas in developing economies, where it is both difficult and costly to connect to the conventional national grid. Energy storage capacity in emerging markets worldwide is expected to grow by more than 40 percent annually in the coming decade, adding approximately 80 GW of new storage capacity to the estimated 2 GW existing today.[131] Growth in demand for energy storage is also driven by the expansion in developed markets of smart-grid systems, which depend on efficient energy storage, and rising demand for EVs.

  Globally, power storage capacity currently stands at about 150 GW,[132] or just under 3 percent of global electricity generation capacity, and is dominated by pumped-storage hydropower. However, the capacity of battery storage solutions, driven by small-

scale Li-ion batteries, has doubled in less than three years. Next-generation battery technologies are further lowering the cost of batteries.[133] Based on sodium, aluminum, or zinc, these batteries avoid the heavy metals and caustic chemicals used in older lead-acid batteries. The current annual manufacturing volume for Li-ion batteries is approximately 30 GWh, but by 2020 battery manufacturers intend to quadruple production capacity to around 120 GWh. Manufacturers also intend to achieve cost parity with pumped-storage hydro facilities before 2035.[134]

Asia already has some of the world's largest battery manufacturers, including Panasonic, LG Chem, BYD, Contemporary Amperex Technology Ltd (CATL), and Samsung. Japan-based Panasonic has the world's largest share of battery production, in part due to its partnership with Tesla to manufacture batteries for Tesla's EVs.[135] The two companies recently started producing batteries at the Gigafactory in Nevada, USA, which is expected to create up to 6,500 jobs at peak production.[136] While Panasonic currently leads the global battery market, Chinese producers are quickly catching up, backed by supportive government policies. According to Goldman Sachs, China overtook Korea as the world's largest supplier of lithium batteries for all electronic products in 2013, and has stretched that lead ever since.[137]

Box 9. Powering off-grid solutions in the Philippines

In rural areas like the smaller islands of the Philippines, generators powered by diesel oil continue to be the dominant technology for off-grid systems. But they are dogged by problems with fuel security and volatility in oil prices. Energy supply on these islands ranges from four to eight hours a day.

To help island communities access more stable supplies of electricity, researchers from the Reiner Lemoine Institut (RLI) looked at introducing renewable energy (solar and wind power) into their energy systems.

Some 193 islands with a population of 1,000 to 100,000 were chosen for the study, which found that adding batteries into their systems increased the share of renewable energy to an average of 81 percent, from 34 percent without batteries. Using a 40 MWh lead-acid battery led to the lowest levelised cost of electricity (LCOE) of €0.29 per KWh, compared to €0.37 per KWh using a diesel generator.

Solar emerged from the study as a clear winner over wind power in terms of efficiency, cost-effectiveness, and reliability.[138]

C. Food and agriculture

The challenges in food and agriculture

Over the next 15 years, Asia's food and agribusiness sector will face numerous challenges and opportunities related to inputs, production, processing, logistics, retail, and disposal (Exhibit 10).

EXHIBIT 10

Challenges facing the global food value chain

Value chain	Current value US$ billions	Challenges
Inputs	520	▪ Environmental impacts and chemical residues from traditional fertilizers. ▪ Feedstock and disease control in aquaculture.
Production	2,175	▪ The costs of soft commodities could increase **50-450 percent** with GHG pricing and water subsidy reform. ▪ **US$490 billion** worth of agricultural subsidies drain government finances. ▪ Growth rates in agricultural yields have been declining and currently keeping pace with world population growth. ▪ **51 percent** of remaining arable land is subject to both infrastructure and political risks. ▪ **33 percent** of soils are moderately to highly degraded. ▪ **61 percent** of 'commercial' fish populations are fully fished. ▪ At least **20 percent** of the world's aquifers are overexploited.
Food processing	1,377	▪ **US$1 trillion** worth of food is wasted throughout the value chain – a large share in food processing in developed countries.
Logistics	>300	▪ Food fraud is estimated to cost up to **US$40 billion** per year.
Retail and disposal	7,180	▪ Over **2 billion** people are overweight or obese. ▪ Over **800 million** people are hungry and more than **2 billion** suffer from micronutrient deficiencies.

Source: Literature search; AlphaBeta analysis

- **Inputs:** The inputs to the agricultural and fisheries sectors will be transformed by the Global Goals emphasis on ending hunger, improving agricultural productivity, and adapting to climate change. While growth in sales of traditional fertilisers may be constrained, there could be a shift in value towards microbial fertilisers. New breeding techniques will be needed to develop crops appropriate for changing environmental

conditions. Aquaculture disease control and feedstock innovation could transform the inputs for protein production.

- **Production:** The challenge of meeting future food demand will be equally significant. Severe land degradation and obstructed access to arable land in regions with limited infrastructure could limit production, especially if combined with political instability. For example, it is estimated that more than 40 percent of arable land in China is degraded due to climate change and erosion,[139] prompting the government to strengthen its monitoring of arable land arrangements and protect farmland.[140] In addition, yield growth has steadily fallen partly due to land degradation, with yields reaching their limits in current circumstances in many countries. Lack of investment in innovation also affects yield. Underinvestment in agricultural innovation is significant worldwide: although agriculture represents 10 percent of global GDP, agricultural technology (AgTech) accounts for only 3.5 percent of global venture capital funds.[141]

  This system is also heavily affected by resource subsidies, which place an increasing financial strain on many governments. Food markets are currently distorted by a range of global subsidies, including US$490 billion in agricultural subsidies, US$35 billion in fishery subsidies, and roughly US$455 billion in water subsidies (since agriculture accounts for about 70 percent of global water demand).[142] So reforming subsidies and/or carbon pricing regimes could have a dramatic impact on competitive dynamics in the food and agriculture system. Analysis by Trucost and McKinsey & Company shows that the prices of soft commodities could increase by 50–450 percent if they reflected the environmental impact of current food production.[143] These challenges could drive the widespread adoption of a range of sustainable farming practices involving new technologies such as robotics and the mobile internet.

- **Food processing:** Worldwide, 20–30 percent of food is wasted somewhere along the value chain, even before any waste takes place at the point of consumption.[144] In Asia, food waste is a particular concern across both developing and developed regions. The Asian Development Bank estimates that up to 37 percent of food is wasted in the Asia-Pacific region, with up to 90 percent wasted post-harvest.[145] Cost concerns and growing consumer awareness, supported by increasing sustainability reporting requirements for food retailers, will favour the development of low-waste food processors.

- **Logistics:** The logistics value chain in urban consumer markets in Asia and elsewhere will be transformed through a combination of new, on-demand customer models (such as UberEATS); technology innovations, driven by the Internet of Things; and responses to growing concerns about food fraud and food safety. A significant opportunity higher up in Asia's food value chain lies in strengthening cold chain logistics, using increasingly clean and sustainable refrigeration technologies.

Photo credit: Vasham (Indonesia)

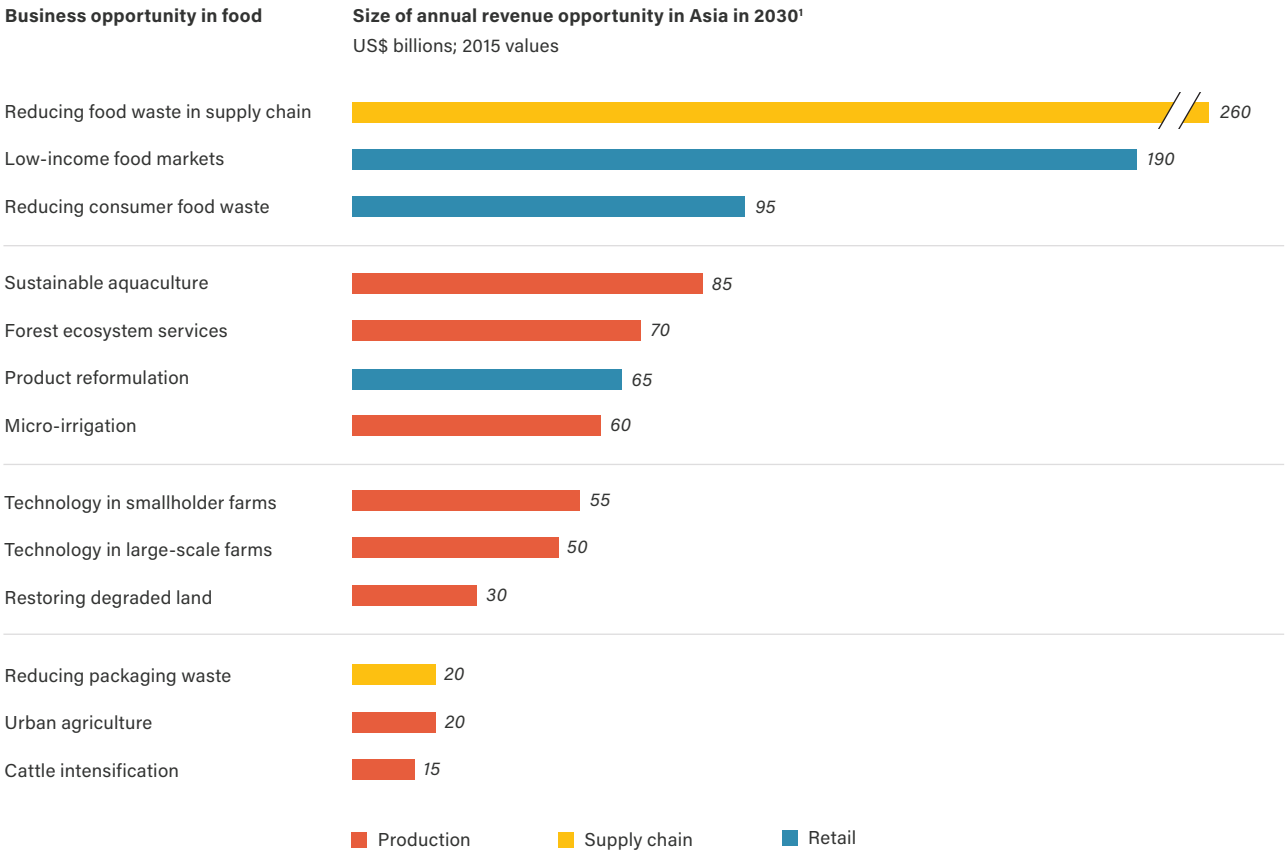
- **Retail and disposal:** The retail sector will undergo one of the biggest transformations in the value chain. Pursuing the Global Goal of ending extreme poverty will open up new markets for nutritious foods among low-income consumers. Pursuing the Global Goals in general will shift sustainably sourced products from being a niche category to becoming the industry standard. According to Nielsen's Global Health and Wellness Survey – a survey of 30,000 consumers in 60 countries – young people are much more interested in sustainably sourced food and are willing to pay a premium for it. Among consumers under 20 years of age, 41 percent said they would willingly pay a premium for sustainable products, compared to 21 percent of those aged from 50 into their mid-60s.[146] Consumers are also increasingly concerned with animal treatment, animal-welfare standards, and overall farming conditions.

