Futures of food provision
Four possible scenarios for the AgriFood industry

€ 1,264 billion

spent on food and drink in EU
See page 4

18 million

employees working in European AgriFood industry
See page 4

100%

rise in milk consumption in China in 6 years' time
See page 8

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1. Introduction

The global population is currently growing by 1 million people per week. That number is already hard to imagine, but let's consider what it actually means for global food demand. For example, the Indian population traditionally has a vegetarian and vegan lifestyle. Lately, the Indian population has been increasing its poultry and egg consumption, to 62 eggs per capita. In Germany, egg consumption is almost four times higher. If the Indian population started eating as many eggs as the German, we would need almost 700 million additional hens to accommodate demand. We would also need many more poultry farms and much more poultry feed to accommodate the future demand for eggs.[1]

Will we be able to accommodate future food demand, knowing that climate change and resource scarcity put additional pressure on the global food supply? Or will innovation and new technologies such as Agtech increase yields and improve production methods fast enough to meet increasing demand and counteract the negative effects of climate change and resource scarcity?

We see several challenges ahead for the global food industry, and for us as individual consumers as well. This paper addresses the impact of these different scenarios and supports you in these challenges, as we have developed a framework for considering potential futures. After comprehensive desk research, we interviewed more than twenty executives in the European AgriFood industry and asked them to share their views on disruptions in the AgriFood industry. In collaboration with our own internal experts, we used these results to create four scenarios for the future.

These possible futures look very different, but all are based on extrapolations of current trends. In practice, of course, no single scenario is neatly ring-fenced. Nonetheless, by thinking carefully about and expanding upon these different scenarios, companies will be able to evaluate their current strategy and plans, as well as the implications for their operating model and capabilities.

We believe the industry has a huge responsibility to recreate itself as an industry that not only feeds the world, but does so sustainably. Deploying innovation in a highly efficient manner will therefore require more effort and investment in innovation and technology, as well as more collaboration across the various value chains. Governments, especially those in Europe, will have to step up their game to create an environment that will allow these innovations to flourish.

Please get in touch if you would like to discuss these themes with us. We look forward to an ongoing dialogue about the future of the AgriFood industry and your company's future.

November 2016,

Peter Hoijtink, Jan Willem Velthuijsen, Gerd Bovensiepen

[1] Source: Statista, PwC Analysis

2. Setting the AgriFood scene

The scenarios in this paper take a look at how the European AgriFood industry may evolve over the next five to ten years by considering the potential disruptors to the sector. To provide some context, we first take a brief look at the sector's current position.

AgriFood industry is a major contributor to society

Providing the population with safe, affordable, and accessible food and beverage is the underlying purpose of the AgriFood industry. In Europe, consumers spend EUR 1,264 billion on food and drinks per year. The AgriFood industry has a huge social and economic impact on society. What, where, and how food is sourced, produced, sold, and consumed is becoming increasingly important to consumers.

From an economic perspective, with an estimated annual turnover of EUR 2,726 billion and added value of EUR 518 billion, the AgriFood industry[2] is a major contributor to the European economy. The AgriFood value chain stretches from fertiliser and seed producers to farmers, food processing companies, and retailers, interweaving transport and government throughout the chain. In Europe in 2015, almost 10.8 million farms, 300,000 food and beverage processing companies, and 2.8 million enterprises within the food distribution and food service industry delivered food to over 500 million European consumers. In this report, we focus mainly on that part of the AgriFood value chain that precedes retail.

Key indicators of the European AgriFood industry in 2014

€ 2,726 billion turnover	€ 114 billion imports	€ 129 billion exports	18 million employees	€ 1,264 billion spent on household consumption of food and drink

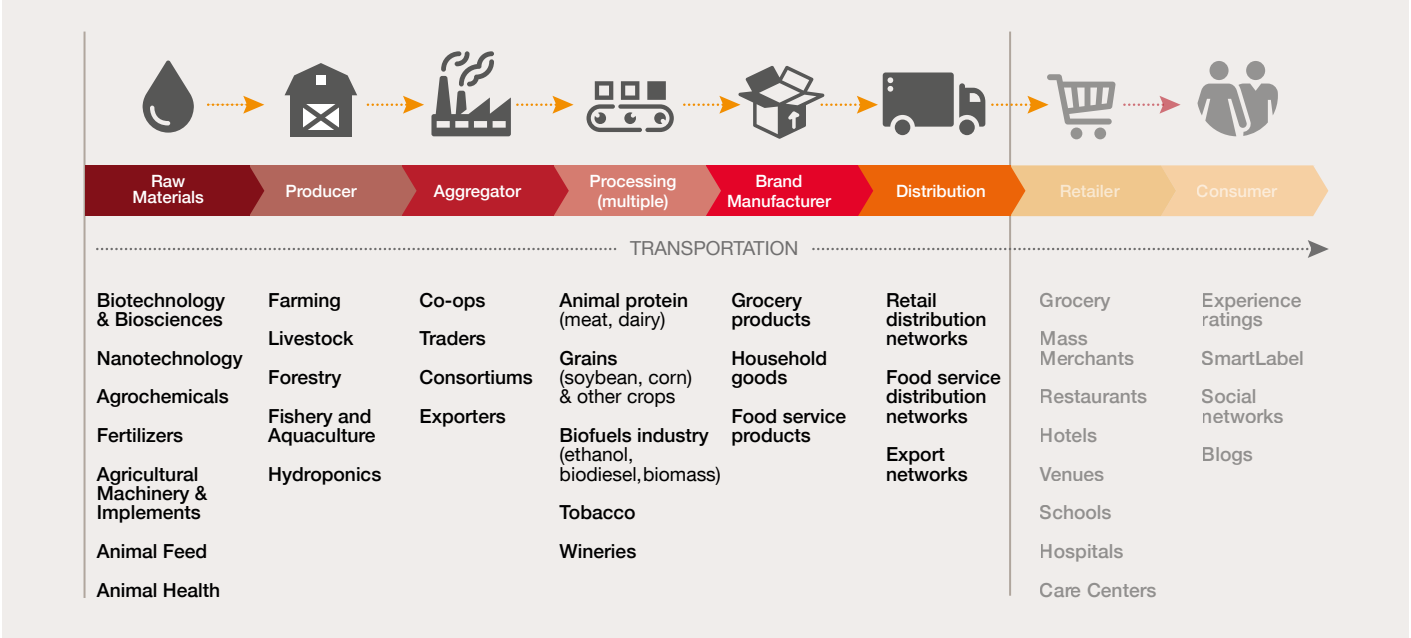
Source: Eurostat.

Pressure on prices and margins

The first decade of the 21st century saw an increase of agricultural commodities and food prices, together with growing volatility. Several factors contributed to higher agricultural commodity prices, such as an increasing demand for both food and industrial use due to the rising world population and a growing middle class,

PwC agribusiness value chain view

The agribusiness value chain comprises **"field to market"** lifecycle capabilities across food, beverage, flavor and textile commodities.



