
FEEDING
TOMORROW'S CITIES

Stichting Metropolitane Landbouw

Metropolitan Food Security

Colofon

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FEEDING TOMMOROW'S CITIES

Life on our planet is undergoing a major transition. The global population is not only increasing at an unprecedented pace, but also all over the globe people are moving to cities. In Asia huge megacities with over 10 million inhabitants are already no exception. Similar developments can be observed in Latin America. The continent with the fastest growing population in the decades to come, Africa, is also urbanizing rapidly. And middle classes in emerging economies are growing by about ten percent annually. Together these developments are leading to an unprecedented growth in demand of food.

Urbanization creates a great number of challenges to secure a healthy living environment in the metropoles, including the provision of safe and healthy food. Smog and dust are already threatening inhabitants in a lot of cities these days and insufficient sanitation and inadequate food chains may cause outbreaks of pandemics.

These interdependent challenges constitute the subject of this book: to ensure food security in tomorrow's cities. How and where will it be produced, stored, processed and transported, without great losses in both quantity and quality?

Simultaneously, rural populations are decreasing in numbers and are aging. Harsh labour and lack of status of farming drive young people to the cities. To encounter these trends, we need a new generation of skilled agricultural entrepreneurs and modernized farming operations at an economically viable scale.

Fortunately science and technology are advancing rapidly. Agricultural and food sciences are shifting their attention from rural areas to cities. We already have ways, methods and systems to ensure healthy food security in the near and further future. But we must develop new and more sustainable agricultural practices and implement them in our societies. Wageningen UR, as one of the leading institutes in the field, is ready to share its insights.

I hope this book will contribute to the awareness of the great importance of the issue of how to feed tomorrows cities.

Prof. dr. ir. Louise O. Fresco,
President of Wageningen UR

Citizens, companies and research institutes worldwide have to find action perspectives concerning two major trends: urbanization and climate change. On a global level, the Netherlands play a leading role in the areas of food, water technology and energy. Through international entrepreneurship, an open and innovative economy and the natural position as 'gateway to Europe', the Netherlands have been able to maintain and improve this position.

In the South Holland region, leading qualities regarding food, water, energy, peace and security come together: the greenhouse horticulture in the Westland, industry and food logistics in Rotterdam, The Hague with its international role peace and justice, and educational institutions with their knowledge about nutrition, health and water.

In the coming years, Rotterdam will redevelop neighbourhoods with proven technology to solve social, economic and environmental issues. We will see totally different cityscapes with new forms of local energy and food production, lighting, water use and most importantly, neighbourhoods providing a safe, enjoyable and creative living and working environment. The economy as we know it will shift into new models, structures and meaningfulness. The value of citizen life gets a totally new dimension.

In this way, urban authorities are setting future standards for excellence, in close collaboration and sharing knowledge with citizens, inventors, artists, developers, research and knowledge institutions, companies, investors and travellers. The search for solutions to global challenges requires international collaboration, sharing knowledge and natural resources. We have to do it together.

Ahmed Aboutaleb,
Mayor of Rotterdam

CONTENTS

* = pagenumbers

ACKNOWLEDGEMENT

We have edited these pages with great pleasure. However, this would not have been possible without the contributions of more than 60 highly appreciated writers. We would like to thank them all for their enthusiasm and cooperation. The very fact that we were able to mobilize their interest in only three weeks time bears testimony to the relevance perceived of the subject-matter of this book.

We were much encouraged in our work by the early preface-contributions by Ms. Prof. Louise Fresco, President of Wageningen University and Research center and Mr. Ahmed Aboutaleb of Mayor of the City of Rotterdam.

This book provides to readers in- and outside the Netherlands a collection of thoughts on issues linked to future metropolitan food security. Contributions of some 40 companies and 6 knowledge institutions allow for an indication of available supply potential, from genetics to logistics and city planning. As such this picture inevitably represents a fleeting moment and is therefore inevitably incomplete. It is our intention to follow up on the printed edition of this book by issuing a digital version of it, early 2016. The digital version can be easily completed and periodically kept up to date. It will allow, we hope, easy access to administrators, scientists and companies alike that are confronted with the complexities of rapid urbanization and corresponding food supply.