The business and investment opportunities emerging from a sustainable development pathway in food and agriculture

The UN Global Goals agenda proposes to meet these profound challenges by shifting the food and agriculture system onto a sustainable development pathway. This shift will be transformative, with major impacts throughout the food and agriculture value chain, and could lead to the emergence of a number of disruptive business opportunities worth more than US$1 trillion in Asia in 2030 (Exhibit 11).

EXHIBIT 11

There will be more than US$1 trillion worth of opportunities in Asia's food sector in 2030, spread across production, the supply chain, and retail



Source: Literature search; AlphaBeta analysis

[1] Based on estimated savings or projected market sizings in each area. Only the high-potential opportunity is shown here. Rounded to nearest US$5 billion.

The following section discusses a few of these key opportunities in further detail.

- **Reducing food waste in the supply chain (US$260 billion):** The underlying causes of the previously mentioned substantial post-harvest losses in Asia's value chains include limited information on which to base feed production planning; pest infestations and diseases; poor and inadequate infrastructure such as roads, water, power, and market facilities; lack of dedicated transport systems for food; and inferior quality bulk packaging that results in spillage and damage.[147] Food waste is a growing problem in the urban

centres of many countries in the Asia-Pacific region. An estimated 11 kg of food is wasted per person per year in developing Asian countries, and this figure rises up to 80 kilograms in developed Asian countries (compared to 110 kg per head wasted in North America).[148]

China accounts for 38 percent (US$97 billion) of the total food waste opportunity. The scarcity of cold chain logistics in many parts of China is one reason so much food is spoiled before it reaches consumers. Local companies are beginning to tap opportunities in food waste, although much more could be done. For example, the Shanghai Tongji Plant Biomass Energy company, started in 2012, has built waste-to-energy plants across China to turn food waste into biogas, fertiliser, and building materials. India accounts for 24 percent (US$62 billion) of the total opportunity, as cold storage facilities are scarce here too. A study by the Indian Institute of Management in Kolkata revealed that only 10 percent of foods in India are kept in cold storage facilities, leaving the rest exposed to the elements.[149] Other factors contributing to waste in India include erratic electricity supply, inefficiencies in the government-run Food Corporation of India (FCI), and a lack of incentives to invest in the supply chain sector.[150] The Indian government has recognised this issue and taken steps to tackle it. For instance, in 2012, the government revised regulations to allow up to 51 percent foreign direct investment in supermarkets, hoping that more funding and new technologies might help India create modern food supply networks.[151]

There are a range of investment opportunities, ranging from data systems to better manage production processes through to investment in cold storage facilities. The Japan Weather Association has collaborated with food producers such as Mizkan Holdings and Sagamiya Foods to develop a novel artificial intelligence system that predicts food demand based on weather information and sales data.[152] This system aims to help companies scale back redundant production and cut food inventory losses. Bangladesh Clean Technology Company Ltd and Solar E Technology, which has offices in Australia and Bangladesh, are introducing affordable solar-based micro cold storage systems for farmers in Bangladesh to replace traditional ammonia-based cold stores.[153]

In countries like China and Malaysia, more companies are building automated freezer storage that uses robots to efficiently stack and retrieve food products, reducing food wasted through human error or delays. A key challenge to scaling this opportunity is the high capital outlay required for cold chain systems, although partnerships between firms can make financing viable. Current cold chain technologies also risk adding to air pollution, unless they use sustainable methods. Many third-party logistics players in Asia use diesel-powered transport refrigeration units, which consume almost one-fifth of a truck's fuel while emitting significantly more particulate matter and nitrous oxide (N_2O) than a modern propulsion engine.

New technologies that reduce hydrofluorocarbon (HFC) emissions in cold storage are also emerging. For example, Hitachi manufactures and sells refrigeration solutions free of HFCs and chlorofluorocarbons (CFCs) to both commercial and home users. Such technologies are crucial to preventing greenhouse gas production and protecting the ozone layer. Governments worldwide are taking more active steps to combat the release of HFCs from air conditioning and refrigeration, underlined by the legally binding Kigali deal agreed to by 197 countries,[154] which is opening up market opportunities in cold storage for innovative firms. The Australian Refrigeration Association estimates that shifting to natural refrigerants and investing in other energy-efficiency improvements can lead to 60 percent savings (valued at A$8 billion) per year in heating, ventilation, air conditioning, and refrigeration-related costs in Australia alone.[155] Many food companies are also adopting more environmentally responsible measures that will increase demand for ozone-friendly refrigeration.

Box 10. India's cold chain infrastructure

India will invest up to US$15 billion to develop cold chain infrastructure over the next five years.[156] Areas of investment include:

- **Building more refrigerated warehouses:** Only about 4 million of the 104 million tonnes of fresh produce in India is transported in a cold chain every year, compared to about 90 percent in developed economies.[157] In addition, the bulk of the Indian refrigerated warehouses are only suitable for storing potatoes, a commodity that produces only 20 percent of agricultural revenue. There is ample scope for building more facilities that house a variety of fresh fruit and vegetables, 40 percent of which currently rot before reaching consumers.

- **Sustainable cold storage units:** Efforts are underway to use renewable energy sources to power cold storage, such as cooling through solar-driven absorption. For example, TESSOL's PLUGnCHILL range of products eliminates the use of fossil fuels for cold chain transport systems by using TESSOL's proprietary energy-storage technology. The company claims that its fuel-free chilling system will reduce the running costs of these units by 60 percent, as well as reducing diesel consumption by 1,000 litres per small vehicle, per year.[158] Some logistics players are also transporting small orders of perishables like milk and vegetables to consumers using motorcycles with delivery boxes that are equipped with energy-saving cold-storage technology icepacks. These are more cost-effective and last longer than dry ice, while cutting down on the use of diesel-fuelled trucks.

- **Improving delivery speeds:** Food waste is exacerbated in India by traffic congestion and poor distribution systems. Adding more refrigerated trucks and optimising distribution systems is another key area of investment that can help to reduce waste.

- **Low-income food markets (US$190 billion):** The world's poorest spend as much as 60 percent of their income on food.[159] Despite this, calorie deficiency and malnourishment persist when populations cannot reach or afford enough of the right kinds of food.[160] Poor populations in South Asia face deficits of 300–500 kCal per day.[161] Consumer goods companies can address this gap by investing in supply chains and food innovation to make more nutritious food products available to poor consumers. If the Global Goal of ending extreme poverty is met, an additional 800 million people could emerge as consumers with incomes capable of meeting their food needs.[162] Having consumer goods companies recognise this new market will be a vital step in meeting the Global Goal of universal access to 'safe, nutritious, and sufficient' food. Established local food demand patterns will be a key barrier to realising value from this consumer pool. For example, some populations in Asia continue to consume locally popular rice even when cheaper and more calorie-efficient grains such as millets are available.[163]

  China accounts for 25 percent of this opportunity (US$47 billion). There have been several food fortification programmes in China, organised by public–private partnerships. For instance, in the early 2000s the Ministry of Health partnered with private companies including the Yishui Zhengji Condiments Company and the China Condiment Industry Association to fortify soy sauce with iron, in an effort to alleviate iron deficiency in the population.[164] India accounts for a further 46 percent of the opportunity in this area (US$87 billion). According to the Food and Agriculture Organization of the United Nations (FAO), 15 percent of Indians are still too undernourished to lead a productive life.[165]

- **Sustainable aquaculture (US$85 billion):** Overfishing of wild-caught fish combined with increasing demand for food have turned aquaculture into a growing industry that is projected to almost double in size in the next 15 years.[166] Global production of aquaculture was 52.8 million tonnes in 2008 and is projected to be 93.6 million tonnes in 2030.[167] The FAO estimates that more than 70 percent of production will come from the Asia-Pacific region, and China alone will account for 75 percent of Asia's total production. Yet aquaculture is a relatively immature practice with large scope for technological improvement. Compared to livestock, aquaculture's feed, disease control, waste management, and other farming techniques are underdeveloped. There is also strong potential for accelerated growth in the sustainable aquaculture market as communities adopt more sustainable diets. Opportunities include developing lower-cost plant-based fish feed that would reduce the feed conversion ratio, and exploring new environmentally friendly methods of land-based aquaculture (including cleaning systems that conserve water) to address some of the common problems like algae blooms and diseases that tend to spread quickly in poorly managed offshore farms.

China accounts for 53 percent of the total opportunity in sustainable aquaculture (US$46 billion). The government's latest five-year plan contains provisions to improve aquaculture standards and provide subsidies to the industry.[168] China's key strengths in aquaculture production include relatively low labour costs, favourable geography, and strong government support. Food safety is a major concern, with the discovery of harmful chemicals in some products in recent years, in part due to pollution, lack of technological best practices, and lack of industry know-how.[169] So, there are opportunities for foreign companies with more advanced techniques to develop in-country production, or to sell services and equipment to Chinese farmers. Other opportunities include introducing high-quality fish feed or new breeds of aquaculture to the Chinese market.

India accounts for 10 percent of the total opportunity in sustainable aquaculture (US$9 billion). The fishery industry, which aquaculture falls under, is of economic and strategic importance to the government as it creates a significant number of jobs and contributes meaningfully to exports and GDP. This is reflected in the array of financial incentives the state provides to the industry through the Marine Products Export Development Authority (MPEDA). Infrastructure to support the aquaculture export trade has undergone broad improvements but it still lags behind the standards found in more developed markets,[170] opening up opportunities for innovative and cost-effective companies to enter the market.

The other developing Asian countries account for 30 percent of the opportunity in sustainable aquaculture (US$26 billion). Southeast Asia is projected to produce around 16 percent of global aquaculture by 2030.[171] The top-producing countries of Indonesia, Vietnam, and the Philippines have recognised the potential of aquaculture to alleviate poverty and strengthen external balances. Two major constraints on the industry in Southeast Asia are pollution from the excessive use of inputs, and poor husbandry practices. These have led to severe production cutbacks in Indonesia, Thailand, and the Philippines, and contributed to the prohibitive cost of feed.[172]

The fishing and aquaculture sector faces concerns around the use of child labour and of the lack of safe and fair work practices. Of the world's 215 million under-age labourers (aged under 18), 60 percent work in fisheries, forestry, agriculture, and livestock-raising.[173] The activities they perform include capture fishing, processing, marketing, and other post-harvest activities, as well as in upstream industries such as netmaking and boatbuilding. Child labour is particularly widespread in Asian fishing and aquaculture sectors because the small- to medium-scale nature of its informal economy means that decent work is poorly organised or absent. Sustainable aquaculture by definition will implement FAO and International Labour Organization recommendations in these areas.[174]

Box 11. Temasek Life Sciences Laboratory

R&D to develop better fish stocks is a critical part of boosting sustainable aquaculture. Temasek Life Sciences Laboratory (TLL), a non-profit research organisation, is contributing to this cause through its work on developing a holistic aquaculture system.

