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SEPARATE TABLES:
BRINGING TOGETHER ASIA'S FOOD SYSTEMS

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Foreword

Transforming our food system to meet evolving consumer needs

Our food system today is facing the pressure of producing about 70% more food to feed a population that will cross 10 billion people by 2050. We need to do this with diminishing resources. Producing more with less and ensuring the highest safety standards are key challenges facing the food and agriculture industries to feed Asia. Three areas that can truly strengthen our food systems in Asia are trade, technology and profitable farming.

Nearly 1 billion people worldwide already depend on trade to meet their basic food needs and to feed 10 billion people by 2050, food must move and increasingly be grown in the most efficient and sustainable manner. There also needs to be fair and equitable rules-based systems as a world without multilateral trade dispute resolution institutions would be a world of chaos.

Innovation can radically transform the food system. In many pockets of Asia today, technology adoption across the food supply chain is not happening or not happening fast enough. We need to ensure that technology is being readily deployed and adapted with the clear purpose of making the supply chain more productive, efficient and resilient.

Agriculture today cannot exist without successful farmers. We need to make farming more profitable to ensure a healthy flow of labour. Today's youth is not interested in farming and with an ageing population and rapid urbanisation, farming is losing labour at an explosive rate in Asia, as high as 2,000 per day in India.

Cargill wants to nourish the world in a safe, responsible and sustainable way. We are constantly engaging governments, farmers, NGOs and other stakeholders to find out the most effective ways of meeting the demand for nutritious food in a growing world. Our hope is that this report will trigger more conversations and dialogues around the future of food and increase collaboration within the industry, with governments and other stakeholders to address the challenges we have today without compromising our ability to feed future generations.

Together, we can rewrite how food is produced, traded and consumed, and feed the world in a safe, responsible and sustainable way.

Peter Van Deursen
CEO, Asia Pacific
Cargill

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1. About the report

This Asia Food Systems 2030 report is an Economist Intelligence Unit report, sponsored by Cargill. The report is based on wide-ranging research and in-depth interviews with experts in the food systems[i] field. A full explanation of the methodology is contained in the Appendix. This particular report is meant to provide regional context about food systems in Asia[ii] and set the scene for subsequent reports. The analysis and content of this report cover the period from June to September 2017. The research was undertaken by us, and the views and opinions expressed in this publication are ours and do not necessarily reflect the views of Cargill.

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[i] At its simplest, a food system covers "end-to- end" activities, from production to consumption, and even disposal. More broadly, it also covers "…the governance and economics of food production, its sustainability, the degree to which we waste food, and how food production affects the natural environment".

[ii] In this report, Asia refers to South Asia, East Asia and South-east Asia, unless otherwise stated. Middle East countries (which are sometimes known as West Asia countries) are not included.

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Cargill provides food, agriculture, financial and industrial products and services to the world. Together with farmers, customers, governments and communities, it helps people thrive by applying insights and over 150 years of experience. It has 155,000 employees in 70 countries that are committed to feeding the world in a responsible way, reducing environmental impact and improving the communities where we live and work. For more information, visit https://www.cargill.com.

2. Executive summary

What will Asian food systems look like in 2030? There is no simple answer to this question, because Asia encompasses a complex mix of countries, divided by borders, policies, cultures, uneven development and other socioeconomic differences. There is no single "Asian" food system, and Asia cannot be analysed as a single entity.

Experts recognise that existing food systems will not remain stagnant as Asia urbanises and grows ever more populous. However, discussions around diet, food supply and food security often focus on Asia as a whole, rather than focusing on its different sub-regions and countries. This broad approach masks complex and often divergent policy and societal concerns, and it also risks strategic misalignment when preparing for the future. In light of this, how are companies and policymakers strategising for the future? How prepared are they to identify where divergence will remain, and where cities and countries will converge into similar food landscapes?

This report begins to address these questions by providing regional context about food systems in Asia, setting the scene for a series of subsequent reports that will analyse the critical issues that the region will face in the period to 2030. In order to understand the systemic concerns regarding Asian food systems, this report focuses on two questions:

- Which megatrends are driving the divides in Asian food systems?

- What are the challenges and opportunities for policymakers and the private sector in managing these trends?

The answers to these two questions are summarised below and discussed in more detail in the remainder of the report.

1. Which megatrends are driving the divides in Asian food systems?

- **Urbanisation will remain a dominant trend, occurring at a faster pace in developing Asia.**
  Asia will be home to nearly half of the world's urban population by 2030, with China, Indonesia and India accounting for three-quarters of Asia's new urban dwellers. This will have significant effects on food production and demand, as urban consumers have more diverse diets and typically consume more convenience food. Competition for land will also affect trade in food and supply chains, particularly as modern retail becomes more prominent and changes food distribution systems.

- **Diets will become more energy-dense and will move away from direct consumption of cereals, but local factors will affect how this transition happens in different countries.**
  Urbanisation, income growth and greater food availability through trade will encourage broad dietary convergence around higher-value categories of food. However, there will still be considerable variation between countries in terms of the specific food items consumed. For example, a trend towards increased protein consumption will be evident across Asia, but different countries will prioritise different kinds of protein, based on their respective religious beliefs (limiting beef or pork consumption) or the presence of a strong vegetarian culture (as in India).

- **The double burden of obesity and undernutrition will become an increasingly pressing problem for all economies in Asia, but the problem will develop at varying speeds.**
  The shift in diet and lifestyle changes that accompany urbanisation and industrialisation will have health implications. Increased access to more energy-dense food and general income growth are likely to drive limited convergence towards the reduction of undernutrition, and to instead pivot Asia towards the double burden of undernutrition and obesity.

- **Research and development (R&D) in food production in Asia will remain a key driver of agricultural development, although the types of innovation will vary across countries.**
  Asia is starting from a relatively low base in terms of research intensity, which means that agricultural R&D expenditure will continue to increase, particularly as investments have high expected payoffs in developing countries. However, institutional differences between Asian countries mean that agricultural technology is unlikely to converge in the short to medium term. Instead, the demand and ability to implement innovative food production techniques will vary across and within countries, depending on their level of economic and industrial development. Some countries will need more knowledge-intensive agriculture to close yield gaps and increase productivity. In other countries, newer innovations such as robotics and vertical farming may be needed to overcome issues such as ageing populations and a lack of arable land.

- **Interest in greater transparency and sustainability in food systems will grow across Asia, but for different reasons.**
  In developing countries, consumers who are worried about food safety are increasingly looking for transparency and traceability (that is, transparency around where food comes from, and the

ability to trace food through all stages of production). In upper-middle to higher-income countries, however, interest in traceability is more closely related to sustainability concerns. Social media and globalisation have exacerbated the need for transparency. Trade liberalisation will also drive this growing interest in transparency and sustainability, although a lack of harmonised standards and a regional focus in trade will limit regulatory convergence.

- **Politics will continue to play a role in food systems due to divergent interests and resource scarcity.**
  As countries urbanise, decisions about how to allocate resources between urban and rural areas will become more political. Water scarcity will become a key issue as national interests diverge, with the advantage resting with upper riparian countries. The headwaters of six of Asia's major rivers are located in Tibet, giving China significant control over water flow to lower riparian countries.

2. What are the challenges and opportunities for policymakers and the private sector in managing these trends?

- **Define food security more holistically to cope with structural changes in food demand and supply.**
  Food security can be more broadly defined to include resilience, diversity and affordability, rather than just self-sufficiency. The rise in demand for food in Asia has made it difficult for most countries to remain self-sufficient, particularly China. As increased trade and resource scarcity increase the need for virtual trade in water and land, food security considerations could be broadened to include other strategies, such as the pursuit of diverse import sources, productivity gains and other forms of food security (such as contract farming with overseas suppliers).

- **Predict and anticipate the convergence of trends for early policy development, but assess spillover effects.**
  Urbanisation, income growth and environmental changes are happening at a far more rapid pace in Asia than occurred in other developed countries. In response, policymakers could try to anticipate challenges and develop early strategies to address them. For example, policymakers could try to understand how changes in income will affect food systems and then develop appropriate policy responses. Policies could also be localised and assessed for upstream and downstream impacts.