[2] Excluding the retail and food service industries.
Source: European Commission (2015a)

increasing prices of inputs such as energy, seed, fertiliser, adverse weather conditions, and financial speculation in agricultural markets.

However, after several years of high yields, lower oil prices, and weakening demand growth due to the overall economic slowdown, prices for dairy, crops, and meat fell sharply, signalling that the era of high prices for agricultural products might be over.

Margins vary within the value chain, depending on bargaining power. Whereas farmers are suffering from extremely low margins at the moment, international trading houses can maintain relatively good margins by hedging their derivative trades. Players in other sectors of the AgriFood industry maintain their margins by creating added value for their customers or by improving their bargaining power by achieving scale.

Increasing consolidation in the value chain

In recent years, consolidation has been one of the key drivers of growth in the AgriFood industry, from dairy farms to regional food processing companies and the largest global multinationals. For this survey, we interviewed several players in the European AgriFood industry. They all expect further consolidation across the value chain in the coming years. As one of our interviewees indicated: "Consolidation could balance the distribution of power across certain supply chains." Consolidation will facilitate dealing with increased legislative pressure while enabling players to compete on a European and global level.

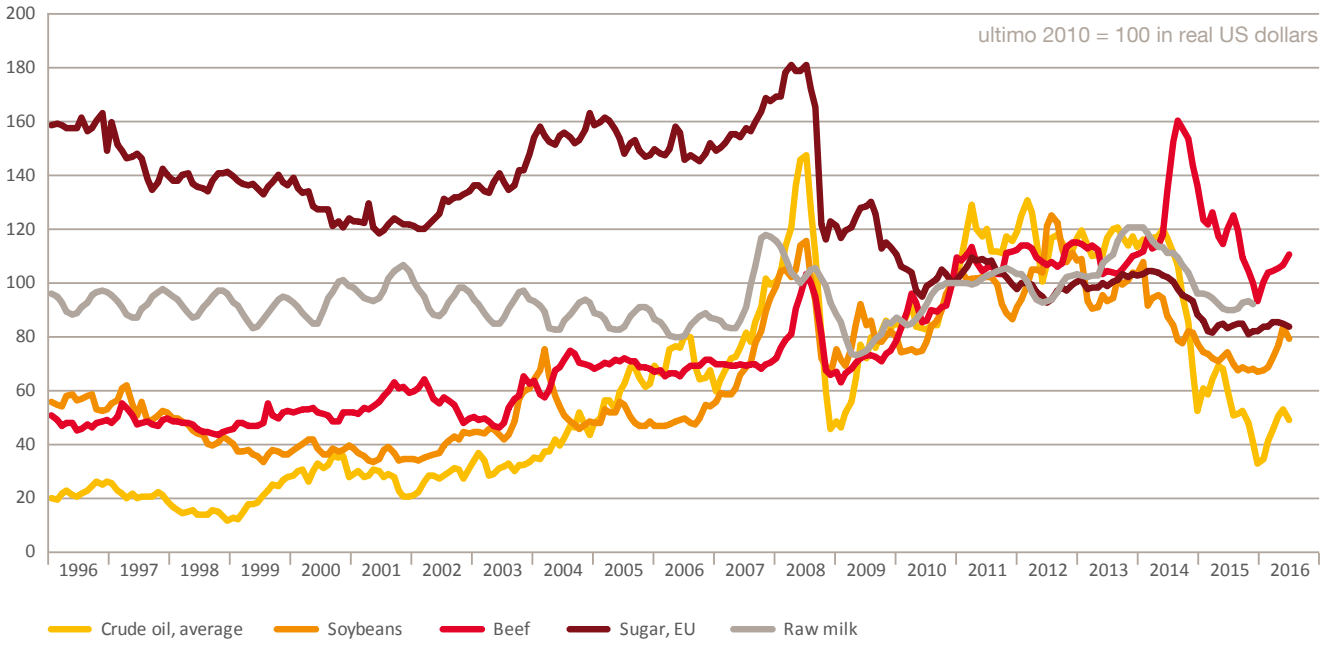
Globalisation versus protectionism

The European AgriFood industry plays an important role in the world market. Since 2013, Europe has been the world's leading exporter of AgriFood commodities and products. Currently, the top five destinations for European AgriFood exports are the U.S., China[3], Switzerland, Russia, and Japan, all of which are experiencing growth in imports from Europe. Rising standards of living in developing economies are creating opportunities for incumbent AgriFood companies to expand their footprint further. These are also bringing new competitors however, including a new breed of powerful state-owned companies, onto the world stage. Both of these factors, as well as the increased complexity of compliance with multi-jurisdictional regulations, are increasing the complexity of supply chains. With a more global footprint, different products are being directed to more diverse customers via different distribution channels which require different supply chains.

"Massive capital from Asian state-owned companies and increases in wealth will create more competition from the East."
Peter Hoijtink, Strategy&

An important question, however, is how consumers, politicians, and the media will react to this increasing globalisation. Trade agreements are already being met with scepticism. Will the market-oriented AgriFood industry regress towards protectionism?

Commodity prices, indexed



Source: World Bank Commodity Price Data and European Commission Milk Market Observatory

[3] Excluding Hongkong

3. Disruptions in the AgriFood industry

In our previous research,[4] we described five megatrends that heavily impact each link in the AgriFood value chain: demographic changes, urbanisation, climate change and resource scarcity, economic power shifts, and technological breakthroughs. Where these megatrends collide, the AgriFood industry is prone to suffer major upheaval and disruption. We discussed the megatrends and disruptions in significant detail with various stakeholders in European AgriFood companies. The interviewees most frequently mentioned climate change and consumer behaviour as the most disruptive factors in the next ten years. They are primarily concerned with two uncertainties in particular: will technology be able to solve the problems caused by climate change and resource scarcity, and how will global consumer demand change over the next ten years? Will the Western diet be adopted globally? Or will it become more sustainable and more diversified?

Climate change and resource scarcity threaten AgriFood

Climate change, resource scarcity, and sustainability are closely intertwined with the triad of water, energy, and food. Resource scarcity continuously poses challenges to the way we produce, source, and consume.

As the global population is set to grow to 9.7 billion by 2050, global agricultural production will have to grow by 70 percent by 2050, and by nearly 100 percent in fast-growing economies, to meet food demand. Without a significant increase in arable land or yields, this will put an enormous strain on resources. On top of this, up to 80 percent more energy and 55 percent more water will be needed globally by 2050.

In Asia, wheat and corn yields have already reached a plateau and are now decreasing by 2 percent a decade. Meanwhile, water consumption has risen at twice the rate of population growth for the past 100 years. By 2025, 1.8 billion people will live in regions with absolute water scarcity.