TLL's strategy is to create a product that is commercially viable, has a positive environmental impact, and benefits the community.

The laboratory combines genetic selection with top-class engineering to breed fish that grow faster, are more resistant to disease, and more nutritious. An additional goal is to create whole aquatic systems that have no negative impact on natural environments.[175] This also benefits the farmers who no longer have to worry about diseases or algae blooms. It significantly reduces their risks, which then allows them more flexibility to manage their stocks and sales.

TLL has developed a recirculating urban aquaculture system, in which water used to house fish is automatically cleaned within the same closed-loop system. Combining this and superior fish genetics, the system could in theory account for 15 percent of Singapore's fish consumption using the same amount of space as about 480 apartments. Particularly useful in urban settings, this could allow city states to ramp up sustainable production closer to sources of demand, and in doing so generate a stable supply of fish protein to enhance food security. It also eliminates the need to transport fish, further reducing the system's carbon footprint, since the fish are bred in the communities where they are to be eaten.[176]

TLL has experimented with two fish breeds:

- **Asian sea bass (Barramundi):** This fish can be found over an enormous geographic range from northwestern India throughout Southeast Asia, Papua New Guinea, and northern Australia. It is one of the most popular tropical high-value marine food fishes currently farmed in the region. TLL is using molecular genetics to naturally increase production of this commercially important tropical fish species. Applying technology for natural selective breeding, it has cultivated a better-quality, disease-resistant fish, with better growth rates and greater nutritional benefits. TLL has collaborated with Singapore's Agri-Food & Veterinary Authority (AVA) since 2003 at the Marine Aquaculture Centre on St John's Island to identify and create superior broodstocks that are fast-growing and more disease-resistant.

- **Tilapia:** One of the most farmed species in the world, tilapia is omnivorous and can be fed well on plant-based diets – a plus factor in sustainable aquaculture. But some species only grow in fresh water, and do not tolerate saltwater. The market for tilapia is one of the fastest-growing fish segments. This makes it an attractive fish species for Asian aquaculture farmers to breed. Since 2010, TLL and AVA have collaborated to improve the growth rate of the Mozambique tilapia, which is salt-tolerant. Using advanced molecular biotechnology and marker-assisted selection techniques together with classical selective breeding methods, they have identified strains of the Mozambique tilapia that grow faster and are more resistant to salt and disease, without any genetic modification. The meat content also has a higher nutritional value.

Box 12. The rise of vertical integration in aquaculture

Due to the relative ease of entry and lack of coordinated regulation, the industry in Asia largely comprises individual farmers, cooperatives, and corporations. However, an increasing number of companies, particularly salmon producers, are adopting vertical integration in aquaculture operations.[177] Broadly speaking, vertical integration refers to ownership of a few parts of the entire value chain, from manufacturing feed to selling the final product.

There appear to be several drivers for this shift. First, it is difficult to secure a stable supply of inputs. For example, farmers are exposed to price fluctuations in feed due to demand–supply imbalances in the marine-based ingredients used in feed. The market power of marine fish hatcheries could also expose farmers to financial and operational risks. Second, the regulatory landscape is tightening as governments home in on unsustainable practices. Similarly, rising consumer consciousness over the environment has tainted public perception of the aquaculture industry, which can increase resistance from local communities. Third, there is no premium market for farmed fish[178] so there is no big margin incentive for farmers to seek economies of scale. Lastly, commercial aquaculture involves many uncertainties arising from disease, unpredictable weather, and machinery failures.[179]

A vertically integrated aquaculture operation can help to mitigate some of these challenges. By innovating and manufacturing its own feed, a business can eliminate uncertainties over feed supply and produce more accurate financial forecasts. It can also control the quality of feed, which helps with marketing and satisfying regulatory requirements. Likewise, control over larvae and juvenile fish production not only improves supply consistency, but creates opportunities for innovation in genetic improvement that can improve yields for farmed species. It could also be easier for vertically integrated aquaculture operations to reap economies of scale and scope by coordinating processes and adding value along the supply chain, creating cost efficiencies in the process. Finally, having control over the food processing and distribution process can help ensure quality and aid efforts to market a high-quality, environmentally sustainable products that could fetch higher prices.

- **Technology in smallholder farms (US$55 billion):** Some 1.5 billion people depend on smallholder farm production – that is, farms with less than two hectares of land. Smallholder farms are an important part of the global food chain. They cultivate about 30 percent of the global cropland, and produce as much as 80 percent of the food consumed in emerging markets such as Southeast Asia.[180] They are still operating at a low-income, subsistence level, and are vulnerable to ongoing environmental risk.[181] For instance, small Indonesian palm oil producers, who account for one-third of production, eke out yields that are roughly 50 percent lower than large plantations.[182] Helping these farmers to raise yields is important not only for food production and environmental stewardship (given they account for 30 percent of cropland), but also for tackling rural poverty. The scope for improvement is large, and academic evidence shows there is potential to double their current yields.[183] The range of levers for achieving this yield

Photo credit: Asian Development Bank/Flickr

improvement include extension services, new technology for greater connectivity, improved access to capital (to fund necessary equipment), aggregation mechanisms (to achieve economies of scale among smallholders), and better links to markets. A meta-study of investment in smallholder extension services found a median rate of return of 58 percent. The available case study evidence on extension services demonstrates their large potential impact on total factor productivity through securing more capital per worker, better use of fertilisers, and improved farming practices.[184]

Palm oil is a particularly significant crop from a Global Goals perspective. Being the highest yielding oil crop, it is potentially more sustainable than alternatives that use more land and resources to produce the same volumes. However, production practices today are far from universally sustainable, both on large plantations and among the smallholder farmers who produce 40 percent of the world's palm oils. Unsustainable palm oil plantations are a major cause of deforestation, meaning that normalising the certification of sustainable palm oil across the industry is crucial to aligning the crop's expansion with the Global Goals. Certification involves the whole value chain. Plantation owners, smallholders, and refineries must commit to growing and refining only Certified Sustainable Palm Oil (CSPO); manufacturers and retailers must commit

to sourcing only CSPO; financiers must commit to funding only CSPO projects; and consumers need to be educated on the benefits of buying only CSPO. (See Box 14 on Unilever's support for CSPO in Indonesia.)

Technology can play a particularly important role in overcoming information gaps and supporting cost-effective business models that serve smallholder farms. For example, almost 200,000 farmers use the *1677 Farmer Information Superhighway in Thailand. This began as an SMS service and has evolved to include MMS, videos over 3G, mobile phone apps, and a mobile marketplace for helping farmers improve productivity. Financing is a particular challenge for smallholders, and a range of new models are also being developed. Financial institutions such as Root Capital, MicroVest, Alterfin, Grassroots Capital Management, and Sarona are exploring financing models that lower transaction costs by using mechanisms such as certification programmes to create investible pipelines, as well as lowering distribution costs through mobile transfers, and using crop and weather insurance products to reduce the risk of default.

Box 13. Olam's partnership with smallholder farmers

Even with sufficient funds, tools, and infrastructural access, smallholder farms may not be able to boost productivity significantly without the right information.

Data is critical to designing good farm management plans. Farmers need to know the exact amount of fertiliser to apply and/or the best times to apply pesticide based on historic records of disease. Many smallholder farmers keep records manually on paper, which may be hard to retrieve, or they omit them altogether.

Recognising the importance of farmer information, agribusiness company Olam has developed an online system to help farmers collect, analyse, and use it. The Singapore-based company's Olam Farmer Information System (OFIS) uses a smartphone app to capture unique attributes of farms, including the farmer's level of farming experience and the geographical features of the land. The data can generate personalised recommendations to help farmers improve their agricultural practices, save costs, and boost yields. The company provides training and resources for farmers to use this technology. OFIS also aggregates data – for instance, to map the density of farmed areas – which offers additional insights. These help Olam and its partners invest money where it is most needed and will best help to improve farmers' livelihoods.

In 2017, Olam aims to extend the use of OFIS to 500,000 farmers across various crops, including nuts, rice, palm, rubber, and cocoa.[185]

Box 14. Unilever's Produce & Protect model for Indonesian palm oil

Indonesia accounts for approximately 60 percent of global palm oil production,[186] and Indonesia plans to double its palm oil production by 2020 (against a 2015 baseline).[187] Indonesia already has one of the highest rates of deforestation in the world, where 54 percent of forest loss is attributable to new palm oil plantations.[188] In 2016, the Indonesian government set up the Peatland Restoration Agency to restore 2 million hectares of dried peatland[189] and declared a moratorium on new oil palm and mining permits.[190] The hope is that productivity gains on existing plantation land can meet both the 2020 palm oil production target and future demand for palm oil.

Smallholder farmers account for about 40 percent of the total planted palm fields in Indonesia, but only produce 35 percent of total crude palm oil output,[191] pointing to significant improvement potential in smallholder farming productivity.

Unilever, the €50 billion Dutch–British transnational consumer goods company, has committed to a Produce & Protect model, whereby intensifying agriculture and achieving higher yields goes hand in hand with protecting forests and livelihoods. To achieve this goal, Unilever is helping every individual palm oil farmer in the small village of Pangkalan Tiga get through the certification processes for the Roundtable on Sustainable Palm Oil and the Indonesian Sustainable Palm Oil system. These are sets of environmental and social principles that companies must comply with to produce CSPO. A whole village like Pangkalan Tiga can be certified as a 'sustainable village' once all the individual smallholder palm oil farmers in it have achieved certification.

Unilever uses palm oil in many of its products, and purchases nearly 3 percent of palm oil produced globally. Unilever has committed to achieving 100 percent physically certified palm oil by 2019,[192] and in January 2017, announced the signing of a three-year memorandum of understanding (MoU) with the provincial government of Central Kalimantan, the district government of West Kotawaringin Regency and Institut Penelitian Inovasi Bumi (INOBU), an Indonesian non-profit research institute. The MoU seeks to support the sourcing of sustainable palm oil at a village level, and improve yields and livelihoods for smallholder farmers in exchange for government support in the fight against deforestation.[193]

The programme will initially affect around 600 independent smallholders on approximately 1,400 hectares of land. If it is successful, Unilever plans to expand it into other Indonesian villages. The process of implementing the model is complex but the financial benefit to investors and smallholders alike includes the ability to use longer-term contracts to de-risk investments in sustainable agriculture intensification. This is forecast to improve palm oil productivity while protecting forests and livelihoods, and help Unilever reach its 2019 sustainable palm oil target. The ultimate vision is to create a model that is replicable and can be brought to scale all over the world.