- **Enhance national capacity in monitoring food system metrics and natural resources.**
  The lack of data on key food system metrics means that policies and interventions are informed by fragmented evidence. Identifying how trends are likely to converge or diverge requires good data. Governments could focus on building robust datasets that would help them to better design and tailor policies to address food system issues—for example, through the development of metrics assessing specific population groups' characteristics, nutritional quality, crop productivity by region and even vulnerability to climate change.

- **Strategise by anticipating the convergence and divergence of trends in each market.** When setting corporate strategies, companies could consider how these megatrends are likely to converge and where they will remain divergent. However, even with convergence, parallel localisation will still be important. For food and retail companies, it is important to understand that the global convergence of a trend does not imply convergence to the norms in a European country or a city in the US. For this reason, companies will still need to consider specific market dynamics in each country, perhaps even each province or city. Consumers in Asia are likely to shift to modern retail, but modern retail in Asia may look quite different from the big-box concepts in the US or even modern retail in Europe.

3. Background

Asia has long been projected as an engine of global growth. High growth rates have taken its share of global GDP to nearly 30% (as of 2017),[1] and projections suggest that it will account for 53% of global GDP by 2050.[2] The rise in income in such a populous region will also drive a surge in the middle-class population, with projections estimating that 85% of the increase in the global middle class will come from Asia.[3]

Figure 1: Asia-Pacific's share of global GDP

(%)
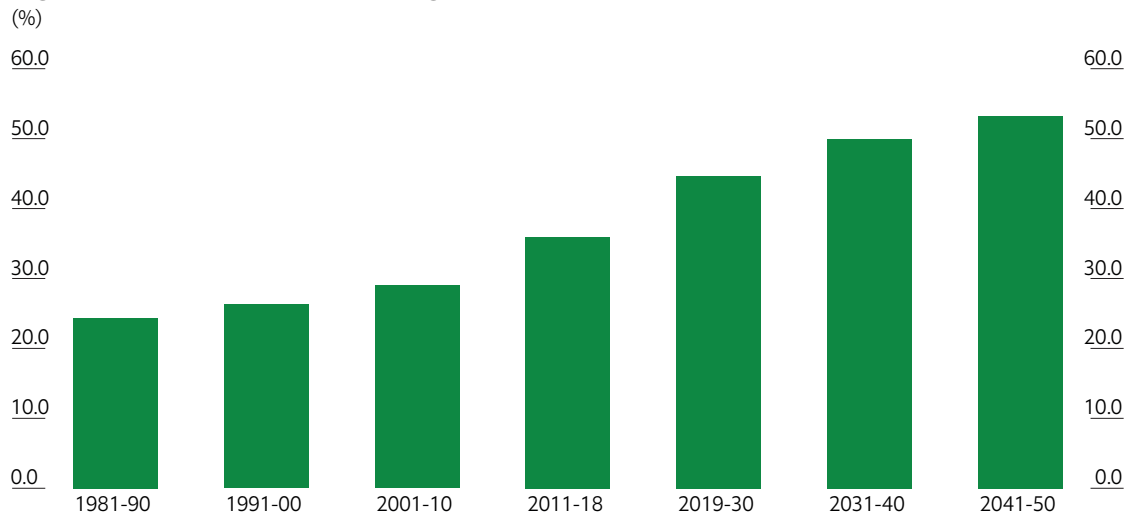
Source: The Economist Intelligence Unit.

The transition to higher-income economies is mostly driven by a shift in economic focus towards manufacturing and services. Although agriculture is still important to many people in lower-income economies in Asia, it is already contributing less to GDP and employment as countries focus more on industrial development and the services sector. This is also driven by rapid urbanisation in Asia, which is home to some of the largest urban agglomerations and nearly 50% of global city dwellers. As urban areas are typically generators of economic activity, national resources are more likely to be allocated to cities rather than rural areas, with an estimated 80% of current investment already going to basic urban infrastructure.[4] As young people look to move into cities, the average age of farmers in rural areas has increased, even as agricultural employment has decreased. The decline in already limited arable land per capita in Asia also continues as more and more land is used for non-agricultural purposes.

Increases in population, labour force participation and income levels also bring about structural changes in food systems. These macroeconomic forces will translate into changes in both production and demand as Asia develops: the proportion of GDP generated by agriculture will decline as the focus shifts to manufacturing and services, and richer citizens will be able to afford to consume more diverse diets.

However, this focus on Asia as one entity often masks significant differences between countries. Without efforts to understand how megatrends such as urbanisation, income growth and dietary changes will either converge or diverge within Asia, there is a risk that policy issues will be overly simplified (if the trends are divergent), and that policymakers and private-sector stakeholders will fall behind the curve. A sub-regional or even national focus can help to identify country-specific historical trends in supply and demand drivers of food systems, and to signal differences in likely trajectories to 2030.

4. Trends and implications

At a basic level, the divide between lower-income and higher-income countries in Asia will drive the different trajectories of their food systems. Higher-income countries will grapple with concerns such as obesity, a decline in domestic food self-sufficiency and increasing awareness of sustainability issues. Some of these issues are already being experienced in other parts of the world, while others will be country-specific. In lower-middle-income countries, the focus will be on undernourishment and stunting,[5] as well as supply-side concerns such as closing yield gaps. In-depth analysis will highlight that even within countries, income inequality, infrastructure quality and rural-urban divides will drive different food system trajectories. This is particularly true in large countries such as China and India, where inequalities already translate into significant intra-country and inter-city differences. As a result, it is important to consider what the roads to 2030 will look like for different countries within Asia.

4.1 Converging to an urban world, driven by rapid urbanisation in developing countries

Urbanisation	Dietary transition	Nutrition	Technology	Transparency, sustainability	Food politics

Asia will be home to nearly half of the world's urban population by 2030, with China, Indonesia and India accounting for three-quarters of its new urban dwellers. Urban agglomerations in Asia will also be significantly denser than cities elsewhere, with six of the top ten most crowded cities located in the region.[6] Urbanisation will have significant effects on food production and demand, and the rapidity of

Figure 2: Urbanisation in Asia

Asia has been urbanising rapidly, with East Asia converging to high-income country levels
(% residing in urban areas)

Urban population in Asia will increase by 578m people by 2030
(Urban population, m)
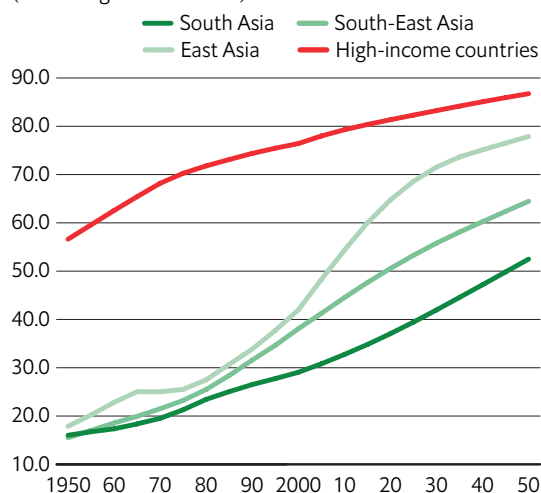
Source: United Nations Population Division (2014).

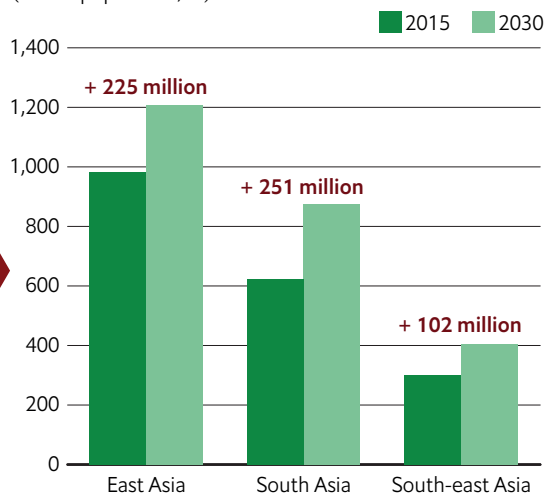this urbanisation means that any convergence of trends affecting food demand and supply will happen much faster. Figure 2 illustrates how rapidly urbanisation will increase in East Asia in particular, and in South-east Asia to a lesser extent.