"If the rest of the world was able to achieve similar yields to those currently achieved in for instance the Netherlands and the U.S., we would be able to feed 9.3 billion people, but at what environmental cost? More is needed to create a sustainable future for the AgriFood industry and the world as well."
Peter Hoijtink, Strategy&

Climate change will significantly affect the global food system. For example, rising water temperatures will reduce yields of countries dependent on fishing by 40 percent by 2050. Climate change will impact agricultural yields, food prices, supply reliability, food quality, and food safety. Gradual climate change, combined with weather shocks, will impact yields and change the usual functioning of supply chains. These factors will also make large swathes of previously arable land dry and unsuitable for crops, creating pressure on the amount of agricultural land available. This will be particularly pronounced in African and equatorial countries. Developed countries will not escape this impact. Even in traditionally milder climates, weather extremes will cause more harvests to be wasted; witness the recent greenhouse-destroying hail storms in the southern Netherlands.

"Evidence suggests that the risk of a 1-in-100 year production shock from extreme weather could increase to a 1-in-30 year or more in the next few decades."
UK-US Taskforce on Extreme Weather and Global Food System Resilience

All of this will impact food supply and price. Conversely, global warming is proving to be a boon for some farmers. Thawing permafrost in Canada and Russia may create new arable land. Higher temperatures in northern Europe are actually increasing yields in some cases.

"A change of climate will undoubtedly cause damaging weather extremes, but a warmer and sufficiently humid climate may also increase the potential of land area available for overall productive dairying in regions with actually too severe continental climate conditions."
Milcobel

Can technology reduce the effects of climate change?

The picture is not uniformly bleak, however. Technological advances in seeds, fertilisers, and animal feed, as well as in farms and greenhouses, have increased the yield per hectare, while reducing energy and water use. HPP1, PEF2, and cold plasma have extended shelf life, while nanofiltering has increased the yield of fermentation. This is only the start of what promises to be a new Green Revolution. For the first time, smart breeding, genome editing and genetic modification – still a very sensitive topic in the European Union – are being adapted to tropical crops and may even be able to produce drought- and heat-resistant crops that mitigate the effects of global warming. Yield-boosting microbes are being cultivated as natural fertilisers to replace traditional chemical fertilisers.

As extreme weather conditions prevail, farmers, insurance companies, and governments need to be prepared for wasted harvests. Rather than compensating affected farmers, governments may subsidise insurance.

In the Netherlands, the number of farmers using subsidies for weather insurance doubled between 2010 and 2015, to almost 1,200.

[4] Megatrends impacting the Dutch agrifood industry: Towards a cleaner, healthier, safer, fairer, smarter and stronger sector (May 2014) and Megatrends impacting the European agrifood industry: A brief look at business issues (January 2015).

"A dichotomy is arising between high-tech food and organic food."
Gerd Bovensiepen, PwC

The role of tech in yield management is already significant and it is set to grow further. Big data is set to play a big role in valorising scientific knowledge. Smart farming is a growing phenomenon, making use of live data-monitoring, hydroponics, and computer-controlled sowing, watering, fertilising, and harvesting. An entire industry is booming in what has come to be known as Agtech. Drones, satellites, and light aircraft are being deployed to survey farms from above and collect data to be processed.

"Robots will be a part of our industry."
BayWa

The use of tech promises to revolutionise the way we think about agriculture, as well as to create huge new disruptions and opportunities. This promises not only to boost farmers' profits on high-value crops in the short term, but possibly to save water, increase yields, and make more of the world's surface "arable" in the long term – even cities (see inset).

"Robotics is changing the nature of farming." ***ForFarmers***

Global consumer demand is changing

The world's population is set to grow from 7.3 billion in 2015 to 8.5 billion in 2030 and to 9.7 billion by 2050. Together, the countries in Asia and Africa are expected to add over 6 million people a year to the global population. Not only is the global population growing, its composition, social structures, and habits are changing as well.

Traditional family structures and roles are changing and households are becoming smaller. The effect on food consumption is significant. Families have fewer communal meals, and the demand for convenience and takeout food is increasing.

"Social change is happening: family structures, traditional food rituals, but also the labour market and leisure time are changing." ***The Federation of German Food and Drink Industries***

The elderly population, defined as those aged sixty and older, is expected to grow from 670 million in 2005, to 2 billion by 2050, representing a change from

Farms are starting to spring up in unexpected places. Growing Underground is just one of a new generation of urban farms tackling the urban environment. Growing Underground is located in a World War II-era bomb shelters beneath Clapham, south London. Light is provided by LEDs tuned so that the light that they emit is optimal for the plants' photosynthesis. Twenty types of salad plant are grown in this artificial urban environment – intended for London's chefs and sandwich shops.

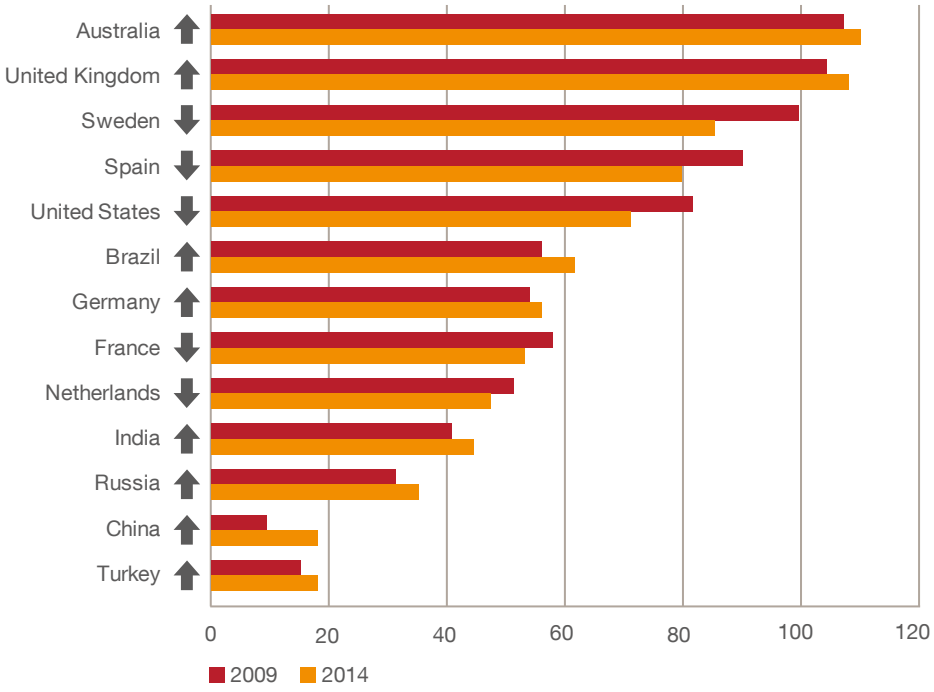
In The Hague, UrbanFarmers built a rooftop farm of 1,200 m^2 and a fish pond of 370 m^2 on top of an old factory. According to UrbanFarmers Benelux, this is the largest commercial urban rooftop facility in Europe. The farm will produce 50 tonnes of fresh vegetables and 20 tonnes of fresh fish every year.

Three common imperatives are driving future investments across agribusiness markets

Farmers that deliver profitability across all three imperatives will likely expand their acreage and become enterprise agribusiness leaders in their markets.