Young girl holding rope woven from plastic and foil packaging waste in Ahmedabad. Photo credit: Meena Kadri/Flickr

- **Reducing packaging waste (US$20 billion):** More than 95 percent of the economic value of plastic packaging is lost after the first use – the global equivalent of US$80–120 billion.[194] Additionally, only 15 percent of material is collected for recycling, at a recycling value yield of only 30 percent. Asia has the highest level of mismanaged plastic waste, as there is little economic incentive for collecting it and limited infrastructure for recycling or disposal. Eight Asian countries appear in the list of top 10 countries worldwide ranked by their mass of mismanaged plastic.[195] The plastic packaging economy is expected to double in value by 2030[196] and Asia is already responsible for an estimated 80 percent of plastic leaking into the oceans. The cost of ocean plastics to the tourism, fishing, and shipping industries is estimated to be US$1.3 billion in the Asia-Pacific region alone.[197]

  There are ample opportunities to increase the amount of material that is recycled. Recovering the amount currently lost to landfills and pollution will require a major change in consumer behaviour. Public policy and business initiatives will need to coordinate to identify the most effective ways to change recycling habits. But success in improving recycling rates for other resources suggests there is good reason to believe improvement is achievable – for example, more than 60 percent of the value of waste paper is now captured through recycling.[198] Key enablers that could drive similar recovery rates for plastics include technology and processing innovations that develop products fit for recycling or recovery systems; recovering value from plastics through incentivised collection models; and regulations that apply at the manufacturing stage to encourage the creation of more recyclable or reusable products.

Box 15. Unilever's sachet waste recovery programme

Unilever sells millions of products in single-use sachets, a simple flat pouch or stick pack for packaging powders and other free-flowing goods. They are heavily used in developing and emerging markets, to make the brands affordable to people on low incomes.[199] Sachets in developing countries generally end up in landfills or as litter due to the complex material composition making them difficult to recycle, a lack of infrastructure, and little economic incentive to collect them for recycling. Waste sachets litter streets, clog drains, cause floods, and are often washed into oceans.

In May 2017, Unilever announced its groundbreaking new technology, developed in collaboration with the Fraunhofer Institute for Process Engineering and Packaging IVV in Germany, to completely recycle waste sachets. This announcement is part of Unilever's pledge to ensure 100 percent its plastic packaging is fully reusable, recyclable, or compostable by 2025.

The waste sachet recycling technology, called the CreaSolv® Process, allows plastic to be recovered from the sachet and used to create new sachets for Unilever products. The CreaSolv® Process is adapted from a technology used to recycle television sets, where brominated flame retardants are separated from waste electrical and electronic equipment polymers. Unilever is looking to use this technology in addition to setting up waste collection schemes that channel the sachets towards recycling, which will help create system-level change. Unilever is working with local waste banks, governments, and retailers, and will look to empower waste pickers and integrate them into the mainstream economy by providing a guaranteed income.

The first pilot CreaSolv® Process plant will be in East Java, Indonesia, and is scheduled to be operational towards the end of 2017. Indonesia consumes approximately 4.4 million tonnes of plastic annually, 70 percent of which is currently mismanaged due to limited infrastructure for recycling or disposal, leaving up to 1.3 million tonnes of waste in the ocean each year.[200] Indonesia has committed to reducing this marine waste by 25 percent by 2025, and pledged up to US$1 billion a year to dramatically reduce the amount of plastic and other waste products polluting its waters.

The aim of the pilot plant is to validate the commercial viability of the new technology and the model. It is the first time that a technology for recycling waste sachets will be operated at this scale, and Unilever intend to make the technology open-sourced. Its vision is to disrupt the system by replicating the application of the technology and scaling up the circular model to other parts the world.

D. Health and well-being

The challenges in health and well-being

Over the next 15 years, Asia's health sector faces several challenges and opportunities related to R&D, inputs and devices, primary and secondary care, and lifestyle management (Exhibit 12).

EXHIBIT 12
Challenges facing the global health value chain

Value chain areas	Current value US$ billions	Challenges
R&D	170	▪ Increasing antimicrobial resistance in key disease strains could cost the global economy up to **US$2 trillion** annually by 2030.
Inputs and devices	1,200 (Pharma) 290 (Biotech) 360 (Medtech)	▪ Basic antibiotics are not available in **40-60 percent** of health facilities, and basic medication to treat non-communicable diseases is unavailable in up to **70-80 percent** of facilities.
Primary care	6,500	▪ The number of healthcare workers must increase at **11 percent** annually to 2030 to meet projected need. ▪ According to the WHO, climate change will pose a "significant risk" to health. ▪ **2.7 million** children died within their first 28 days of life in 2015. ▪ Low-cost healthcare remains out of reach for many. **100 million** people fall below the poverty line each year due to health expenditures.
Secondary care		▪ Global health emergencies – especially infectious disease outbreaks – pose a challenge to global surveillance and coordination mechanisms. ▪ Health systems in poorer countries receive inadequate public financing. Low-income countries spent **2.5 percent** of their GDP on health systems, compared to a global average of **4 percent.**
Lifestyle management	~250 (including gyms)	▪ The burden of non-communicable diseases continues to increase. For example, the prevalence of obesity has **doubled** since 1980, with no recorded decrease in any region. This has increased the burden of diabetes and heart disease.

Source: Literature search; AlphaBeta analysis

- **Research and development:** Pathogens have always rapidly evolved to resist antibiotics' ability to treat communicable diseases, but it is only in recent years that this antimicrobial resistance (AMR) has become a global health problem as R&D in antibiotics has declined. Around 700,000 people each year die from infection by drug-resistant pathogens and parasites. In Thailand alone, 19,000 deaths are attributable to AMR each year.[201] Without action, the global number of people dying as a result of AMR could rise to 10 million by 2050. The economic cost would be enormous, potentially reducing global GDP by 2–3.5 percent.[202] Although there is an urgent need for new antibiotics, the Association of the British Pharmaceutical Industry estimates that bringing a new drug to the market takes up to 12 years and costs £1.5 billion (US$1.9 billion).[203] Businesses can save on the time, effort, and money spent cleaning and analysing data by using more modern digital tools to collect it. Tools like digital sensors for improved data collection can partly automate the work of tracking what every

A hospital in the remote province of a Preah Vihear, Cambodia. Photo credit: World Bank/Flickr

patient is doing, reducing the number of patients' clinic visits during the R&D period.[204] The Lancet Commission on Investing in Health urges the international community to increase pharmaceutical research investments from US$3 billion to US$6 billion annually by 2020.

- **Inputs and devices:** Drugs and devices have traditionally targeted developed countries, meaning there have been fewer effective and affordable drugs available to treat conditions prevalent elsewhere. The development of low-cost products that use digital technologies could transform both how healthcare services and instruments are used, and their overall efficiency. For example, Netra is a US$2 examining device that clips onto the screen of a smartphone and can be used to diagnose eye conditions, reducing time for diagnosis and thus saving costs for patients. The value of the Asian health device market is estimated to reach US$15 billion by 2020, up from US$13 billion in 2012.[205]

- **Primary care:** There will be rapid growth in demand for healthcare in Asia over the next 15 years due to a combination of an ageing population, a rising consuming class, and increases in the prevalence of chronic diseases such as cancer and diabetes. However, there are significant gaps in healthcare supply. The World Health Organization (WHO) estimates that globally 4.45 skilled health workers are needed for every 1,000 people. Based on that ratio, by 2030 an additional 14 million medical

professionals will be required worldwide. Many countries in Asia have significant gaps in primary care provision. For example, Southeast Asia averages 0.6 physicians per 1,000 habitants, and the ratios for dentists, nurses, and midwives are even lower.[206] The gaps in quality and accessibility are increasing not only within Asian countries but also between them. Malaysia, Singapore, and Thailand – with their well-developed private healthcare sectors and relatively low-cost treatments and services – attract roughly US$1.4 billion annually from Indonesians who travel abroad to get treatments unavailable to them in Indonesia.[207] Such medical tourism has led countries with less developed healthcare systems to suffer severe revenue losses.

Modern technology in medicine has the disruptive potential to increase the geographical reach of quality treatment, diagnosis, and communication between medical service departments and locations. Webcam and audio technologies have already been pioneered in a number of remote locations across Asia, including in Mongolia and India, where senior physicians can give expert advice and guidance to distant medical workers on the ground.

- **Secondary care:** In-hospital treatment is often very expensive across Asia, so many people opt out of hospital treatment because they cannot finance it.[208] Using 'lean' surgical interventions could give many more low-income consumers access to secondary healthcare.