The trend towards increased consumption of convenience food will continue in cities in Asia, although with sub-regional variation. People in urban areas consume more convenience food, in the form of either processed food or ready-made food such as street food. In Asia, imports of processed foods more than doubled to US$162bn[iii] between 2005 and 2015 as the opportunity cost of time (particularly in cities) rose with economic development. The Global Panel on Agriculture and Food Systems for Nutrition estimates that sales of ultra-processed foods in East Asia and South-east Asia will approach the levels in high-income countries by 2035.[7] Although convenience food has become more popular overall, localisation efforts are still needed to suit different preferences. Oreos, for example, only became popular in China after they had been reformulated to include less sugar and the biscuits had been changed to wafers.[8] Indonesians prefer snacks that are sweeter and available in smaller packaging.[9]

Increased consumption of convenience food also does not fully translate into increased consumption of processed or ultra-processed food. Interviews conducted as part of this research highlighted the strong street food culture in Asia. For example, only 10% of Thai people rely on processed food, with the majority of the population getting their nutrition from traditional street food.[10] In 2016, Baker and Friel noted that street food dominates South-east Asian food service, accounting for 55% of Association of Southeast Asian Nations (ASEAN) transactions in 2011.[11] Street food is likely to remain a dominant form of convenience food in Asia, although with increased regulation[12] and gentrification.[13,14]

Diverse and energy-dense urban diets will drive convergence towards increased trade and modern retail. As consumers urbanise, changes in diet will drive changes in the composition of the food trade. Consumers will become more open to non-traditional foods as their incomes rise and cities become more open, and they will diversify their diet to include higher-value but increasingly affordable proteins, fats and sugars. Traditional food supply chains will not be able to keep up with this rapid diversification of urban nutrition and trend towards increasingly calorie-rich diets. Competition for land and water, as well as poor infrastructure in developing countries, will mean that domestic production struggles to meet increased demand. Imported food may be cheaper and preferred if it is of higher quality.[15,16]

The desire for convenience and greater concern about food safety will also encourage growth in modern retail. Supermarket sales in Asia have already expanded much faster than GDP growth,[17] and in countries such as Vietnam, food safety concerns are accelerating the shift towards buying produce and poultry from supermarkets.[18] The spatial concentration of urban populations also creates scope for modern retail chains, attracting foreign investment from global retailers. The increasing importance of modern retail, and the subsequent implications for price-setting, quality standards and overall logistics, benefit companies with economies of scale, particularly those that are vertically integrated.

[iii] Calculated for Bangladesh, Cambodia, China, Hong Kong, Macao, India, Indonesia, Japan, Malaysia, Maldives, Mongolia, Pakistan, Philippines, South Korea, Singapore, Sri Lanka, Thailand, Vietnam and other Asia. Asian countries without data were excluded. Data sourced from COMTRADE.

Regional giants such as the CP Group and San Miguel Foods Group have their own supermarket-type supply chains and retail outlets.

Increased dietary diversity will cause divergence between demand and domestic supply, increasing regional competition for food imports. Asian countries will have difficulties meeting growing demand using local resources. This will provide export opportunities for countries with strong agricultural sectors,[19] and Asian countries converging towards heavier consumption of meat, fish, oil and sugar will begin to compete for imports from exporting nations outside Asia. Today, imports for key staples already depend heavily on countries outside Asia. For example, China imports about 85% of its soybeans from Brazil and the US while the Philippines is almost completely dependent on imports of wheat, mainly from the US.[20] Meat imports in Asia are also mainly from the Americas (US and Brazil), as well as Australia.[21]

For developed countries that are already dependent on neighbours for specific crops, virtual trade in water and land (which refers to the concept of how global trade has allowed resource-scarce countries to rely on the resources in other countries) will be disrupted as developing countries shift away from agriculture, driving regional competition for land and infrastructure funding. At present, a significant proportion of Asian imports for food come from intra-regional trade: 37% of all 2016 food imports in Asia came from other Asian countries.[iv]

At the macro level, agriculture's contribution to GDP will decline as developing Asian countries industrialise, reducing the incentive to export unless there is a strong comparative advantage in doing so (for example, palm oil for Indonesia and Malaysia; rice for Vietnam and Thailand). As agriculture's contribution declines, the focus will shift to balancing the need to transition to high value-add crops or crops with strong comparative advantage against the need for some security in staple crops.

Figure 3: Relationship between income and agricultural dependence
Increasingly wealthy Asian countries depend less on agriculture, increasing the need for imports of food, particularly food that is not produced locally or that is cheaper to import
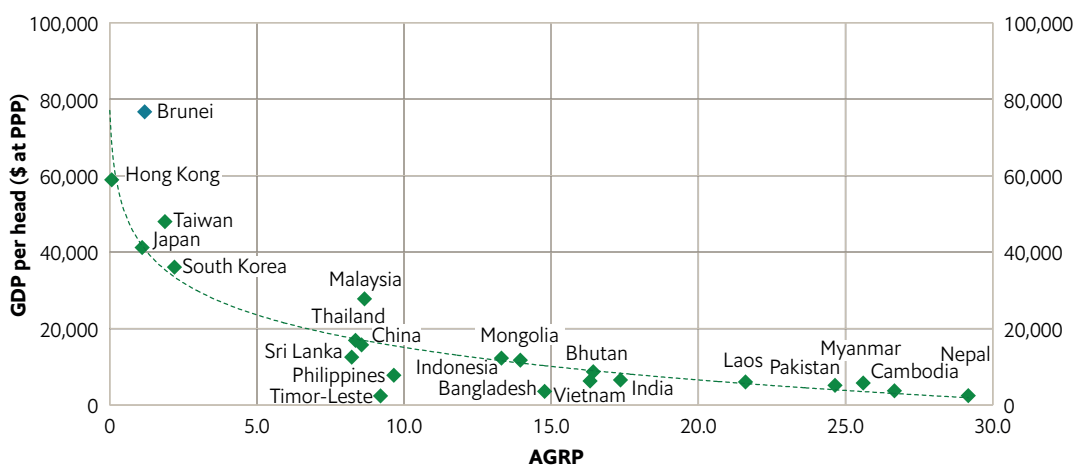
Source: The Economist Intelligence Unit.
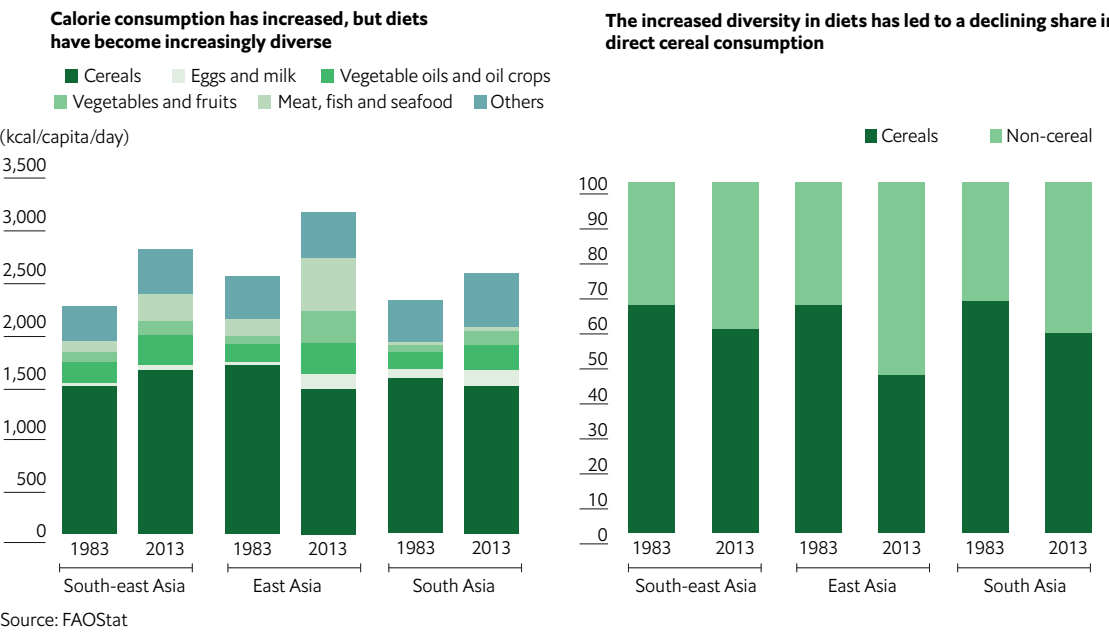
[iv] Calculated from UNCTADSTAT trade data