Source: AgTech Insight and PwC Analysis

Milk consumption (liters per capita)



Source: International Dairy Federation and Statistics Canada

10 percent to 22 percent of the global population. This effect is currently most pronounced in the West, but is expected to follow on a global scale. Elderly consumers spend less and spend differently, on smaller packages and private label goods for instance. They represent the wealthiest consumer group in many countries and continents, making their spending habits increasingly relevant.

"Middle-aged people have an increasing focus on healthy food, and this will only grow in the next five to ten years."
Iglo Netherlands

In the emerging world, the size of the middle class is undergoing a seismic shift, with a pronounced effect on diets. In the Asia Pacific region alone, the middle class is set to rise from 525 million in 2009 to 3.2 billion by 2030. This middle-class boom has increased the disposable income of families in emerging economies, and brought with it a change in tastes. As disposable income increases in middle-income families, they tend to spend more of it on wheat, meat, milk, convenience food, and soft drinks, as they adopt Western eating habits. The trend is most striking in China, where milk consumption jumped from approximately 9 litres per capita annually in 2009 to 18 litres in 2014. The trend will grow as the Indian population introduces poultry and eggs into its diet, moving away from a vegan and vegetarian lifestyle.

"In the past few years, Asian players have been buying large volumes of wines from exclusive and popular chateaus. Competition for these exclusive and popular wines is increasing globally."
Sligro

Digitally connected millennials, concerned for the future of their planet and spurred by NGOs and retailers, are seeking sustainably, locally sourced, or ethically traded foods. They are leading a growing trend: in a survey conducted by BBMG, 66 percent of respondents said that they "feel a sense of responsibility" to society, and 65 percent said they felt a responsibility to purchase products that are good for the environment and society. This trend is not exclusive to the West. In fact, 82 percent of respondents in developing markets also felt this responsibility. Furthermore, a recent Nielsen poll suggests that sustainably sourced ingredients are most important to consumers in Asia-Pacific and Latin America, with 43 percent of respondents in each region stating that sustainably sourced ingredients are "very important."

"Sustainability is a trend driven not only by government regulations, but also by NGOs, and especially by consumers."
Dr. Oetker

"Organic could become mainstream, but this will take a generation (say 12 to 20 years)." ***Iglo Netherlands***

Another major factor influencing food choices is consumer perception surrounding the food chain. In the past few years, several food scandals revealed major flaws in the traceability of the food supply chain that have impacted consumer trust. Consumers expect governments and companies themselves to improve the way food companies are governed. Consumers are increasingly expecting their brands to do the right thing and are holding food companies primarily responsible for transparency throughout their supply chain. Such transparency is relevant to many aspects of the supply chain, including health and safety, impact on the environment, and livestock well-being. Traceability, following the farm-to-fork paradigm, is the key to enhancing food safety standards.[5]

"You need to have a lead in credibility and trust."
Emsland Group

"The factors credibility, trustworthiness and reliability will play a stronger role in the food business in the future."
Dr. Oetker

Chinese consumers buy directly in the Netherlands
Recently, Chinese e-commerce platform Alibaba announced a collaboration with Dutch webshop *Hollandbuy*. Chinese consumers can buy food products directly from Dutch food producers and have it home-delivered.

[5] For more information on the issues raised by Food Trust and Food Security see PwC's Food Supply Integrity services.

4. Four scenarios for the future

Based on the interviews and desk research we conducted, two uncertainties will have the greatest impact on the extent of change in our scenarios for the future: can technology solve the problems that are caused by climate change and resource scarcity, and how will global consumer demand change over the next ten years?

These uncertainties can be plotted at the extreme ends of a vertical continuum. At one end, we see AgriFood companies harnessing tech to overcome climate change and resource scarcity. At the other, we see that tech alone cannot solve the problems caused by climate change and resource scarcity, and that other solutions are needed to secure food supply. There will be major crop relocations and agricultural supply chain disruptions.

The horizontal continuum follows the current trend of changing consumer food preferences. At one end of the continuum, the consumer focuses on a high-calorie, meat-, grain-, and dairy-rich Western diet with mass-produced food at cheap prices. At the other, fully differentiated food desires become mainstream across the world, including sustainably sourced, environmentally and animal friendly, fairly traded, organic, and healthy food. To fully differentiate these scenarios, each adapts an extreme end of the continuum for each variable.

Taking the implications of these uncertainties to their logical conclusions, the two continuums create two axes, creating a matrix of four scenarios. We consider these four plausible future scenarios in order to explore what the AgriFood industry might look like in the future.

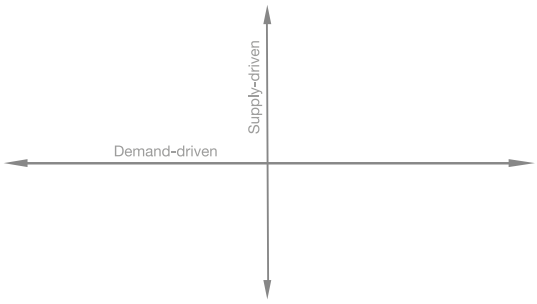
It is worth taking a moment to define what "sustainable sourcing" means in this context. Sustainability is a broad and ever-evolving concept. Here, it is viewed through the prism of consumer demand. Consumers' desires are diverse and include food and farming that: is ethical and based on the principles of fair trade, promotes biodiversity, does not deplete fish populations/forests etc., produces low carbon emissions, is environmentally friendly, leaves a small ecological footprint, and promotes animal welfare and/or organic food production.

AgriFood companies harness tech to overcome climate change and resource scarcity challenges

AgriFood companies overcome the power of nature. Farms become more like factories, optimising every input. Technology enables farming to become less resource-heavy. Farms become less reliant on water, manpower, fertiliser, and even "arable" land. Productivity yields continue to increase, overcoming yield plateaus and spurring a new Green Revolution.

Current Western eating habits spread across the planet

The consumer focus is on ample food at cheap prices. The traditional Western diet is adopted globally, resulting in increasing meat and high-calorie food and drink intake. The trend towards biological and health food comes to very little and is seen as a passing fad.



Individualised and sustainably sourced food becomes mainstream

Consumers increasingly look to differentiate through their diets. Around the globe, consumers demand food that is sustainably sourced, organic, and healthy. Foods from different regions are valued and appellations are desirable. Every aspect of the supply chain is scrutinised.

Climate change has a significant impact on the AgriFood industry

A changing climate and resource scarcity mean that crops can no longer grow where they once did. Crop relocations, major disruption in supply chains, and high price volatility follow. The increasing pressure of supporting a growing population lead to food scarcity.

The scenarios

Scenario 1: Food for all

This scenario is one of abundance. Farmers and food processing companies have adopted technology to increase yields and streamline production processes. Precision farming has become mainstream globally, increasing yields not only in the West, but also in emerging countries. GMOs lead to better-quality seeds, higher germination rates, and sturdier crops. Countries formerly considered to be unsuitable for certain crops now grow them in abundance. Food is cheap and plentiful. Production yields continue to rise. A new "Green Revolution" dwarfs its predecessor.