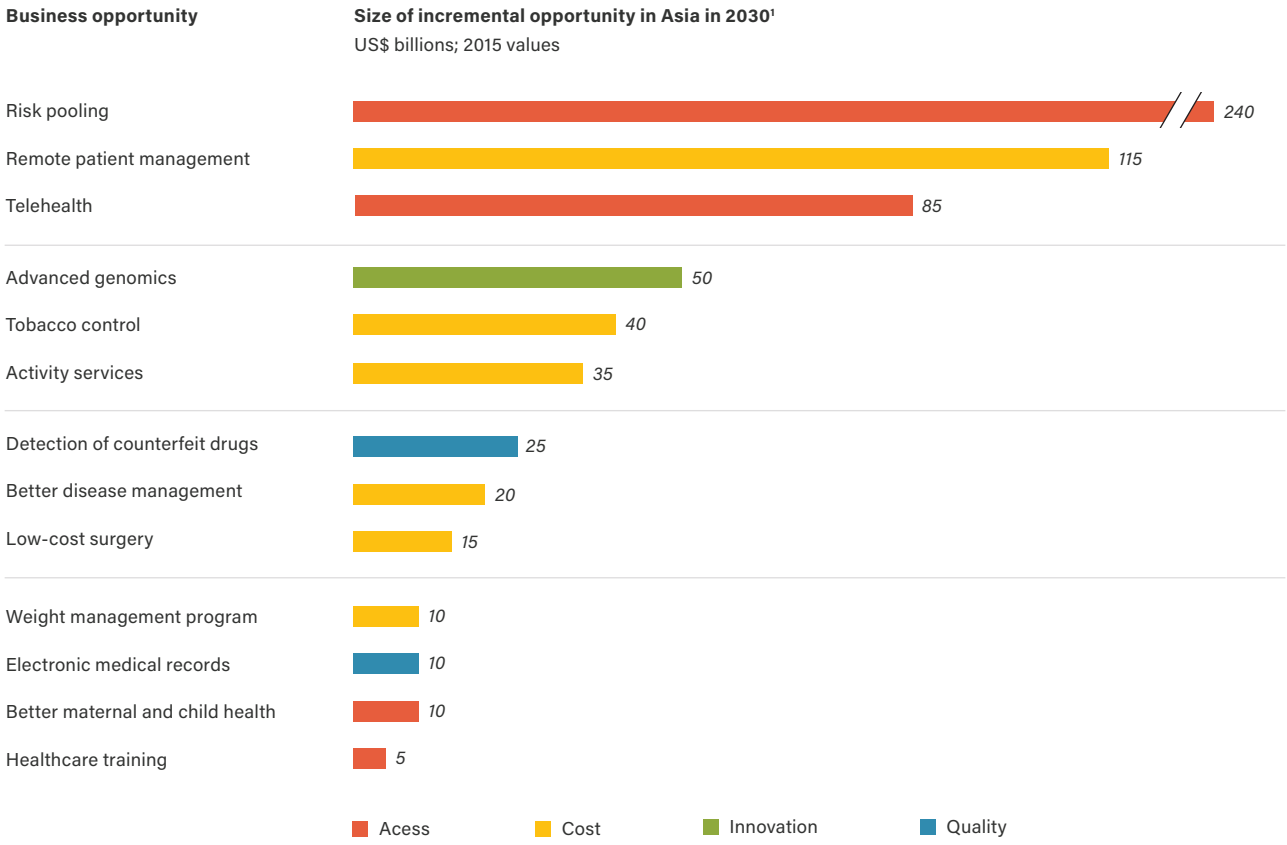
- **Lifestyle management:** With increased emphasis on preventive care, the lifestyle sector will continue to grow. As a side effect of Asia's increased affluence, inactive lifestyles are becoming more prevalent, which leads to chronic diseases; more than 190 million people in Asia are now diagnosed with Type 2 Diabetes.[209] A study in 2014 showed that in rural China 17 percent of boys and 9 percent of girls under the age of 19 were obese, up from 1 percent in 1985.[210] The prevalence of obesity has also doubled since 1980 – there has been no recorded decrease in any region – increasing the burden of diabetes and heart disease. Food product reformulation and other levers have the potential to lower obesity levels in 2030 from a projected 41 percent of the global population to around 5 percent.[211]

The business and investment opportunities emerging from a sustainable development pathway in health and well-being

The Global Goals agenda proposes meeting these profound challenges by shifting health and well-being onto a sustainable development pathway. This shift will be transformative throughout the value chain, and could lead to the emergence of a number of disruptive business opportunities worth US$670 billion in Asia in 2030 (Exhibit 13).

EXHIBIT 13

The largest business opportunities in Asia's health and well-being system could be worth US$670 billion in 2030



Source: Literature search; AlphaBeta analysis

[1] Based on estimated savings or projected market sizings in each area. Only the high-potential opportunity is shown here. Rounded to nearest US$5 billion.

The following section discusses a few of these key opportunities in further detail.

- **Risk pooling (US$240 billion):** Increasing the penetration of private, public–private, and community insurance schemes is an essential step towards making healthcare affordable and achieving universal healthcare coverage in line with the Global Goals.[212] World Bank research has shown that the out-of-pocket share of total health expenditure in East Asia and the Pacific reached more than 25 percent in 2014, and was as high as 61.5 percent in South Asia in the same year. One reason is that almost 60 percent of the population in the Asia-Pacific region are part of the informal economy,[213] which makes them ineligible for public health insurance. Since the poor pay a disproportionate share

of their income in unavoidable health costs, this situation is also inequitable. In addition to better distributing health risks across communities, risk pooling arrangements often include organised contracting functions that purchase healthcare on behalf of the individuals covered, which in turn encourages higher-quality private sector providers to emerge.[214] Despite these benefits, health insurance coverage remains very low in many parts of Asia because of the lack of consumer knowledge and suitable products. The expansion of risk pooling arrangements will require educating consumers to invest in their future health needs, and building the analytical talent to operate risk-pooling arrangements. This is a particular challenge given the lack of good-quality health statistics in many parts of developing Asia.

Microinsurance is a nascent business model that is gaining momentum across developing countries due to the large untapped market. Global data from the Microinsurance Network and Munich Re Foundation reveals that overall microinsurance penetration in the Asia-Pacific region lags behind Latin America, Africa, and the Caribbean. Within the Asia-Pacific region, penetration is highest in the Philippines, Thailand, and India, whereas most other countries have no coverage.[215] Swiss Re estimates the market for 'commercially viable microinsurance products' to be 2.6 billion people and US$40 billion in direct written premiums,[216] and Lloyd's estimates a market of 1.5–3 billion policies at an annual growth rate of 10 percent.[217] While these numbers cover demand for all insurance, most of the demand is for health and life insurance products.

Private sector firms have devised innovative digital payment methods to spur higher levels of risk pooling. Increased access to mobile and internet services even in developing and rural areas is facilitating these digital business models. New approaches combine more conventional insurance mechanisms with modern technologies such as digital distribution technology, big data, and blockchain. As of late 2016, mobile insurance startup BIMA had almost 24 million customers across developing countries in Asia, Africa, and Latin America, which the company charges for monthly rolling insurance through their mobile subscription plans.[218] Similarly, Grameenphone, a Bangladesh-based subsidiary of Telenor Group, is pioneering innovative mobile services in India. In 2016, it launched 'Tonic', a digital health service that provides health tips via text, a 24-hour medical call centre resourced by licensed physicians, and a discount programme to make hospital care more affordable. It also offers cash to help cover costs if users of the service are hospitalised for three nights or more.[219]

Box 16. The digital financial inclusion opportunity in Asia

Digital finance could provide access to financial services for 1.6 billion people in emerging economies and increase the volume of loans offered to individuals and businesses by US$2.1 trillion.[220] It could also be a powerful driver of economic growth. Financial inclusion could increase GDP by as much as 32 percent in Cambodia and by up to 14 percent for relatively large economies like Indonesia.[221] Asia has more than 1.1 billion 'unbanked' people[222] and relatively high mobile or internet penetration rates, generating big opportunities for the region to benefit from extending digital finance.

Governments can use digital channels to make sure welfare payments and salaries reach the correct end users, avoiding the risk of them falling into the wrong and possibly corrupt hands. In India, some US$22 billion in government payments goes missing each year. Meanwhile, Indian customers forgo more than US$2 billion a year in income because of the time they spend going to and from bank branches.[223]

Mobile apps can offer a low-cost way for people in remote or rural locations to make and receive payments on mobile devices, without having to open a bank account. These apps can cut the costs of banking services by up to 19 percent, according to Asian Development Bank (ADB) estimates.[224]

Online, peer-to-peer microlending and crowdfunding platforms can help SMEs to expand. These are the biggest job creators in developing economies such as China's. These entrepreneurs often lack the collateral and track record to receive formal bank loans, but can raise funding online by pitching financially viable projects.

Microinsurance can help the poor to handle income shocks caused by events such as a poor harvest. Just 4 percent of Asians have microinsurance,[225] although countries like Malaysia and Thailand are seeing fast growth of microinsurance for health, life, crop, and livestock protection.

Digital finance is gaining traction across Asia as more companies and government players use web-based financial technology to expand financial services offerings for lower-income households. For example, in the Philippines, the central bank has teamed up with mobile providers to offer mobile money services to more than 50 million clients. In China, the dominant mobile wallet app Alipay has attracted 450 million users, who store cash, pay for online transactions, and save money in online fixed deposits with the app.[226] It is also becoming a valuable source of finance. In 2016, Alipay dispersed US$43.4 billion to 12 million borrowers, and loaned 740 billion yuan to more than 4 million small and micro enterprises.[227]

- **Remote patient monitoring (US$115 billion):** The ADB projects that Asia's elderly population could reach 923 million by 2050.[228] Ageing populations are putting increasing pressure on healthcare systems, on both their physical infrastructure and human capital. For example, Singapore needs to recruit 30,000 more healthcare workers between 2015 and 2020 to staff the healthcare facilities being built in anticipation of its rapidly ageing population.[229] But Singapore already has a tight labour market and declining workforce, forcing the government to provide more incentives for workers to

join the health sector. The imperative to lower healthcare costs and build sustainable health systems is feeding demand for remote monitoring systems, which can reduce unnecessary hospitalisations and make preventative care more effective. Sensors that read the vital signs of patients at home can alert nurses and doctors to problems before they worsen.[230] Remote monitoring of patients can reduce the cost of chronic disease treatment by 10–20 percent. It reduces emergency room visits and unnecessary routine monitoring in hospital for those whose condition could be remotely monitored regularly, making preventative care the standard.[231]

China accounts for 39 percent of the remote patient monitoring opportunity in Asia (US$46 billion). Strong economic growth, improvements in basic healthcare and declining birth rates are contributing to China's ageing problem. India accounts for 21 percent of the remote patient monitoring opportunity in Asia (US$24 billion), spurred by its lack of health infrastructure. For instance, World Health Statistics show that India has only 0.9 hospital beds per 1,000 people, while the global average is 2.9. According to industry studies, India's remote healthcare delivery market was worth around US$500 million in 2015 and is set to grow 20 percent annually until 2020.[232] Infosys is seizing this opportunity by teaming up with state medical institutions to develop remote patient monitoring solutions. Another example is Portea Medical, a Bangalore-based homecare provider with a 24-city network in India, which is rapidly expanding into Malaysia. The company raised around US$50 million in equity funding from private investors at the end of 2015.[233] Portea has also struck an agreement to partner with US-based American Megatrends India (AMI) to use its monitoring devices to collect real-time health statistics remotely. These will allow Portea to scale up personalised treatment plans and increase staff members' awareness of changes in patients' conditions.[234]

Developed Asia accounts for 27 percent of the remote patient monitoring opportunity in Asia (US$32 billion). In Singapore, the Elderly Monitoring System enables senior citizens to live independently, thanks to unobtrusive technology that allows caregivers and family members to monitor patients' activities remotely. When wireless sensors pick up atypical inactivity, the technology alerts the caregiver.[235] Singapore is also a key research and innovation hub for global manufacturers of medical devices linked to remote patient monitoring. For example, Royal Philips has launched the Philips APAC Center in Singapore, which will create customised solutions and serve as a gateway to patients in ASEAN and the Pacific region. The centre's innovations include the Philips Continuous Care Monitoring Room, where healthcare professionals leverage big data and predictive modelling to monitor the health of home-based patients.[236]