4.2 Dietary convergence, but diverging local consumption

Urbanisation	Dietary transition	Nutrition	Technology	Transparency, sustainability	Food politics

Interviewees consulted as part of this research highlighted that significant growth in calorie consumption is unlikely in the coming years in Asia because few countries in the region are consuming less than 2,500 calories per capita a day. As a result, people may consume more food, but not a lot more. However, the composition of those calories will change, with a shift towards more oils, fats, livestock products and fruits. There is already broad convergence towards higher-value categories of food, reflected in growing consumption of convenience foods and animal protein. At the same time, there is still considerable variation across Asia in how these increases translate into specific food items. Local factors such as culture, religion and demographics widen the divergence.

Income growth in Asia will continue to drive the transition away from direct consumption of cereals, particularly rice. Globally, it has been observed that people eat fewer direct carbohydrates as they become wealthier, but consume more cereals indirectly through meat.[22] This is much more resource-intensive because it takes 2 to 3 kg of feed to produce 1 kg of chicken or 1 kg of pork. The ratio for beef is between 5:1 and 20:1.[23] In Asia in particular, this shift will lead to decreased consumption of rice on a per-capita basis. However, increased consumption of wheat in the form of cakes, pastries and bread has been observed in some Asian countries due to interest in more "Western" forms of food. For example, South-east Asian countries will consume 23.4m tonnes of wheat in 2016–17 (up from 16.5m tonnes in 2012–13), and India has become a net importer of wheat (after long being a net exporter).[24]

Figure 4: Increasingly diverse and rich diets

Calorie consumption has increased, but diets have become increasingly diverse

Legend: Cereals; Eggs and milk; Vegetable oils and oil crops; Vegetables and fruits; Meat, fish and seafood; Others

(kcal/capita/day)

The increased diversity in diets has led to a declining share in direct cereal consumption

Legend: Cereals; Non-cereal

Source: FAOStat

Rice consumption has been observed to decrease faster among higher-income countries and urban populations,[25] supporting the argument that per-capita rice consumption will plateau as incomes rise. However, although there is general agreement that per-capita rice consumption will decrease, different countries are likely to have different minimum thresholds before consumption plateaus, which will slow diversification away from rice.[26]

Consumers in Asia will move towards more energy-dense diets, particularly involving protein and sugar. Protein, fat and sugar will account for most of the increase in calories consumed in Asia, and an increased share of the food basket. Meat, dairy and fish consumption is already responsible for higher protein intake in South-east Asian countries, particularly Myanmar, Indonesia and Vietnam.[27] The United Nations Food and Agriculture Organization (FAO) projects that most of the increase in demand for animal protein by 2030 and beyond will come from developing Asia. This will have knock-on effects on demand for animal feed. Between 1990 and 2012, demand for concentrated feed (which includes wheat, rice and coarse grains) more than doubled in the Philippines, Indonesia and China, driving increases in feed prices and increased volatility in the market.[28]

Trade liberalisation will accelerate the shifts in diet. The reduction in trade barriers, access to wider markets and potentially cheaper commodities available on a global market will help to drive a shift in diet in developing countries to include more animal products. As Drewnowski et al. have argued, trade reduces the relative cost of dietary energy, resulting in increased consumption of energy-dense (if not necessarily more nutrient-rich) food, through factors such as increased trade in food such as sugar and vegetable oils, as well as income growth encouraged by trade.[29]

Divergent local consumption will be driven by culture, religion and demographics. Although Asian consumers will move away from direct consumption of cereals and towards more diverse diets, different consumers in different places will still eat different food. For example, although protein consumption is set to increase across the board in Asia, people's main source of protein will differ across countries and ethnic and religious groups. Muslim-majority Indonesia will drive demand for poultry, for example, while China drives demand for pork (of which it currently consumes half of the global supply).[30] Similarly, although consumption patterns for processed foods have converged, Malaysia reports high levels of consumption of oils and fats, while the Philippines and Thailand report significant consumption of soft drinks. [31] Importantly, convergence also does not necessarily mean convergence to a Western norm. In Asia, for example, non-alcoholic and fortified beverages (such as juices, tea/coffee and bottled water) drive growth in the beverage sector. In the West, growth is driven by alcoholic beverages and carbonated soft drinks.[32]

4.3 Convergence towards the double burden of undernutrition and obesity, although at varying speeds

Urbanisation	Dietary transition	**Nutrition**	Technology	Transparency, sustainability	Food politics

The structural shift in consumer demand for food and the changes in lifestyle that accompany a transition away from agricultural production will have cascading effects on health and production. Accelerated urbanisation and globalisation have already produced food systems that focus on food quantity rather than quality, particularly cheap but filling processed food and increasingly affordable sugar- and fat-heavy food.

Dietary changes are likely to drive limited convergence towards a reduction in undernutrition, but at rates that are insufficient to end all malnutrition by 2030 (Sustainable Development Goal 2). Estimates of global reductions in calorie insufficiency expect the bulk of this progress to occur in Asia, where there is considerable variance in the prevalence of undernutrition. However, Asia is still likely to have significant levels of undernutrition in 2030,[33] and this will continue to be driven primarily by South Asia, where 35.8% of children under the age of five were stunted in 2010–16. South Asian countries have made slow progress towards reducing undernutrition, reflected in the still-high levels of undernutrition and the slow rate of reduction in undernutrition during the most recent decade.[34] In comparison, a much lower proportion of children under the age of five are stunted in East Asia and the Pacific (9.8%). Projections for South-east Asia suggest that the number of undernourished individuals will continue to fall, although at rates that are insufficient to overcome food insecurity.[35]

Nutritional concerns will pivot towards the double burden of undernutrition and obesity. Current estimates of overweight/obesity exceed global averages in many East Asian countries.[36] Countries in Asia, therefore, show an increased prevalence of both obesity and undernutrition, resulting in a so-called double burden. In Indonesia, for example, 12% of children are overweight, but another 12% suffer from "wasting" or moderate malnutrition.[37]

Trade liberalisation is likely to accelerate the convergence of health outcomes in Asia, both positively and negatively. Trade liberalisation is closely linked to dietary changes: as increasing liberalisation encourages the shift to more energy-dense diets, it also drives subsequent health outcomes. On one hand, trade liberalisation can be a positive force in countries where the food supply is inadequate and calorie insufficiency is an issue. For example, evidence at the national level shows that trade liberalisation tends to increase the overall amount of food that is traded and available in food-deficit countries.[38,39] On the other hand (and as discussed in earlier sections on urbanisation and dietary convergence), trade can also encourage increased consumption of energy-rich food, leading several studies to highlight the links between obesity and trade liberalisation.[40,41]

4.4 Divergent technology paths due to different constraints and technology frontier levels

Urbanisation	Dietary transition	Nutrition	Technology	Transparency, sustainability	Food politics