As food is cheap and plentiful, the Western diet, with its focus on meat, grain, milk, and soft drinks, is adopted globally. Consumers begin to treat food akin to a common good. Consumers stick to traditional brands that they have grown up with and trust. The benefits of globalisation are appreciated by all. Internationally, legislation is harmonised to facilitate agricultural trade. Barriers between nations are whittled away and free trade reigns supreme. Competition amongst retailers drives prices ever lower and prices for growers diminish.

"When you open the fridge today and take a picture of its contents, it doesn't look much different from a fridge from 40 years ago. People have strong relationships and trust with specific brands they grew up with." ***The Federation of German Food and Drink Industries***

AgriFood companies can achieve lower prices through scale. There is an unprecedented spate of acquisitions driving consolidation in the industry. Vertical integration is creating efficiencies in increasingly complex supply chains. The resulting multinationals will control supply chains, and will be able to steer global food demand.

Big data can be better produced and put to use by a few ubiquitous food giants. Proprietary Agtech breakthroughs are achieved by well-funded research departments or acquired by those with the deepest pockets. Established brands command consumer loyalty and advertise to increase brand equity.

The Indian population traditionally has a vegetarian and vegan lifestyle. Lately the Indian population has been increasing poultry and egg consumption. But what if Indians were to increase their egg consumption to German levels?

Germans ate 232 eggs per capita in 2014. Indians ate 62 per capita per year. On a population of 1,271 million people, you would need 697 million additional hens to accommodate the Indian population.

"The battle for the consumer gets more intense. Share of stomach and share of wallet are becoming equally important. Some consumers shift to less and more healthy food and will spend less on indulgence food. When consumers do choose indulgence food, taste and quality will prevail." ***Continental Bakeries***

Winners must be highly efficient and improve production; scale will be key. The import and export markets will be huge.

Some countries will prove more adept than others in this scenario. The coffee industry in Colombia will not survive, for instance, once it has to compete directly with Brazil due to the marginal cost of coffee production being higher on Colombia's hilly plantations than on Brazil's flat plains.

Scenario 2: Leading the diversified field

In this scenario, the healthy and sustainable sourcing food trends grow as the millennial generation's disposable income increases. Their influence also spreads and healthy and sustainable sourcing criteria become mainstream. This is driven by the rise of social media and improved transparency. Consumers use their smart devices to assess calorie content and the sourcing of their food. Consumers in emerging countries adopt the same criteria as they become increasingly aware of the burden on the climate and their own well-being.

"Consumers already use apps to scan products in supermarkets and check company policies about social responsibility and sustainability. This trend will continue, and will become a key differentiator for food producers." ***Peter Vermeire, PwC***

AgriFood companies utilise new technology to bring healthy, organic foods to the masses and use technology to construct complex global supply chains which deliver plentiful food in an eco-friendly manner. Indoor farming plays a significant role in this, using no pesticides and little fertiliser and water to grow fruit and vegetables locally for consumers in urban environments. The shortage of arable land is no longer a constraint. Data-based farm management systems can be implemented easily and on a small scale. Farm management software proliferates. Tech becomes cheap as start-up suppliers compete. Uber-like platforms are used for sharing farm assets, as well as for matching crop supply and demand. Barriers to entering niche production farming are very low.

In 2014, China was already the country with the fourth-largest area of organic agricultural land. In China, 1.9 million hectares, or 0.4 percent of total agricultural land, is used for organic agriculture. Between 2011 and 2014, the growth percentage (CAGR) was 0.44%. If China were to retain this moderate pace, they would have added over 95,000 hectares of organic agricultural land - or 130,000 soccer pitches – by 2025.

Source: FIBL and IFOAM, PwC Analysis

Moreover, consumer preference favours a focus on market niches. Consumers demand differentiated products as they increasingly define themselves by the way they eat in an idealogicalisation of nutrition. Some favour animal welfare or fair trade, others health and nutritional properties, and still others regional appellations or locally grown food. They are happy to spend a little more on products that suit their preferences.

New niche players develop to cater to different tastes. There is a wide spectrum of large and smaller players in a relatively more fragmented industry than in the Food for all scenario. More and more consumer demand will be met by local producers that can meet sustainable sourcing and transparency criteria, as well as cater to the multifarious tastes of different consumer groups. Food will travel further in the case of demand for regional appellations.

Internationally, legislation on sustainability, food safety, and animal welfare is harmonised to facilitate trade. Both consumers and retailers will demand even stricter procedures, and food producers and processing companies will comply, with management and staff intrinsically driven to play their part. As technology is incorporated into every aspect of the supply chain, sourcing is very transparent. Consumer trust in AgriFood reaches an all-time high.

"Consumers and retailers have driven the animal well-being and healthier food agendas. This will lead to an expansion of food offerings in niche segments, such as more organic food." ***ForFarmers***

Consumers recognise the efforts made to grow and produce sustainable, healthy or regional food and are willing to pay for this effort. Prices will rise slightly, as will margins throughout the supply chain. Winners must have quality supply relationships, access to consumer data and tailored nutritional offers. Small, agile players will be successful, as will larger players with multiple supply chains. Social compliance and transparency throughout the supply chain will be key. Vertical integration may be a way of achieving this. Sustainable sourcing by larger players may be achieved by different transportation methods (train instead of truck) and smart packaging. Technology, packaging, and delivery medium can contribute to minimising food waste. Innovation with consumer preference in mind will be a dominant strategy. AgriFood companies throughout the value chain will learn to interact, listen to, and create a dialogue with consumers. The winning companies will be those that create social impact and value and explain their complex value chain in a simple answer.

"Information about the consumer is the gold of the future. The access to data will be relevant to everyone." ***Dr. Oetker***

Linking back to our coffee example, Colombia will be able to compete with Brazil in this scenario through the differentiation of its product. It may be that a Colombian appellation is more sought after than Brazilian, or that Colombian coffee growers are given a fairer trade deal, or even that Colombia is closer to the place of consumption, boosting its environmental credentials.

Scenario 3: Two-tier production

In some parts of the world, arable land has become too dry or the weather too unstable to grow crops successfully in certain areas. There is large-scale disruption in agricultural production which causes considerable uncertainty. As climate change and resource scarcity impacts the global food supply, food prices rise. Land is at a premium and food shortages are common. GMO crops remain controversial, but are being produced out of necessity. Price volatility reigns and trading becomes high-value, while hedging and arbitration become essential to players up and down the value chain. Nimble players mobilise major crop relocation to adjust to natural resource conditions and continue to provide output.

Interest in organic, sustainably sourced, and healthy foods is high, spurred by millennials globally. However, as prices rise, many turn to less sustainable or healthy food. Niche players provide the sustainably sourced and healthy food for those that can afford it. "Grow your own" solutions are in high demand. Cities become "agri" hubs with rooftop gardens to supply locally produced organic food.