We hope that this book will promote a perspective, a view on the entirety of the agro and food chain needed to feed tomorrow's cities and its related challenges.

The printed version of this book was made possible by the generous support of Stichting Metropolitane Landbouw.

Henk C. van Latesteijn and Ate Oostra

THE NETHERLANDS:

HISTORY AND POSITION IN AGRO AND FOOD

The history and geographical location of the Netherlands has led to a well-balanced food system.

Cooperation and co-creation are deeply rooted in Dutch history. The geographical situation of our country is part of the explanation for this attitude. The Netherlands- or Low Countries- can be seen as a densely populated smaller size state. With shifted perspective and zoomed out its appearance is that of a sprawling city, interspersed with intensively used "green". Its position in the delta of the Rhine and Meuse rivers provided good connections to both open sea and the hinterland and enabled early development of international transport and trade.

The fertile lands in the delta were also well suited for agricultural production. The combination of trade and agriculture created the country's present cityscape surrounded by a mosaic of natural habitat and areas of agricultural production.

These production regions had to deal with a growing population and with limited space. Over the years therefore an intensive and efficient type of agriculture developed. Common feature for the different disciplines involved was to aim at adding value. This enabled substantial agricultural exports; pig, veal and poultry meat, dairy products, genetic material, vegetables, flowers and potted plants. In 2014 these exports added up to over 80 billion euros.

The equipment that the system's efficiency required has in the meantime also become an export commodity by itself. In 2014 the exports of agro-related machinery - for production, preservation, processing and transportation - added up to 15 billion euros.

So, the relative disadvantage of a small size country in a risky delta region turned into a driver of agricultural success. How did this happen?

Cooperation

Since the Middle Ages the Netherlands have had to face the fact that the sea threatened large parts of the country. Regional Water Boards were set up to deal with all aspects water management. Consensus building was a prime requirement and later became known as the ‘Polder model’.

Cooperation is also paramount in the development of the Dutch agro and food system. Investments in infrastructure and education, two essential elements of modern agriculture, often are generated by public-private partnership.

A “Golden Triangle” cooperation of companies, research and government has been set up to drive knowledge creation and innovation.

Northwest European Delta

The Netherlands is part of the larger Northwest European Delta region. Apart from the cost of keeping “dry feet”, Dutch agriculture has substantially benefitted from this position. Access to open sea on one hand and to the Rhine and Meuse rivers on the other, providing links to a densely populated ‘hinterland’ put the country right at the nexus of important trade routes.

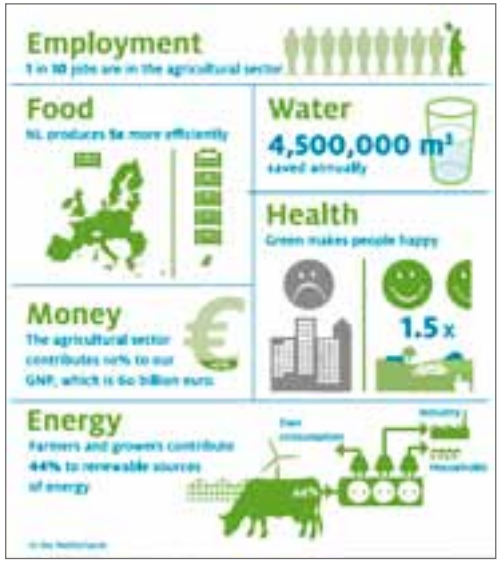
Most food related trade develops within a circle of approximately 300 km. radius. This comprises the densely populated area between London, Paris and the Ruhr region. Both the port of Rotterdam and the productive agricultural sector helped the Netherlands to a pole position in the vast Northwest European Delta region.

Continuous innovation

Since the start of modern agriculture, the Netherlands has consistently opted for an open economy. Unlike most of its neighbors it did not close its borders in the event of crisis. This choice left no alternative but to go for continuous innovation to stay ahead of the pack.

This strategy worked out well. Publicly funded research and education, combined with a willingness to share knowledge within producer organizations generated innovation leads. Healthy competition in processing and distribution made the system robust. Continuous innovation did not only lead to ‘doing things better’ but moreover to ‘doing better things’; in short to a rather unique agro and food system.