Global demand for food is expected to increase by about 60% in the period to 2050,[42] with demand undergoing structural changes based on population growth, ageing and urbanisation.[43] Average yields in Asia are currently below the maximum, and closing these yield gaps will be instrumental to increasing efficiency against a backdrop of resource scarcity and climate change. However, due to considerable variation in income and R&D expenditure on agriculture, the level of agricultural sophistication differs greatly among Asian countries. In some countries, agriculture is still dominated by subsistence farming. In others, more technology-intensive farming is dominant (for example, extensive farming or urban farming).
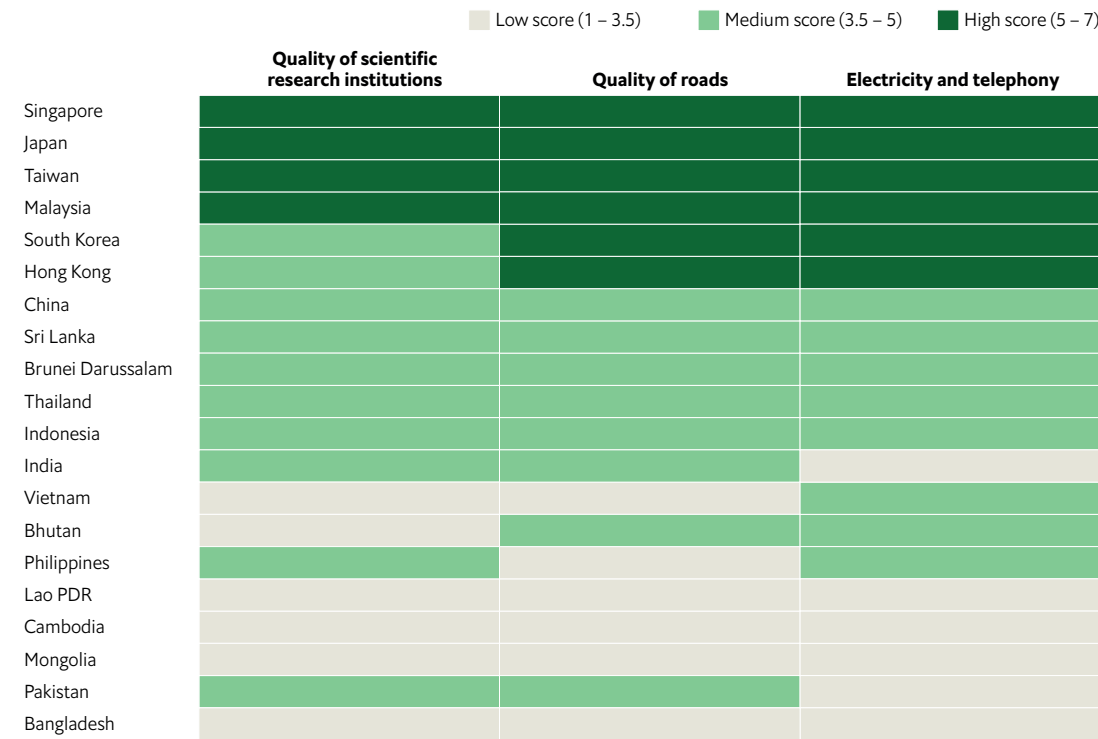
Agricultural R&D expenditure in Asia is likely to continue increasing, albeit from a relatively low base. Given the current level of research in Asia, there is significant room for R&D to expand in agriculture, particularly as investments have high expected payoffs in developing countries.[44] Overall, public agricultural research spending has already increased significantly in Asian countries, with China driving one-third of total Asia-Pacific expenditure in 2008. However, many countries in Asia continue to underinvest in agricultural research. Cambodia, Laos and Pakistan all invest less than 0.20% of their agricultural GDP in research, while China and India have relatively low-intensity ratios of 0.50% and 0.40%. To provide some points of comparison, developed countries such as Japan, Australia and South Korea invest 5.46%, 3.56% and 2.22%, respectively, of their agricultural GDP in research. [45]

Institutional differences between Asian countries mean that agricultural technology levels are unlikely to converge in the short to medium term. In the period to 2030, countries that are dependent on subsistence farming will focus on implementing knowledge-intensive agriculture, with the aim of closing the yield gap. The advent of ICT and the affordability of smartphones have helped to bridge the gap between R&D providers and smallholders, although structural challenges remain, such as illiteracy, a lack of familiarity with technology and a lack of access to capital. These challenges will persist in the longer term, which means that divergence in agricultural technology is likely to continue. Developing countries need improvements in education, land consolidation and quality investment in infrastructure (such as electricity and the internet) before they will be able to fully implement solutions such as precision agriculture, biotechnology and robotics.

In highly urbanised and high-income areas, technological innovation is likely to focus on solving challenges such as ageing farmers, a lack of land and the need for more capital-intensive solutions. Japan has invested significantly in robotics in agriculture to address the issue of ageing farmers, utilising a second quasi-zenith satellite (Michibiki No. 2) to improve the accuracy of the country's GPS (and hence improve data for unmanned farming). It plans to launch two more navigation satellites

by the end of 2017.[46] Agriculture is a key aspect of Japan's Robotics Strategy, and the country aims to implement automatic driving tractors in actual fields by 2020. It is also introducing more than 20 types of robot in agriculture and the food industry.[47] South Korea is focusing on transitioning towards technology and capital-intensive agriculture, with an emphasis on smart farming,[48] while Singapore is looking to pioneer urban farming solutions through vertical farming and indoor farming.[49]

Figure 5: Divergent infrastructure quality and research capabilities in Asia

	Quality of scientific research institutions	Quality of roads	Electricity and telephony

Low score (1 – 3.5) Medium score (3.5 – 5) High score (5 – 7)

Countries (top to bottom): Singapore, Japan, Taiwan, Malaysia, South Korea, Hong Kong, China, Sri Lanka, Brunei Darussalam, Thailand, Indonesia, India, Vietnam, Bhutan, Philippines, Lao PDR, Cambodia, Mongolia, Pakistan, Bangladesh

Source: World Economic Forum

4.5 Converging interest in transparency and sustainability, but for divergent reasons

Urbanisation	Dietary transition	Nutrition	Technology	Transparency, sustainability	Food politics

In developing countries, consumers who are worried about food safety are increasingly looking for transparency and traceability. Food safety will become a more important issue, partly because longer and more global supply chains make it harder for consumers to know where their food comes from, but also due to greater consumer awareness of the food safety issue. Food safety is already a key concern in Asia, where unsafe food remains a major cause of disease and death. According to World Health Organisation (WHO) estimates, food-borne diseases in South-east Asia are responsible for more than 150m illnesses and 175,000 deaths annually.[50] Food safety is not

limited just to retail and restaurants; hygiene and feed contamination are also issues for livestock and slaughterhouses.

Interviews with experts highlighted significant food safety concerns in developing countries such as Vietnam and Myanmar, as well as China (although there has been some improvement in China following stricter food regulation). Food adulteration and fraud scandals have also increased consumer vigilance. Regulations in most countries are becoming stricter, driven by increased consumer awareness, food scares and greater local capability in food testing. For example, China's new Food Safety Law 2015 imposes stricter obligations on producers, distributors and retailers to monitor products across the supply chain, with harsher sanctions in the event of non-compliance.

In upper-middle to higher-income countries, interest in food traceability is related more closely to sustainability concerns. Environmental issues such as deforestation, responsible sourcing and food miles have been topics of interest in developed countries for some time, but they are now beginning to attract more attention (albeit at a slow pace) among consumers in Asia. From a demographic perspective, millennials are more likely to indicate a willingness to pay for "green" labels and traceability,[51] which means that wealthier millennials will be a key demographic for markets such as organic food and sustainably sourced ingredients by 2030. There are also indications that developing countries have a strong interest in sustainability.[52] However, "ethical" food tends to be priced at a premium, and consumers in developing countries have lower disposable incomes, potentially limiting their consumption of sustainable food. Some estimates suggest that sustainable products are 30% more expensive than traditional products.[53] If this remains the case, the shift towards sustainable food is likely to be led by higher-income countries in the period to 2030.