"Technological developments like 3D food printing and supercells – a specific type of refrigerator – for growing vegetables will definitely make a difference. You won't even need soil to grow food." ***Florensis***

Microproduction will predominate to meet the high demand for differentiated goods. Platforms to upload food and meals will allow smaller players to supply home-grown and home-delivered organic food to affluent consumers. Affordability will be key to meeting the needs of consumers who cannot afford differentiated goods. Scale and flexibility will be the only way to achieve this, to improve bargaining power and overcome supply chain disruptions. A two-tier food supply will evolve. One part of the population will be able to afford sustainable, healthy, organic food. For others, food will become basic.

The AgriFood industry will be highly differentiated, with several large multinationals and many niche and local players. Winners must be able to mobilise their operations quickly to take advantage of the changing climate and growing conditions, in effect shifting their supply chains geographically. They must be

How many indoor farms are required to feed the cities of Amsterdam and Berlin?

The self-sufficiency ratio of cities is low for staples such as dairy, vegetables, eggs, and especially fruits and meats. A recent newspaper article stated that an indoor farm of 9,300 m2 with 37 floors of plant racks would be able to produce 10.4 kg/m2 of vegetables a year. If every inhabitant of Amsterdam were to eat 200 grams of vegetables a day, as the WHO advises, this would amount to 73 kg vegetables a year for each inhabitant. If that were so, you would need 634 indoor farms to feed all the inhabitants of Amsterdam, and 2,661 indoor farms to feed all the inhabitants of Berlin.

While urban farming may provide a partial answer, more sustainable solutions for logistics will need to be developed and deployed in order to connect cities and their corresponding food-production sites.

Amsterdam-based Foodlogica provides container storage facilities for food producers around the outskirts of the city, where bike couriers on e-trike cargo boxes pick up food and deliver it to consumers.

Source: NRC Next, PwC Analysis

open to collaboration, as production will be very localised and fragmented. For larger players, diversification in multiple supply chains and sourcing will be key. Tech platforms can be used to match local supply and demand. They will also need to be flexible in their ability to change locations and adapt raw ingredients or end-products.

"Will Uber step into food delivery and cut out the middleman?" Jan Willem Velthuijsen, PwC

In this scenario, Brazil might be producing coffee on an industrial scale for those who cannot afford Colombian coffee, while Colombia might be producing sustainably sourced, high-quality coffee for the affluent. Neither source would be meeting demand.

Scenario 4: Renationalisation

Technology cannot compensate for decreasing yields due to climate change, so food supply becomes highly volatile. Competition for resources and food increases as the majority of the population demands high-protein and high-calorie food. Demand for organic, sustainable, and healthy food is low, due to extremely high prices. Food is expensive and sometimes of poor quality. Consumers will face severe supply shortages and price fluctuations. The key for them is affordability. Increasingly, food shortages and demand for cheap food will cause political unrest, as consumers demand, and politicians promise, food security. Feeding the population becomes a public service and food is used as a political tool. Food producers in many poorer states become state-owned or quasi-state-owned enterprises. Increasingly, (semi) state owned companies will claim their role in the global food value chain. State-controlled food companies will consolidate. Meanwhile, mass migration will put pressure on wealthier states.

In those states where the government does not become a major stakeholder, control of the food supply is concentrated in the hands of a few powerful conglomerates where economies of scale and the ability to adapt to changing environmental pressures are key. Food insecurity drives regulation and protectionist policies across the board in the form of import restrictions and duties. Governments' top priority is the cheapest possible food and they impose export duties. Food producers need to partner or pull out of some markets to survive in an unfair playing field.

Brazil recently surpassed the EU as one of the world's largest meat exporters and is now second only to the U.S. But what if… Brazil were to adopt a strategy of self-sufficiency and were to diversify its production to focus more on potatoes and vegetables and much less on soy and beef? And what would that mean for the Middle East?

Winners must be able to achieve scale. They must secure government contracts or collaborate with government departments where necessary. They must develop their political lobbies. Government assistance may also help bridging financing gaps in case of displacement from certain markets due to crop or market failures.

In this scenario, we see Brazilian coffee being consumed to a significant extent in Brazil, and Colombian coffee being consumed in Colombia.