While demand for remote patient monitoring is rising quickly, consensus has not been reached on the ideal business model. This leaves an opening for entrepreneurial vendors

to gain first-mover advantage in a competitive market.[237] An already common model is for vendors to form partnerships with stakeholders such as hospitals, governments, telecommunication companies, and insurance companies. For example, insurance companies are willing to provide remote monitoring devices and services to reduce the probability of hospitalisation claims.[238]

- **Telehealth (US$85 billion):** Telehealth facilitates greater access to healthcare by expanding remote consultation and diagnosis of patients. Using basic mobile internet technologies, such as videoconferencing, doctors and patients – or doctors and local health workers – can discuss symptoms and determine treatment, without anyone needing to travel or queue for services. Out of Asia's 4 billion people, approximately 80 percent live in rural areas and lack access to adequate education and healthcare.[239] China accounts for 40 percent of the telehealth opportunity in Asia, largely due to a severe urban–rural disparity. It is estimated that around 80 percent of health and medical services are located in urban areas, leaving approximately 100 million rural people without access to either.[240]

  Three types of business model are particularly interesting in telehealth. The first focuses on increasing consumer power using apps designed for consumers that enable them to store and share medical records with doctors and pharmacists via links to the app. The revenue streams include commission on consultations, subscription fees for providers, and fees for corporate employees signed onto the platform. One example of this model is Ping An Good Doctor, valued at around US$3 billion and backed by insurance giant Ping An. The company is reported to have 77 million registered app users and 50,000 doctors signed on to its medical service platform.[241] The app provides a full suite of services including free diagnostics, internet consultation, an appointment booking service, and an online pharmacist and health store.[242] By consolidating healthcare providers onto a common platform, Ping An Good Doctor encourages price competition, as well as collaboration among healthcare providers. A variant of 'e-doctor' services is provided by Guahao.com, which started as an internet service that allows patients to take a virtual queue number at a hospital. The service has evolved into an information sharing and health consultation platform, with 100 million registered users and 190,000 specialists.[243]

  The second business model for e-doctor services uses basic mobile and internet technologies to extend patients' access to healthcare by enabling remote consultation and diagnosis. In India, various small-scale entrepreneurs are operating profitable businesses providing telehealth services to rural communities using investment-light models: a telehealth centre, which costs around US$2,000 to set up, can yield a 25 percent return within a year.[244] Big companies are also participating. For example, Mediphone was launched by telecommunications company Airtel in 2011 to provide

health consultations to existing users. Mediphone communicates medical advice to patients via SMS and either applies a consultation charge to the patient's monthly bill or deducts money immediately if the patient's subscription is prepaid.[245]

The third model uses technology to upskill health workers so they can handle more complicated cases and undertake higher-value activities. For example, trained midwives use handheld ultrasound scanners to monitor foetal health in remote villages, greatly improving the care given to high-risk patients and the decisions about when patients should be referred to hospital.[246]

Box 17. Apollo and the telehealth opportunity

Apollo Hospitals in India is a pioneer and one of the leaders worldwide in the field of telehealth. Set up in 1999 by Dr Prathap C. Reddy, Apollo Telehealth Services is the largest multi-speciality telemedicine network in South Asia.

Integrating ICT with healthcare services, equipment, and patient information systems, Apollo gives patients from remote locations across the globe access to their physicians. The organisation aims to use telehealth to minimise travel for healthcare services, avoid unnecessary relocation of medical practitioners, enhance quality of care, and ensure cost-effective continuity of care.

After 18 years, Apollo has set up more than 200 telehealth centres in India and internationally. Teleconsultations cover numerous disciplines, ranging from dermatology to neurosurgery, and other services include diagnostics, ophthalmology, preventive care, and chronic disease management. Patients have been evaluated from distances of around 200–7,000 kilometres.

Apollo's success is partly attributed to the attractive public–private partnership model it has established in India. Under this model, the government bears the capital and operating expenses of a telehealth centre, while the private organisation manages its programme on a turnkey basis. This model has worked out well for Apollo, which has seen a dramatic rise in demand for telehealth services in the last two to four years.[247]

- **Advanced genomics (US$49 billion):** As patients react differently to medical treatment, genomics research could advance medication, ensure early detection of genetic risks for non-communicable and rare diseases, and reduce patient and hospital costs. To illustrate, testing for the KRAS gene mutation in patients with colon cancer can save patients with the mutation as much as US$50,000 in ineffective treatment. Another candidate for genomic detection is the genetic variant in the 540 million people of almost exclusively East Asian Han Chinese descent who experience flushing and an

increased heart rate after drinking alcohol. Consuming alcohol puts people with the genetic variant at risk of oesophageal cancer.[248] Similarly, in Southeast Asia, more than 45 million people (9 percent of the region's total population) suffer from rare diseases, of which 80 percent have a genetic component.[249] Advanced genomics could detect those affected before they develop symptoms, leading to mitigating treatment. Next-generation sequencing can create entire DNA profiles for citizens before they show symptoms.

Analysts predict that the Asia-Pacific region is likely to be the highest growth region for the genomics market, with a projected compound annual growth rate (CAGR) of 12.7 percent from 2014 to 2020.[250] Capital investment, talent development, and closer links between research and industry will be critical levers in capturing this opportunity. For example, barely 2 percent of current theoretical research on genomics discusses methods for practical implementation.[251]

The main genomics business model provides diagnostic tests – conducted and interpreted by medical professionals – especially for rare genetic disorders, and paternity and prenatal screening. Customers can be individuals, insurance companies, or pharmaceutical companies testing the effectiveness of customised medications. Players in the field are concentrating on reducing the costs of their tests. Prenetics is a Hong Kong-based start-up that raised US$10 million in funding from Ping An in 2016. It provides DNA tests that cost less than US$500 per patient, generates results within 48 hours, and delivers results via a mobile app.[252] A similar company is Singapore-based Asia Genomics, which has partnered with medical technology companies to provide a wide range of tests to healthcare providers that were previously unavailable in Asia. Their products include non-invasive prenatal tests and hereditary cancer tests. Another company, WuXi NextCODE, has an online platform, which, after a patient inserts their genome data, can identify key variants in real time.[253] An emerging business model uses genetic information for lifestyle management. This can take the form of integrated personal health planning to help users take preventive steps to protect their health or better manage certain ailments. A final model in this area links genetics to personal interests. For example, 23andMe offers comprehensive genomic testing services directly to customers via the internet, providing them with detailed information on their ancestry, character traits, relative health risks, and so on.

Box 18. Advanced genomics

In China, the race for dominance in genome sequencing is on. In the lead is BGI (formerly known as Beijing Genomics Institute), a public–private partnership based in Shenzhen, which is seeking to sequence the genomes of 1 million people, plants, animals, and microbial ecosystems.

The company was set up in 1999 to participate in the Human Genome Project. In 2003, it rose to prominence when it decoded the SARS virus genome and created a detection kit for the virus.

In 2010, due largely to the efforts of BGI, China became a global leader in DNA sequencing. Working with 128 of the world's fastest sequencing machines, BGI was said to have more than 50 percent of global capacity for decoding DNA.

Since then, rival companies like Novogene and WuXi NextCODE have emerged. In response, BGI co-founder Wang Jian has led efforts to reduce the cost in the next few years of human genome sequencing to less than US$200, using a machine designed as a desktop instrument. This should help meet China's emerging need for clinical sequencing.

In September 2016, through a public–private partnership with China's National Development and Reform Commission, BGI developed and launched China National GeneBank, the first national-level gene storage bank in the country. It will store more than 10 million genetic samples from humans, animals, plants, and microbial species.[254]

In 2016, the Chinese Ministry of Science and Technology announced a US$9 billion, 15-year precision-medicine initiative. The China Food and Drug Association provides regulatory oversight, which requires that all components of a national genome sequencing commercial diagnostic system must be approved before being used in a clinical setting, to assure safety and effectiveness.[255]

Garbage sorters at the bio-waste management centre in Sri Lanka. Photo credit: ILO/Alan Dow

4. THE IMPACT ON JOBS

About 33 million people enter Asia's workforce every year. Yet employment growth in recent years has not kept pace with the region's economic growth.[256] In 2015, employment grew by only 1.1 percent or 21.3 million jobs in the whole Asia-Pacific region. In East and Northeast Asia, jobs growth was noticeably weak, at 0.3 percent, because of slowing growth in China.[257] Young people in the region are 3.8 times more likely than adult counterparts to be unemployed, with youth unemployment estimated at 11.8 percent.

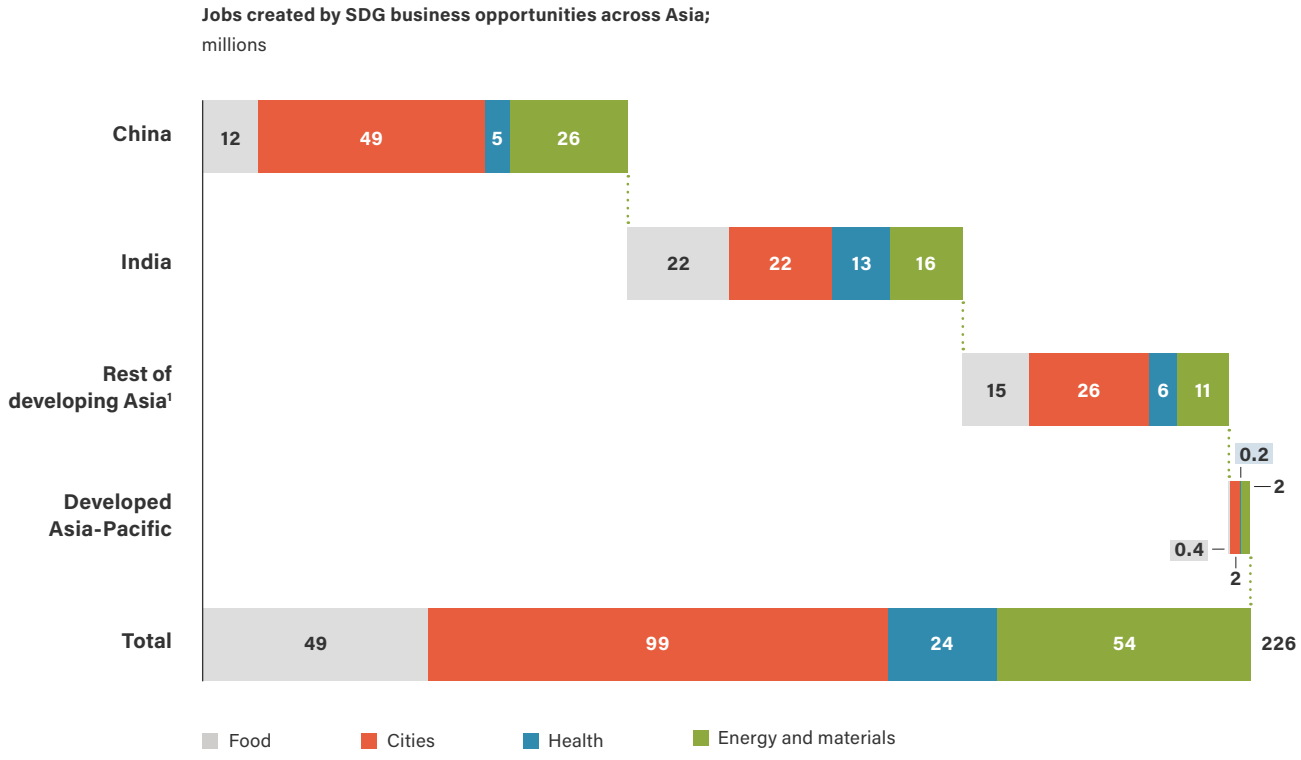
In addition, an estimated 54 percent or 1 billion workers in the Asia-Pacific region are in vulnerable employment. The International Labour Organisation (ILO) defines vulnerable employment as 'the sum of own-account workers and contributing family workers'. The ILO further states that, 'They are less likely to have formal work arrangements, and are therefore more likely to lack decent working conditions, adequate social security and "voice" through effective representation by trade unions and similar organisations. Vulnerable employment is often characterised by inadequate earnings, low productivity, and difficult conditions of work that undermine workers' fundamental rights.'