Social media and globalisation amplify the feedback loop for food trends and scandals, increasing the need for transparency. Public interest in sustainability and food safety is also driven by globalisation and social media, both of which make it possible to disseminate information more rapidly and more widely. On the positive side, this means that consumers can now access nutrition information easily. Interviewees noted that nutrition is complicated and often relies on scientific jargon, but access to the internet can make this easier to navigate, particularly if health and science authorities build a strong online presence. Social media also incentivises companies to behave, as a mishap in one market can easily spread to another via viral news. However, social media also amplifies fears about food safety. According to Sun Yat-sen University's Big Data and Communications Laboratory, rumours about food safety constitute one of the most widespread topics on WeChat in China.[54] Dieticians have also noted the challenges associated with misinformation and hype, ranging from the gluten-free trend[55] to fad diets (such as the grapefruit diet)[56] and celebrity promotion of quick-fix products. The use of smartphones and increased use of the internet will further increase the need for transparency and trust-building with consumers.

Trade will drive converging interest in transparency and sustainability, although a lack of harmonised standards and a continued regional focus in trade will limit regulatory convergence. Although trade liberalisation can affect food safety both positively and negatively, one

of the advantages of imported food is that it can be of higher sanitary quality than locally produced food in lower-income countries.[57] For example, a domestic milk poisoning scandal in China in 2008 drove Chinese consumers to mass purchase foreign brands of milk powder when travelling overseas.[58] Integration into global supply chains also means that firms in Asia need to cater for the demands of consumers in developed markets, and exports to markets such as Europe help to improve food safety because exporters have to meet higher standards. For example, Thailand has improved its poultry standards as it seeks to export to the EU.[59] Farmers concentrating on domestic markets face less pressure to improve food standards.

There has been some regulatory convergence towards global food safety standards (for example, at the ASEAN level), albeit at a slow pace. In countries where food safety and seasonality are issues, imports also help to increase food availability and make food safe to eat (for example, Chinese imports of infant formula following domestic food safety scandals).[60] In Vietnam, consumers already focus on the country of origin when purchasing food.[61]

4.6 Politicised food systems due to divergent interests and resource scarcity

Urbanisation	Dietary transition	Nutrition	Technology	Transparency, sustainability	Food politics

As countries become more urban, decisions about how to allocate resources between urban and rural areas become more political. For example, the decision to protect farmers through the use of subsidies, price floors or trade barriers comes at the expense of higher prices for consumers in urban areas. Globalisation has also led to the coupling of energy and food markets, increasing food price volatility. For example, the 2011 food price spikes led Asian governments to feel wary about market movements and their impact on food security.

From an intra-country perspective, large urban centres are usually the economic centres of a country. Policymakers are therefore incentivised to invest in urban infrastructure, resulting in an estimated 80% of investment today going to basic urban infrastructure.[62] This may lead to underinvestment in the urban-rural links necessary for a resilient food supply chain, which imposes economic costs. A 2008 report from the World Bank, for example, estimated that India's fruit and vegetable post-harvest losses were equivalent to 40% of total annual production.[63]

National interests will increasingly collide as water scarcity worsens, with the advantage resting with upper riparian countries. While climate change is a long-term trend, increased water scarcity will be a key impact. Agriculture is the main user of freshwater on the planet, but it faces competing uses. By 2030, Asia is projected to need 65% more water for industrial use, 30% more water for domestic use and 5% more water for agricultural use.[64] This increased need for water (coupled with declining resources) will drive water politics between upper and lower riparian countries. The headwaters of six of Asia's major rivers are located in Tibet, giving China significant control over water flow to lower riparian countries.[65]

Figure 6: Dams along the Mekong

The Mekong Delta is a major agricultural centre in Asia (producing more than 16m tonnes of rice annually) and a productive inland fishery. However, the uneven development between countries along the Mekong River has given rise to competing demands for the Mekong River's resources.[66] China and Laos both have major hydropower plans for the Mekong River: Laos wants hydropower to be its main source of revenue by 2025, and China has built six hydroelectric dams on its stretch of the river.[67] Downstream Mekong countries worry about the impact of the dams on fisheries and agricultural sites. (The dams could cut the sediment load—which provides the river's nutrients—and adversely affect soil and fishing.) In South Asia, dams built in India and China have negatively affected agriculture in Bangladesh,[68] and tensions have risen in recent years, partly due to hydroelectric projects (as well as geopolitical issues).

Water-related tensions will worsen as demand for electricity and water increases in Asia. Energy demand is expected to rise by 27% to more than 300 quadrillion British thermal units (Btu) by 2030, and China alone is expected to account for nearly one-quarter of global primary energy consumption by 2030. With no formal transboundary water-sharing agreements in Asia between China and downstream countries, divergent political interests will continue to drive water nationalism, posing significant food system risks to lower riparian countries.

5. The Big 3: China, India and Indonesia

China, India and Indonesia alone will account[v] for 75% of Asia's total population and 60% of its real GDP by 2030.[v] The food system transitions in these three countries will therefore have profound regional and global impacts, with the sheer size of their populations and their economic strength in the coming years affecting global demand and supply of food.

Increased consumption of meat in China and Indonesia, but low growth in India. China's calorie consumption increased by almost 30% between 1983 and 2013. During the same period, India and Indonesia's calorie consumption increased by 11% and 17%, respectively. By 2030, China is projected to consume an additional 30 kg of meat per person.[69] India's strong vegetarian culture reduces the possibility that India will emerge as a major meat consumer, but some projections estimate that India's meat consumption (mostly poultry) will rise to 9 kg in 2050, from a base of 3 kg.[70] Indonesia is projected to consume 10–11 kg of meat per capita by 2030.[71] In terms of composition, China's increase in calorie consumption has been driven by increases in the consumption of meat, as well as vegetables and fruit. Pork accounts for the majority of animal protein consumed, and it accounted for 75% of meat consumed in China.[72] Consumption of beef, fish and chicken has also grown quickly, albeit from a low base. India's meat consumption mainly involves chicken and fish (63%), reflecting the fact that 80% of residents claim Hinduism as their religion.[73] In Indonesia, meat consumption mainly involves fish (45%). Dairy products and eggs account for a larger proportion of calories consumed in China and India (4% and 6%, respectively) than in Indonesia (1%).

Growing demand for food that is more resource-intensive and a lack of resources will drive the need for trade, to varying degrees. China has a long-standing grain self-sufficiency target of 95% and has remained largely self-sufficient in grain, with the exception of soybean (feed material for pigs), of which it is the world's largest importer.[74] However, China is unlikely to be able to maintain absolute self-sufficiency given the surge in demand, its lack of arable land and soil degradation. Projections tend to point towards greater import dependence for meat and dairy products, as well as grain to a lesser extent.[75] India is more likely to meet increases in demand for staples through domestic supply, although it will need to import significant amounts of vegetables, oils, and to a lesser extent, pulses and meat.[76] Indonesia currently relies on imports to meet demand for key food products and ensure its food security, and it is likely to face increased demand for imported food such as wheat and beef.[77]

[v] Economist Intelligence Unit data. This excludes Australasian, West Asia and Middle Eastern countries.

All three countries have food self-sufficiency targets, but China has displayed greater willingness to move to market-based solutions. China has ambitious self-sufficiency targets, but the Thirteenth Five-Year Plan (2016–20) focuses on land consolidation and modernisation of the agricultural sector, as well as greater openness to imports.[78] Indonesia introduced a new Food Law in 2012 to build self-reliance and ensure food security by prioritising the domestic production of staple food, and it has set self-sufficiency targets for five staple crops. However, these programmes have been criticised for their high costs and significant market distortion.[79] India is largely self-sufficient in most key staples and has stressed the need for self-sufficiency in its five-year plans. However, it is expected to face significant challenges in meeting its self-sufficiency targets due to decreasing productivity growth and scarce natural resources.[80]

6. Opportunities and challenges

The challenge for policymakers and companies will be to identify specific hurdles and opportunities in each market, while managing any eventual convergence towards urban food systems. By looking into drivers of future trends, stakeholders can identify areas of risk and evaluate existing policies based on projected challenges to the food system. Any long-term strategy should proactively anticipate challenges and seek solutions. With this in mind, how can policymakers and companies manage the trends discussed in this report?