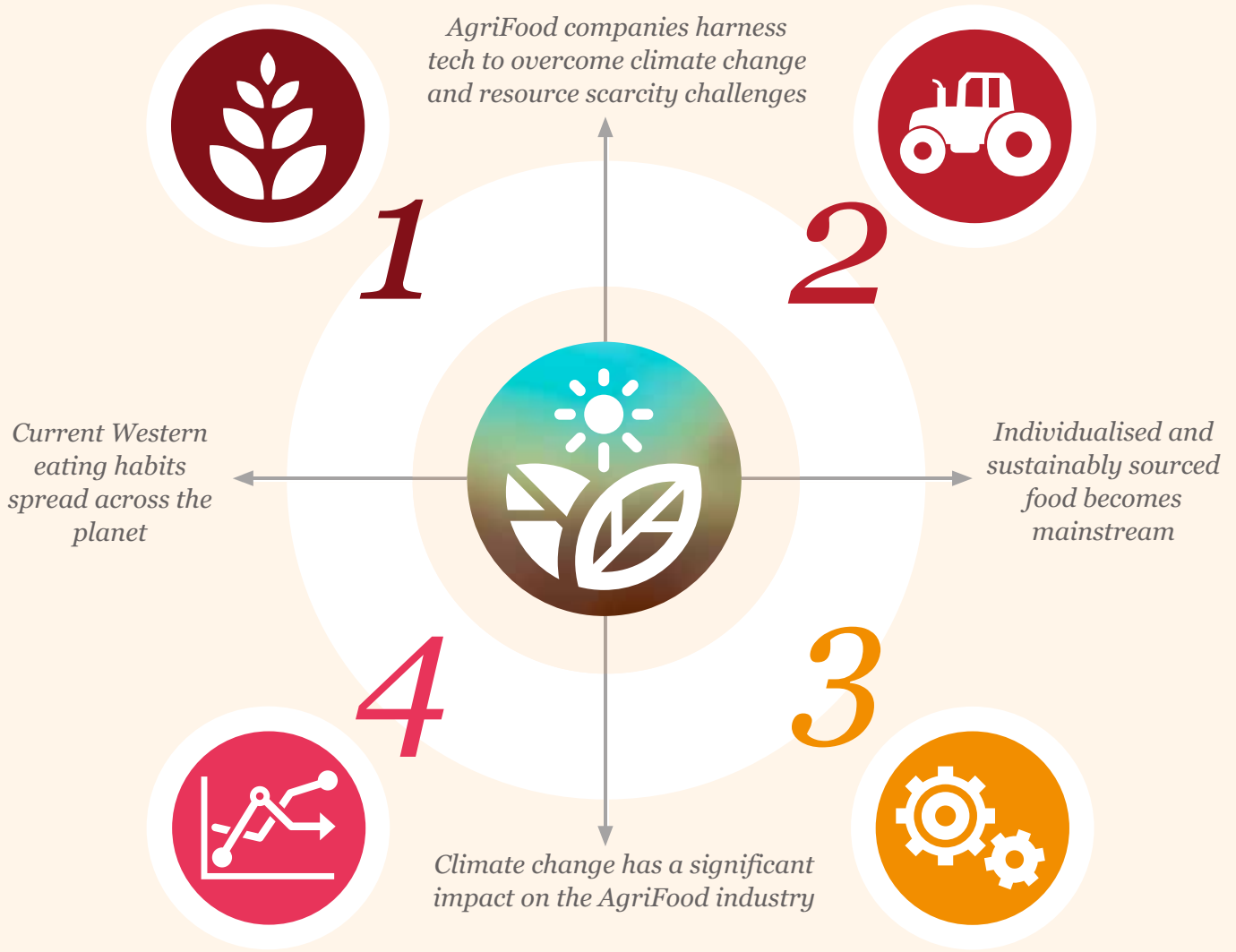
The four scenarios for the future

1. Food for all

Western diet of meat, grain, milk, and soft drinks is adopted globally. Agtech, GMOs, precision and smart farming increase yields and enable mass production, in both developed and emerging countries. Increasing yields provide the global population with plentiful food. Abundance decreases food prices.

2. Leading the diversified field

Organic, sustainably sourced, healthy foods gain market share, spurred by retailers and millennials globally. AgriFood companies utilise new technologies such as smart and indoor farming to produce sufficient organic, sustainable, healthy foods to feed the global population.



4. Renationalisation

Western diet of meat, grain, milk and soft drinks is adopted globally. As climate change and resource scarcity impacts the global food supply, fluctuations in food supply and reduced food quality prevail. Food prices rise and food shortages are imminent. Countries will try to secure food supply.

3. Two-tier production

Demand for organic, sustainably sourced, healthy foods rises, spurred by millennials globally. As climate change and resource scarcity impacts the global food supply, food prices rise. Those who can afford it buy healthy food from local sources, niche players and “grow your own” solutions. For everyone else, food becomes more basic.

5. What do these scenarios mean for your organisation?

We now discuss the four possible future scenarios outlined in the previous chapter and how they might impact several sectors in the AgriFood industry: traders, feed suppliers, dairy companies, and food processing companies.

Agricultural commodity traders

Agricultural commodity traders use their networks and assets to identify, at an early stage, where agricultural production is booming and cheap, and where demand will rise. Commodity traders thrive in times of high price volatility. When we look at the four possible future scenarios, we see that the impact of each of them on agricultural commodity traders varies. Both the *Food for all* and the *Leading the diversified field* scenarios would prove challenging for commodity traders. As Agtech thrives and becomes mainstream, data on crop quality and yield estimates becomes freely available. The lead in knowledge that traders used to have will disappear; they may even be replaced by supercomputers that can forecast supply and match demand automatically.

In times of abundance, as is the case in the *Food for all* and the *Leading the diversified field* scenarios, margins for commodity traders would be under pressure. In the *Food for all* scenario, the means of food production and distribution would be consolidated and vertically integrated, so there would be little room left for traders. Their strategy in this scenario should be to become a part of that vertical integration and bring their assets to bear up and down the value chain. In the *Leading the diversified field* scenario, commodity traders would be able to find niches in consumer demand to derive higher margins. As sustainably sourced food becomes mainstream globally, commodity traders would also need to invest in contacts and contracts with new, more specialised suppliers and producers. In the *Two-tier production* scenario, matching oversupply and shortages would generate significant yields for traders. In the *Renationalisation* scenario, however, despite a great deal of potential for their services, traders may be inhibited by regulation and import/export restrictions, making their activities more localised, or they may be made redundant by vertically integrated conglomerates or state corporations.

"It is crucial to have a strategy of adaptation and diversification to be resistant to volatility and to do business sustainably." ***BayWa***

In all scenarios, they would need to be agile and innovative to be able to match both supply (know where to source) and demand (know what and where to sell). In all scenarios, competition would change. Traders would be likely to diversify: more large multinational traders, more small and specialised or local ones.

"You'll have to integrate methodologies of disruptions within the company, like start-up thinking and Canvas. Be flexible, be agile due to demand." ***AGRAVIS***

Feed suppliers

Feed suppliers process grain, soy, and protein into animal feed. Feed suppliers would thrive in the *Food for all* scenario where agricultural commodities are abundant and the Western diet is widely adopted. Cheap soybeans, grain, and different types of meal will reduce their production prices and increase their margins, especially as demand for meat rises. However, in both the *Leading the diversified field* and the *Two-tier production* scenarios, where sustainably sourced food has become more mainstream, the demand for beef and pork will probably stagnate in the West. As individuals become more concerned about the strain that pork and beef production puts on the environment, they will change their diets towards more environmentally friendly sources of protein, such as chicken, fish, beans, vegetarian meat substitutes, or even insects. Feed companies will have to adjust their products and service offerings to changing consumer demand. On top of that, the origin and traceability of the commodities used will be very important. This could lead to higher costs for feed producers, thus impacting their margins.

The *Renationalisation* scenario will have the biggest impact on feed companies. As food supply and quality decrease due to climate change, governments will choose food over feed. New regulations limiting grains used for feed will be implemented. Trade restrictions will be introduced as governments protect their supply and production.

Dairy companies

For dairy companies, the impact of the various scenarios would vary greatly depending on which type of player we consider: cooperatives or non-cooperatives. Non-cooperatives may benefit from the *Food for all* and the *Leading the diversified field* scenarios, due to the low cost of milk and their marketing and innovation capabilities. Their margins will increase.

Cooperatives, however, benefit most by valorising milk. Abundance and low raw milk prices would drive dairy cooperatives towards diversification. More of the value add from processing the milk would accrue to them as they differentiate or expand their global presence. As consumer preferences vary around the world, a larger global footprint would mean a larger portfolio with more varied products.

However, many dairy cooperatives already have a large product portfolio. More differentiation might lead to lower prices by suppliers, as they buy smaller volumes. Differentiation would also decrease equipment effectiveness and increase marketing and overhead costs. Dairy cooperatives need to increase synergy and reduce complexity in their products, for example, in ingredients and packaging.

"One of our global dairy clients produced so many different products, we collected them all and built a wall 25 meters long and 3 meters high, just to see the complexity of their products."
Reinhard Vocke, Strategy&

In the *Food for all scenario*, the larger cooperatives would gain market power with a strategy of acquisition and consolidation. The L*eading the diversified field* and the *Two-tier production* scenarios may call the sustainability of dairy farming into question; however, cows' production of manure and use of space may raise concerns that milk and dairy products such as cheese are not sustainable enough. The *Two-tier production* scenario, in particular, would prove challenging for large dairy cooperatives. In this scenario, land and feed for dairy farms would be expensive, impacting the price of milk. As demand would be high, some farmers might opt to "cut out the middleman" – in this case dairy cooperatives – and supply local consumers directly to gain higher profit margins. This might impact dairy companies' cooperative nature and business model. Investing in innovation will be key for dairy companies facing this scenario. Differentiation and significant value add will become crucial in order to demand a significant premium from consumers.