Low female labour force participation also continues to be a major challenge for several economies in the region. This is particularly so in Southern Asia, where only 28.5 percent of working-age women are active in the labour market. However, structural demographic trends, including ageing and declining populations, are pushing businesses to rethink hiring policies and incentives to get more women to enter the workforce.[258]

Notwithstanding these challenges, the good news is that by 2030, opportunities created by pursuing opportunities linked to the 60 Global Goals identified in this report could create almost 230 million new jobs in Asia, providing work for around 12 percent of the current labour force (Exhibit 14).[259]

EXHIBIT 14

Almost 230 million jobs could be created by SDG business opportunities in Asia



Source: Literature search; Alphabeta analysis

[1] Rest of developing Asia includes Central Asia (e.g., Uzbekistan), South Asia (e.g., Bangladesh), Southeast Asia (e.g., Laos), and North Korea.

The opportunities in cities could create the most jobs. Developments in urban construction, mobility, and infrastructure will generate an estimated 99 million jobs. Pursuing Global Goals opportunities in energy and materials could create 54 million jobs. However, these jobs created will only meet Global Goals targets if they provide decent, well-paid work and the companies that create them are inclusive in all activities.

What can businesses do to ensure decent work and inclusive growth?

- The imperative for businesses to provide 'decent work', complying with ILO decent work guidelines and the UN Guiding Principles on Business and Human Rights, remains critical. The ILO defines decent work as that which is productive and delivers a fair income; provides security in the workplace and social protection for families; offers prospects for personal development and social integration; gives people freedom to express their concerns as well as to organise and participate in the decisions that affect their lives; and ensures equality of opportunity and treatment for all women and men.[260] Businesses should ensure that these principles are embedded in their own workforces, and that their suppliers are doing the same.

- The changing shape of employment reflects the structural transformation taking place in the region, with investment and jobs moving from lower- to higher-value sectors. Employment in agriculture has been shrinking across Asia, offset by the expansion of employment in services, manufacturing, and more advanced industrial sectors.[261] Ensuring that schooling and skills training aligns with future job requirements will remain an essential component of many Asia-Pacific education and labour market policies. Businesses could provide critical inputs to government on skills required for jobs of the future, and provide appropriate training or reskilling.

- The increased digitisation and automation of processes is expected to displace jobs in traditional labour-intensive functions such as assembly-line manufacturing. Automation is not just a trend confined to the developed world. It is rapidly expanding in developing countries too. According to recent forecasts by the International Federation of Robotics, China will have more installed manufacturing robots in 2017 than any other country in the world.[262] Many businesses will face a trade-off in the cost to their reputations: laying off workers in favour of automation could lead to productivity gains but political and social backlash from workers and consumers. However, businesses must be mindful that the choice is not a binary one. Automation allows businesses to rethink their business models, including scaling up and diversifying into services that are related to their core operations. This creates opportunities to retrain workers and take on higher-value jobs to complement automation, rather than be replaced by automation. Discussion among companies, representative bodies, and governments must take place to ensure that the changing labour market requirements are socially sustainable.

  The challenge of youth unemployment requires businesses to engage with career guidance and programmes that prepare young people for the world of work. There are many opportunities for businesses to be more actively involved in this area. For example, a 2014 McKinsey study, 'Unleashing Youth in Asia', notes that to solve the skills mismatch problem in South Korea, the country's conglomerates (chaebols) have

worked with the government to revamp the vocational curriculum and equip students with the skills required for jobs in these large firms.[263]

- Increasing women's participation in the workplace and ensuring their equitable treatment is widely understood to be a positive driver of economic progress. Results of a new simulation model suggest that closing the gender gap could generate a 30 percent increase in income per head of a hypothetical average Asian economy in one generation.[264] This is not relevant in all countries. For example, the Philippines ranks eighth out of 142 countries on the 2014 Gender Gap Index of the World Economic Forum. However, the opportunity to leverage women more significantly in the economy is one of Asia's greatest opportunities. There are excellent examples of businesses significantly increasing women's empowerment in the workplace, including by using inclusive business models, with remarkable productivity gains.[265]

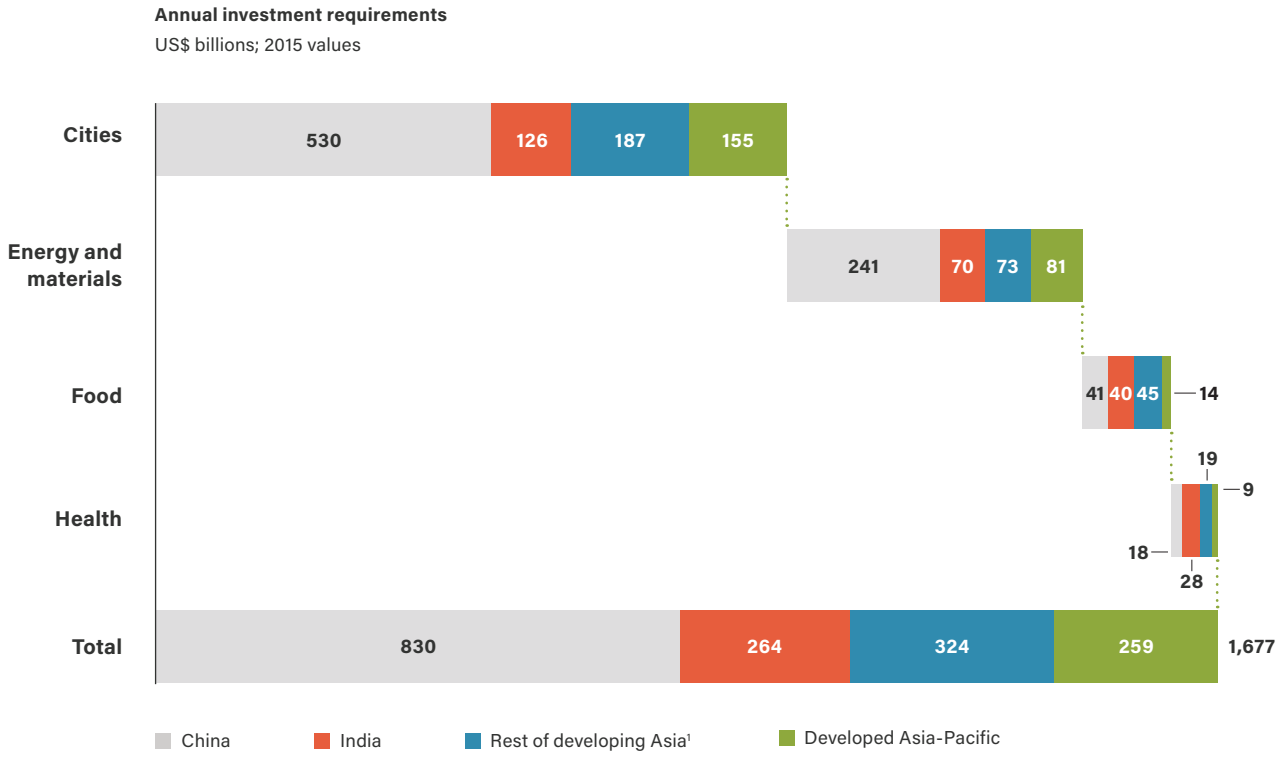
- Finally, developing inclusive business opportunities and linking SMEs to global, regional, and national supply chains are two of the most powerful ways for businesses to pursue Global Goals in Asia. SMEs account for 97 percent of all enterprises and more than half of the workforce across Asia-Pacific Economic Cooperation (APEC) economies.[266] Linking these SMEs to larger value chains and providing viable finance options for them will be critical to improving the region's productivity and delivering on the Global Goals.[267]

5. SUSTAINABLE FINANCE IN ASIA

Substantial investment will be needed to capture the Global Goals opportunities (Exhibit 15). We estimate that the total investment required for all 60 opportunities in Asia's cities, energy and materials, food, and health systems is almost US$1.7 trillion a year.

EXHIBIT 15

The capital requirements to support the identified SDG opportunities in cities are significantly higher than other systems



Source: Literature search; Alphabeta analysis

[1] Rest of developing Asia includes Central Asia (e.g., Uzbekistan), South Asia (e.g., Bangladesh), Southeast Asia (e.g., Laos), and North Korea.

Cities are clearly the largest area of investment, and China is the country with by far the largest capital requirements, accounting for almost half of the total. Some opportunities are particularly capital-intensive. For example, expanding the supply of affordable housing in Asia could require over US$340 billion each year to 2030. Expanding renewable energy is

also highly capital-intensive. The Energy Transitions Commission estimates that US$200 billion will need to be invested over the next 15 years to deliver this transition in Asia. In addition, US$100 billion will be needed annually to build grid and distribution networks to support the electrification of the economy.[268]

At best, the public sector is likely to be able to finance about half of this investment. This implies the need for a roughly fourfold increase in private investment in sustainable infrastructure in the region to provide the other half. The risk profile of many infrastructure projects could deter private investors. But this hurdle may be overcome by developing the region's capacity for raising blended finance (or concessional finance) for projects. Under blended finance, public and philanthropic finance providers take on high-risk tranches of an investment, encouraging private investors to provide the remainder at lower risk. Box 19 describes a successful example of blended finance used for a sustainable power project in Laos.