6.1 Define food security more holistically to cope with structural changes in food demand and supply

Food security could be more broadly defined to include resilience, diversity and affordability, rather than just self-sufficiency. The Global Food Security Index defines food security as an issue encompassing the availability, affordability, and safety and security of food for households. Food self-sufficiency, on the other hand, refers only to a country's ability to feed its population from domestic resources.[81] The surge in demand for food products in Asia has made it difficult for most countries to remain self-sufficient, particularly China. It is unlikely that these countries will be able to meet the growing demand for food with domestic resources alone over the next 15 years.

As trade flow increases and resource scarcity heighten the need for virtual trade in water and land, food security considerations could be broadened to include other strategies, such as identifying diverse food sources (including sources of imports, particularly for staples), optimising local production through investment and research, and contract farming. These strategies address the broader aim of securing safe, affordable food for consumers and have been implemented with success in Singapore—a country that imports 90% of its food but was ranked third in the Global Food Security Index 2016. Agricultural policies could also address more long-term concerns, such as competition for water, labour productivity and land use.

Mirroring the shift in consumption, food security policies could look beyond rice. Food security efforts in Asia are heavily biased towards policies dealing with staple grains, such as public support for rice production and interventions in staple grain markets. The bulk of public subsidies and research have been linked to national targets for cereals output and self-sufficiency (particularly in rice), despite changing demographics and diets.[82] Per-capita rice consumption is falling, however, which means that self-sufficiency policies centred on grains and access will become outdated if they are not revised in response to changing consumption patterns. Current policies such as stockholding and trade restrictions in large importing ASEAN countries have stabilised prices but at a much higher price level.[83] This is regressive, as lower-income households tend to spend more of their budget on food and staple crops.

Policymakers could consider incentivising farmers (particularly marginal farmers) to diversify production and move towards supplying more lucrative crops, while also boosting productivity assistance to larger and more productive farms. Productivity needs to increase and should be measured across a broad range of indicators, extending well beyond rice yields.

6.2 Predict and anticipate the convergence of trends for early policy development, but assess spillover effects

Develop proactive policies anticipating coming changes in diets, supply chains and health issues. The management and regulation of food systems—from growing food to disposing of it—requires a complex and multi-stakeholder effort from governments, often in the face of competing interests. Urbanisation, income growth and environmental changes are happening at a far more rapid pace than occurred in other developed countries. In light of this, policymakers could consider ways to anticipate challenges and develop early strategies in response. For example, policymakers could focus on understanding how changes in income will affect diets in different parts of the country, and then build a transition plan to prepare their agricultural sector for this shift in demand. Alternatively, policymakers could focus on the double burden of undernutrition and obesity and move proactively in anticipation of increased incomes and urbanisation. (In such cases, the best policy is often education, which is a long-term investment.) At the macroeconomic level, an integrated approach is needed to manage urban-rural links for long-term development. Strengthening urban-rural infrastructure connectivity is critical to building a resilient food supply chain, both in terms of channelling food imports through urban centres and supplying local food through rural areas.

When assessing the upstream and downstream consequences of food and agriculture policies, look beyond the border for impacts. Increasingly diverse diets, longer food supply chains and complex nutritional choices complicate policy decisions when it comes to food. Policy interventions in one part of a food supply chain will have cascading and often unintended upstream and downstream impacts. For instance, restricting imports of rice to protect smallholders may have nutritional impacts. The World Bank noted that in Indonesia and the Philippines, retail prices for rice have been more than 50% higher than in other South-east Asia countries, leading the urban poor to spend more on rice rather than on food with greater nutritional value.[84] The growing interdependence across countries adds further complexity because policies need to consider international competitors and consumers. For example, Thailand conducted a rice stockpiling exercise (buying up rice from farmers at above-market prices) in 2012 to drive up global prices. In the end, however, India increased its rice exports and left Thailand with 13m tonnes of rotting rice and legions of unpaid farmers.[85]

Local and regional influences affect the success or failure of policy transfers. Interviews with experts highlighted that when solutions from other, more developed countries are implemented elsewhere, they are not always localised to meet the country's specific concerns and requirements. For example, the prevalence of street food in Asia means that policies targeting large-scale manufacturers to reduce sugar or fat are insufficient, because people can switch to equally unhealthy options

available in hawker centres.[86] Similarly, when considering meat consumption, policies would need to recognise that environmental concerns differ greatly in China (where pork and beef are popular) and India (where beef is not generally eaten and there is a large vegetarian population).

6.3 Enhance national capacity in monitoring food system metrics and natural resources

A lack of updated, detailed data makes it difficult to tailor policies appropriately. Identifying how trends are likely to converge or diverge requires good data, and tailoring or designing policies to address food system issues requires robust and comprehensive data on specific population groups, nutritional quality, crop productivity by region and even vulnerability to climate change. As the Global Panel on Agriculture and Food Systems for Nutrition noted, much of the data available on diets are not about what people actually eat, but are estimates based on a range of assumptions drawn from production or sales data.[87]

Collecting statistics is a resource-intensive exercise, and developing countries tend to need more time to build capacity in this area. However, the lack of data on key food system metrics—such as the average size of farms,[88] the quantity and quality of food intake across different population groups[89,90] and food loss data[91]—means that policies and interventions are based on fragmented evidence. With increased pressure on resources, and in anticipation of the coming impact of climate change, there is a need to better manage Asia's natural resources. Gathering information on sustainable practices and mapping the use of natural resources will be necessary to avoid resource overexploitation and improve resource management.

6.4 Strategise by anticipating the convergence and divergence of trends in each market

Companies could assess where trends are likely to converge or diverge and then plan corporate strategies accordingly. When setting corporate strategies, companies could take into account the short-term and long-term implications of trends that are likely to converge and trends that are likely to remain divergent. For example, it is clear that urbanisation trends will converge in the long term, but how this happens, and how it should be managed, will differ greatly between countries and even cities. Investment in infrastructure is also likely to increase as countries develop, but the quality and enforcement of regulation will differ greatly based on existing political structures. To manage this, long-term corporate strategies could incorporate likely improvements in expressways or ports up to 2030, while recognising that institutional changes (such as metropolitan planning and local taxes) will remain divergent.

Convergent trends do not negate the need for localisation. For food and retail companies, it is important to understand that the convergence of a trend does not imply convergence to the norms in a European country or a city in the US. For example, convergence towards modern retail is likely to happen, but modern retail in Asia will not be exactly the same as in other regions. Walmart's failure

to take into account local Chinese tastes led to a loss of market share to Sun-Art.[92] Sun-Art integrated the convenience of modern retail with the look and feel of traditional wet markets, successfully outperforming Walmart's big-box format. Localisation is not just limited to country tastes; city-level tastes may be the driving predictor of localisation needs, given Asia's rapid urbanisation.

7. Appendix: Research approach

The term "food system" can be defined in different ways. At its simplest, a food system covers "end-to-end" activities, from production to consumption, and even disposal. More broadly, it covers "the governance and economics of food production, its sustainability, the degree to which we waste food, and how food production affects the natural environment.[93] The FAO defines a food system as encompassing all the stages of keeping us fed: growing, harvesting, packing, processing, transforming, marketing, consuming and disposing of food.

For the purposes of this report, we have defined a food system as including "all activities in the food supply chain, from production, processing and packaging to logistics, distribution, consumption and disposal, as well as policy considerations such as the environment, health, governance, sustainability and supporting infrastructure and institutions."

Asia is also defined differently in various publications and databases. In this report, Asia refers to South Asia, East Asia and South-east Asia, unless otherwise stated. Middle East countries (which are sometimes known as West Asia countries) are not included.