The *Renationalisation* scenario would be challenging for multinational dairy companies. As protectionist policies and legislation proliferate, many regulatory limits would be imposed on dairy companies. As trade barriers are erected and quotas imposed, the dairy trade would become yet more difficult. The agility to adapt to government requirements and scale, through consolidation, in order to be able to create a state lobby would be necessary capabilities. Larger dairy multinationals could also improve their bargaining power in their dealings with retailers, shifting the balance of power to their advantage.

Food processing companies

In the *Food for all* and the *Leading the diversified field* scenarios, food would be relatively cheap and abundant. In the Food for all scenario, given the lack of consumer demand for differentiation, food processing companies would benefit from expanding their markets and upgrading their production facilities to meet increased global demand. There would be consolidation and greater collaboration with retailers on a pan-European or global level. They would also attempt to get closer to consumers with a move towards e-marketing and using social media to create brands. They would leverage food delivery companies.

In the *Leading the diversified field* scenario, catering to what consumers value most would be key. By tailoring their offerings to the tastes of specific target audiences, such as by creating foods with health benefits and differentiated nutritional value, food processing companies would be able to gain market share. In this scenario, supply chains may shorten through vertical integration and deliberate sourcing, due to the need for increased sustainability and traceability.

"Players that have multiple supply chains to soften any risks will be successful." ***Lamb Weston Meijer***

A similar strategy would also pay dividends in the *Two-tier production* scenario, although this would be the most complex scenario for food processing companies. In this scenario, there would be many small, local players offering locally produced, sustainably sourced, or healthy food to those consumers who could afford it. However such small, local companies could not meet the demand for large amounts of consistent food products that food processing companies require. For people less inclined to pay a premium, more generic but still sustainably sourced products would be available. Private label food processing companies would have an advantage, as they would be able to meet organic demand at lower costs than "brand players".

"Making one really good cookie isn't difficult. Making 2 billion cookies a year with the same consistent quality is." ***Continental Bakeries***

Other

Other players in the value chain, such as farmers and aquaculture companies, would have the most to gain individually in all but the *Food for all* scenario. In that scenario, food prices would be very low and only those who could achieve scale

and be innovators or early adopters of technology would survive. In the *Leading the diversified field* scenario, yields would soar through the use of Agtech. People would be willing to pay a premium for organic and sustainably sourced products so smaller farmers who took the risk of investing would thrive. Who would be able to benefit most from this would depend not only on the bargaining power of farmers, aggregators, and retailers, but also on who could realise and capture the greatest differentiating value add to the consumer. In the *Renationalisation* and *Two-tier production* scenarios, farmers and aquaculture companies who could secure and maintain arable land would profit from higher margins due to scarcity. Farmers should invest in silos to store crops in high-yield years to regulate supply and capture more of the value created by fluctuations and scarcity for themselves.

"Creative chameleons will be winners." ***Florensis***

	Agricultural commodity traders	Feed suppliers	Dairy companies	Food processing companies	Farmers and other companies
Food for all	👎	👍	👍	👍	✊
Leading the diversified field	✊	✊	👍	👍	👍
Two-tier production	👍	👎	✊	✊	👍
Renationalisation	👎	👎	✊	✊	👍

6. A capabilities-driven strategy

In a rapidly changing world, full of uncertainty, AgriFood companies face great challenges and also great opportunities. Could AgriFood companies survive and thrive in the future scenarios we have described? AgriFood companies will need a coherent strategy that aligns external market positioning and internal capabilities.

Companies have developed into what they are today with certain distinct capabilities: the ability to reliably and consistently deliver a distinctive outcome, relevant to a company's business, through the right combination of processes, tools, knowledge, skills, and organization. But will these capabilities still be the ones that will bring success in the future?

To create a coherent, future-proof strategy, three interlocking elements need to be aligned. First of all, choose a way to face the market and create value for your customers. What is your **way to play**? Especially in the *Leading the diversified field* and *Two-tier production* scenarios differentiation is crucial for success.

Once companies have defined their way to play, they should focus only on the **capabilities** that enable them to deliver on this. For instance the application of new technologies in a fast and efficient way will be important for many aggregators and traders to remain relevant in a market where data becomes commoditised.

To be able to thrive, companies will need to create coherence between their capabilities system and the way they operate. **Product and/or service fit** will be key to achieving coherence. These are the most tangible elements of what a company does. For example, how will animal feed providers combine even more services towards their customers with their current product portfolio in order to prevent margin pressures as farmers become increasingly advanced?

"The winning companies will be the ones that can provide a simple answer that explains a complicated world. The company that will give the consumer certainty in its products." ***The Federation of German Food and Drink Industries***

With so much uncertainty in the AgriFood industry's future, AgriFood companies at every level need to build coherence in order to get ahead of the trend and define their industry. Especially in the AgriFood industry where trust and confidence towards larger corporates is low, AgriFood companies need to be clear and coherent in their message to customers and consumers. They need to be transparent about production and products, and how they influence consumer demand. This distinctive capability is required in several scenarios.

We have taken a broad view in this paper, providing hints on some ways the AgriFood industry might develop, but you will want to consider the detailed implications for your specific business and operating model. Going forward, we will reflect further on how these scenarios may play out differently around the world as well as up, down, and across the value chain.

"As many AgriFood companies have changed their processes towards more sustainable production, the new generation C-suite feels more comfortable explaining their company's policy on food to their kids." ***FNLI***

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Databases
European Commission - Eurostat
International Dairy Federation and Statistics Canada
OECD - OECD.Stat
CBS - Statline
Worldbank - World Databank

Sources
AgTech Insight (2016) AgTech Market map. http://www.agtechinsight.com/.
BBMG et. al. (2012) Re:Thinking consumption: Consumers and the Future of Sustainability
BCG (2012) Millennial passions
Economist, The (2016) Special on AgriFood
Euromonitor (2016) Eco worriers global green behaviour
European Commission (2016) Annual Agri-food trade report 2015
European Commission (2016) The competitive position of the European food and drink industry
European Commission (2015) You are part of the food chain: Key facts and figures on the food supply chain in the European Union.
European Commission (2015) Price developments and links to food security - price level and volatility
Edelman (2016) Trust Barometer 2015.
FIBL and IFOAM (2016) The world of organic agriculture
FOA (2016) Agricultural Outlook 2016-2025
Nielsen (2015) We are what we eat: healthy eating trends around the world
NRC Next (2016) Sla en kersen uit de fabriek, 30 July 2016
PwC (2016) Clarity from above
PwC (2016) Understanding the AgTech Ecosystem
Royal Society (2010) Possible changes to arable crop yields by 2050
United Nations (2015) World population prospects: 2015 revision
USDA Foreign Agricultural services (2015) Grain report: Poultry and Poultry Products Annual 2015
WEF (2016) Tackling global challenges

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