Public infrastructure investment already has a strong track record in Asia, and the region's pool of available public finance is growing fast. China's 'One Belt One Road' initiative is an example of an ambitious government-funded sustainable infrastructure transformation. Countries such as India and Indonesia have announced multi-year infrastructure build-out plans worth hundreds of billions of dollars, based on domestic spending. This includes a five-year, US$500 billion infrastructure initiative in Indonesia.

However, the leverage of the significant pools of capital in Asia's national domestic banks (NDBs) and sovereign wealth funds is nowhere near its potential. Despite proven potential to attract infrastructure investment from the private sector, a recent survey found that of 90 NDBs in 61 countries only 4 percent have an infrastructure-targeted mandate. There is a big opportunity to broaden the mandate of NDBs to include infrastructure financing, and to do this in partnership with multilateral development banks (MDBs), where they can add value and help scale up investment.

To date, MDBs have financed an estimated 2.5 percent of the region's sustainable infrastructure projects. Excluding India and China, MDB contributions to infrastructure investment are about 10 percent. The region has a substantial pool of international public finance to draw on for infrastructure. This is evident from the creation of the Asian Infrastructure Investment Bank and the New Development Bank (the BRICS bank), capitalised at US$100 billion and US$50 billion respectively, plus a major increase in lending by the Asian Development Bank in the wake of new accounting rules and the infusion of US$110 billion from the Japanese government.

Despite this growth in available public finance, it will not be nearly enough to provide the US$1.7 trillion required for all the Global Goal opportunities. More blended finance – which taps the large pools of private capital in the region – will be needed to fill the gap. Achieving a step change in the number of projects financed this way will depend on public and private finance providers learning how to develop more blended products together, a greater

supply of financially viable projects, and improvements in legal protection and regulatory environments.

Closer relationships between public finance institutions, such as the NDBs and MDBs, and institutional investors, such as pension managers, are critical to rapidly expanding blended finance. The former have intellectual and practical experience in infrastructure financing, while the latter have significant and fast-growing savings to invest. They need to work together to design products that support development needs, and meet institutional investors' portfolio requirements and shareholder responsibilities.

The necessary enabling regulatory and institutional reforms include reforms to public–private partnerships (PPPs); for example, to streamline PPP procurement and bidding processes and introduce dispute resolution mechanisms for protecting various parties.

Box 19. Sustainable infrastructure investment: Nam Theun 2 hydropower project, Laos

In Laos, one of Asia's poorest countries, the Nam Theun 2 (NT2) hydroelectric dam is generating both electricity and national income. Like most big dams, it has divided opinion. But the project's backers hope it will come to be seen as a model of socially sustainable infrastructure. On track to generate US$2 billion in revenues over 25 years, the 1,070 MW plant could contribute significantly to development and reducing poverty in Laos.[269] Opponents of NT2 have criticised institutions that have supported the project, which has displaced more than 6,000 people.[270] But its backers hail it as a success in leveraging international finance for alleviating poverty.[271] While a portion of the electricity generated stays at home, the bulk is exported to Thailand under a 25-year fixed-price power purchase agreement, meaning a big income boost for Laos.[272] That revenue is largely reinvested in programmes to tackle poverty, boost health and education, and improve environmental management domestically.[273]

The US$1.3 billion dam was jointly financed by a host of multilateral development banks, bilateral funding agencies, and commercial banks from around the world. In all, 27 parties were involved, including the World Bank, Asian Development Bank, French Development Agency, BNP Paribas and Fortis Bank.[274]

The Nam Theun 2 Power Company – whose owners include Électricité de France, the Laos government, and Thai power producer EGCO[275] – has also sought to mitigate environmental and social impacts. It does this by investing heavily in local conservation efforts,[276] as well as new housing and infrastructure on the Nakai Plateau.[277] According to the World Bank, household surveys suggest resettled communities are better off today than before they moved.[278]

Challenges remain, including ensuring sustainable livelihoods for resettled people and been disrupted.[279] However, by enabling small and impoverished Laos to sell clean electricity to its energy-hungry neighbour, NT2's backers point to a double win, and say they have shown that hydropower – done properly – can be an important development tool.[280]

6. BUILDING AND ENERGISING THE SOCIAL CONTRACT IN ASIA

The public sector, civil society, and increasingly the private sector are urgently pursuing the same Global Goals across Asia. They need each other to achieve them. There will be different emphases and difficult trade-offs to negotiate, but in principle, all these stakeholder groups are pointing in the same direction. All three groups in Asia could renew a social contract with the following actions.

Actions for businesses

Companies can show their commitment to the Global Goals by respecting basic standards of behaviour enshrined in both the UN Global Compact and the UN Guiding Principles on Business and Human Rights.[281] Many Asian businesses are already focused on the Global Goals. That is why 1,420 companies across Asia have already signed up to the 10 principles of the UN Global Compact, a guide to sustainable business behaviour for companies around the world.[282] However, while many companies have embraced the need to reduce their negative environmental impacts, much less progress has been made on improving their social impacts.

Photo credit: ILO in the Asia and the Pacific/Flickr

Businesses should develop good jobs that offer reasonable pay at every step along the supply chains, and integrate human rights into operations, an approach that promotes sustainable development while also reducing harm. Sustainable company leaders look for ways to support their smallest and poorest suppliers, working with them to improve productivity, invest in skills, build resilience, improve access to credit, and ensure that no one is left behind. The 10 principles of the UN Global Compact, developed to help businesses do the right thing, is a useful guide. Fully implementing these principles should extend from the formal to the informal sector.

Companies should ensure that they pay their taxes and disclose tax information, as it is a crucial source of finance for sustainable development. Many Asian countries are struggling to balance their finances, and tax avoidance is estimated to be as high as 7 percent of GDP in some countries.[283] The public mood has shifted against companies that do not pay their tax bills. In this environment, companies that avoid tax will likely face increasingly negative consequences in investment and consumer markets.

Finally, businesses can use their influence on policy in a responsible, transparent, and accountable way. Much of the current mistrust in business derives from occasions when companies have used their power to access policymakers, petitioning them to lobby for the business's own narrow interests rather than aligning their agenda with the common good. Instead, companies should be transparent about all public affairs activities; avoid lobbying for policies that are contrary to achieving the Global Goals; and support sound science and the greater good.

Actions for governments

Governments in Asia can help businesses pursue these shared goals by creating an environment that enables private sector growth; good and accountable governance; the rule of law; effective contract enforcement and legal systems; and functioning customs regimes. While some Asian countries, such as Singapore, have become global leaders for ease of doing business, Asia also contains a large number of countries with the lowest rankings on the World Bank's 'ease of doing business' scorecard.

Just as all businesses need to pay their taxes, government spending must be transparent and free from corruption. Due to low levels of enforcement and monitoring, corrupt practices such as facilitation payments and bribes persist throughout Asia. The infrastructure and real estate sectors are perceived to be the most vulnerable, followed by metals and mining. Corruption leads to lost economic opportunities, has an adverse effect on inflows of foreign direct investment, and exacerbates inequality. Ending corruption requires a sustained, concerted, and joint effort.

Actions for civil society

The Business and Sustainable Development Commission recognises that civil society has a crucial role to play in monitoring institutions and ensuring that businesses, governments, and community organisations are transparent and respect the rules of national and international law. Equally, civil society has a responsibility to engage into dialogue with all sectors, and to advocate for changes to laws and practices where they are failing or are inadequately dealing with corruption, modern technology, socially destructive practices, and disruptive change. Trade unions have a specific responsibility to engage in social dialogue with businesses – and governments, where appropriate – to ensure rights, fair wages, and safe and secure work are accepted and respected as part of the social contract.

Many of the greatest human rights challenges are relatively remote, existing in the supply chains of large companies where their influence is also limited. There is a special role for civil society under these circumstances, where action could have a lasting, positive impact. All parties need to follow up on the guarantee of social protection, and monitor labour market institutions to ensure a dignified future for societies and a fair competitive basis for business.

7. CONCLUSION

This report has presented the case for businesses to concentrate on pursuing the Global Goals to solve Asia's greatest challenges. Much more than US$5 trillion worth of value is at stake. There is the opportunity to shape a safer, more prosperous world, with a more predictable future that is worth investing in and innovating for.

Achieving the Global Goals would make the world more sustainable, inclusive, and full of opportunities for everyone. There would still be many challenges, but societies would be better equipped to tackle them. The alternative is more uncertainty, intensifying risks, growing social and environmental costs, and bigger shocks. Reaching that better world depends on business leaders in the private sector choosing to lead the charge for sustainable growth.

The Business and Sustainable Development Commission has identified the following six actions that business leaders can take to make this transformational change a reality:

- Build support for the Global Goals as the right growth strategy to pursue, in your companies and across the business community.
- Incorporate the Global Goals and other long-term sustainability considerations into your company strategy.
- Drive the transformation towards sustainable markets, with the involvement of your peers in the sector.
- Work with policymakers to pay for the true cost of natural and human resources.
- Push for a financial system oriented towards longer-term sustainable investment.
- Rebuild the social contract.

Members of the Business and Sustainable Development Commission have chosen to lead our own companies towards the Global Goals. With this report, we urge others to join us. The world has 13 years before we reach the 2030 deadline for achieving the Global Goals. There will never be a better time for company leaders to align their business objectives with creating a better world.

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THE BUSINESS AND SUSTAINABLE DEVELOPMENT COMMISSION

The Business and Sustainable Development Commission was launched in Davos in January 2016. It brings together leaders from business, finance, civil society, labour, and international organisations, with the twin aims of mapping the economic prize that could be available to business if the UN Sustainable Development Goals are achieved, and describing how business can contribute to delivering these goals.

The *Better Business, Better World* report was led by the commissioners, and supported by: the Australian Department of Foreign Affairs and Trade (DFAT), the Bill & Melinda Gates Foundation, the Global Green Growth Forum (3GF), the Swedish International Development Cooperation Agency (Sida), the Netherlands Ministry of Foreign Affairs (MoFA), the Norwegian Ministry of Climate and Environment, the Rockefeller Foundation, and the UK Department for International Development (DFID). The Commission also benefits from the generous financial support of its commissioners.

The Business and Sustainable Development Commission has overseen this report with secretariat support provided by the UN Foundation and SYSTEMIQ. Chaired by Lord Mark Malloch-Brown, the Commission comprises business leaders from around the world.

Members of the Business and Sustainable Development Commission endorse the general thrust of the arguments, findings, and recommendations made in this report, but should not be taken as agreeing with every word or number. They serve on the Commission in a personal capacity. The institutions with which they are affiliated have not been asked to formally endorse the report.

The Business and Sustainable Development Commission is committed to mobilising a growing community of executives who want to align their companies with the Sustainable Development Goals. To learn more, visit www.businesscommission.org/join.

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