7.1   Overview

The objective of this research was to analyse food-related trends along the value chain (from production to waste) and to draw out underlying themes that will be critical in 2030 and themes that are particularly relevant to Asia. For this reason, our methodology focused on identifying a list of key trends through a literature review, and then narrowing the list of over 90 trends down to key thematic issues for Asia, based on our internal analysis and expert input (gathered via interview). Each thematic issue was then explored to develop a consistent narrative for Asian countries.

7.2   Triangulating themes

We identified more than 90 trends along the various parts of the food value chain, based on the literature review and the environmental scan.[vi] A PESTLE analysis was then carried out to categorise these trends, and to ensure that the list of trends was comprehensive. An internal discussion was held to validate and review the PESTLE analysis, and to identify the 30 major and consistent trends (based on the literature review).

An online questionnaire focused on the shortlisted trends was then developed and shared with the experts who were being interviewed for the study. We ran concurrent interviews with these experts to obtain their views on the overall food system(s) in Asia, as well as underlying trends. The interviews provided deeper insight into critical research issues and topics, ensuring that the study incorporated the latest thinking and expertise of those working directly in this field. The insights from the interviews and the results from the questionnaires were then analysed to draw out the themes.

[vi] The list of publications reviewed during this phase is listed in the section titled "Literature review: references."
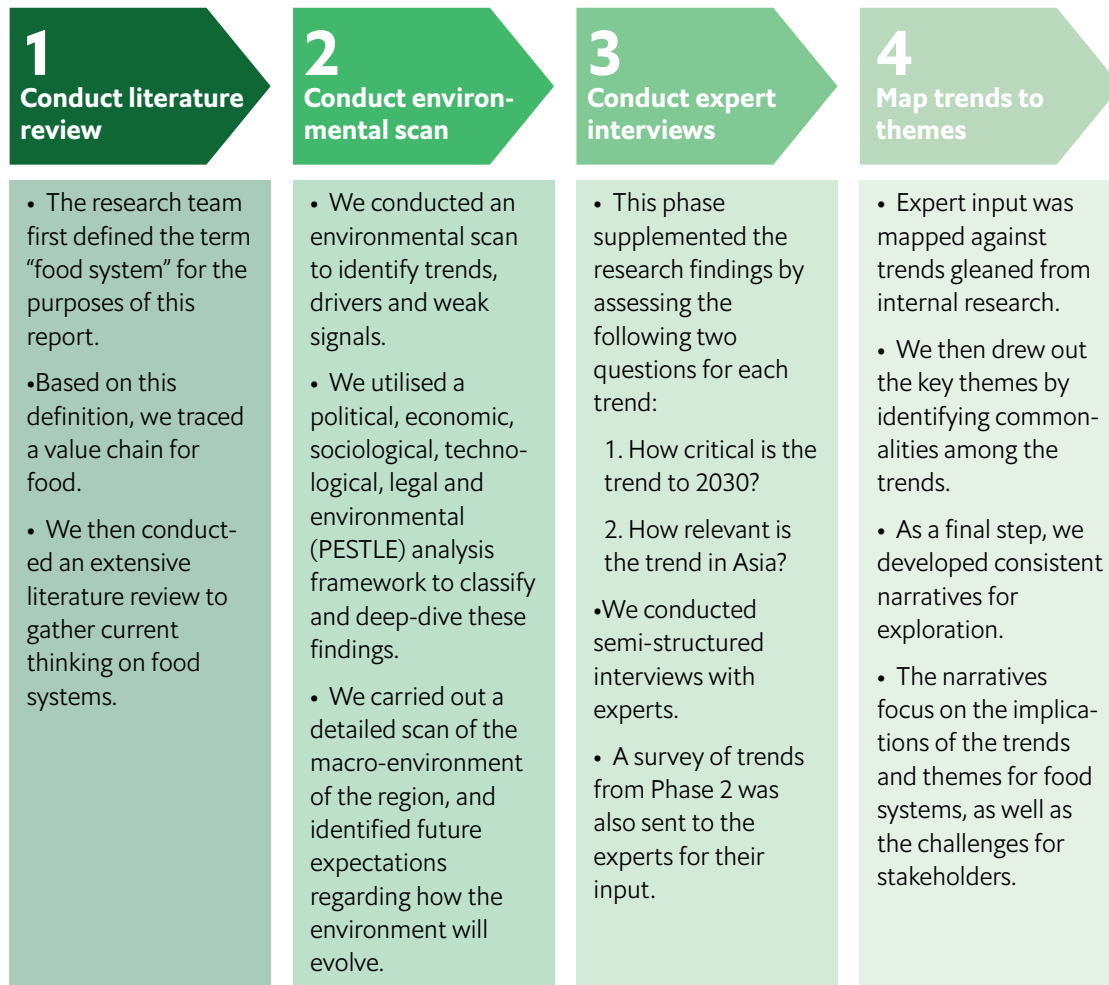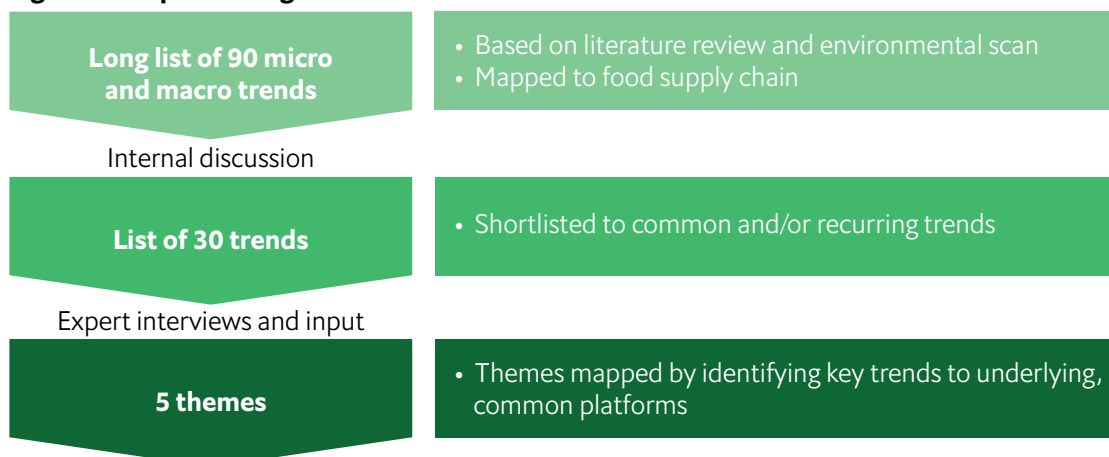
Figure 7: Research programme phases

1 Conduct literature review	2 Conduct environ-mental scan	3 Conduct expert interviews	4 Map trends to themes
• The research team first defined the term "food system" for the purposes of this report.	• We conducted an environmental scan to identify trends, drivers and weak signals.	• This phase supplemented the research findings by assessing the following two questions for each trend:	• Expert input was mapped against trends gleaned from internal research.
•Based on this definition, we traced a value chain for food.	• We utilised a political, economic, sociological, techno-logical, legal and environmental (PESTLE) analysis framework to classify and deep-dive these findings.	1. How critical is the trend to 2030?	• We then drew out the key themes by identifying common-alities among the trends.
• We then conduct-ed an extensive literature review to gather current thinking on food systems.	• We carried out a detailed scan of the macro-environment of the region, and identified future expectations regarding how the environment will evolve.	2. How relevant is the trend in Asia? •We conducted semi-structured interviews with experts. • A survey of trends from Phase 2 was also sent to the experts for their input.	• As a final step, we developed consistent narratives for exploration. • The narratives focus on the implica-tions of the trends and themes for food systems, as well as the challenges for stakeholders.

Figure 8: Steps in triangulation of themes

Long list of 90 micro and macro trends
- Based on literature review and environmental scan
- Mapped to food supply chain

Internal discussion

List of 30 trends
- Shortlisted to common and/or recurring trends

Expert interviews and input

5 themes
- Themes mapped by identifying key trends to underlying, common platforms

Source: The Economist Intelligence Unit.

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