THE DEVELOPMENT OF AN AGRO AND FOOD SYSTEM



The agro and food system of the Netherlands was developed over 150 years.

The development of modern agriculture in the Netherlands started after the crisis of 1880. The European markets got flooded by imports of grain and other commodities from the New World; the effect of steamship development.
This marked the end of traditional agriculture that had lasted for several centuries.

In the Netherlands with its tradition in trade, continued open door policy combined with an additional innovation efforts were the deliberate reaction. As a trade nation the only way to keep up with global developments is trying to take or at least be part of the lead. In agriculture this led to fundamental public investments in research, education and extension.

Research, education and extension have driven the development of the system.

The foundation of an agricultural university in Wageningen and a number of schools for 'green education' at different levels helped to develop a skilled and trained agricultural workforce. An extension service (now taken over by private parties) helped to get results of field test brought into practice.

Banking helped farmers to invest in new production methods. For certain commodities (such as dairy and sugar) bottom-up cooperatives sprang up to help secure a stable supply and income for their farmer-members.

Government – and sector funded research, through field experiments in specialized institutes or otherwise, provided the basic ingredients to keep all elements of the value chain up to date.

Seeds and genetics

Plant breeding and selection are part of a long lasting tradition in the Netherlands. Already in the 17tth century, unique tulip varieties were auctioned (origin of the stock exchange system) and exported worldwide. An open innovation system based on the regulation of breeder's rights led to the development of globally operating seed companies.

Also in the livestock sector much attention has been spent on selecting favorable genetic strains in dairy cows, pigs and chickens. These entrepreneurial activities benefit fully from the collective investment in academic institutions and specific research programs aimed at understanding the process of selection and breeding.

Primary production

Given the limits of the area suitable for arable farming in the Netherlands, much attention has been paid to specialization into high value products. Most notably this can be seen in the horticulture sector. In open field horticulture and in greenhouses the main focus is on fresh fruits, vegetables and flowers. Arable farming mainly focuses on seed potatoes and animal feed. Sugar (beet) and starch (potato) remain of regional importance.

The livestock sector has developed high yielding and efficient systems that are keeping up with tightening requirements as to animal welfare and environmental constraints. Under the scrutiny of critical consumers the production systems of pigs, poultry, veal and dairy set standards for efficiency and environmental awareness worldwide.

Processing

The development of the processing industry has gone through impressive transformations during the last decades. Nowadays, a large fraction of fresh agricultural raw produce is transformed into convenience products. Vegetables and fruits are washed, sliced and packaged. Meat is cut, seasoned, cooked, grilled, smoked, and packaged in numerous ways. The processing industry takes care of all those different activities.

This has led to carefully controlled production, processing and outlet channels in which high quality food products are is being provided to consumers. As a result, the level of food safety is very high.

Value-added logistics

Trade and transport have always been prominent in the Netherlands. Agro-logistic systems see to it that primary producers receive their raw material in time, that primary produce finds its way to (secondary) processors, that distribution centers are being supplied and that shops, supermarkets and consumers receive their products fresh and with best feasible shelf life.

Together, tailored transportation, effective storage, fine-meshed distribution and responsive control see to it that the chain of raw materials, primary products, processed goods and consumer products operates without a hitch. Good standing of the chain-participants and trust among them are of cherished value.

ICT

All elements of the agricultural production chain rely on knowledge and information. Traditionally carried by agricultural craftsmen, ICT has partly taken over: allowing to capture and manage information needs and to digest responses, it enabled further professionalization.

Growth or feeding cycles in primary production get monitored with ICT systems. So do yields, in quantity and quality, and the occurrence of pests and diseases. Sophisticated systems regulate all aspects of greenhouse production. Orchestration of agro-logistics, including tracking and tracing, is only possible with the help of computers. ICT has become an integral part of the agro and food system.

Organization

Collaboration between different stakeholders is needed to manage the chain from field to fork. Producer's organizations have been active for many years. During the last decades new forms of collaboration have been set up that reflect a more demand driven and market oriented character.

In fresh produce a shift from commodities towards branded products is apparent. This calls for new modes of cooperation between producers, service providers and retailers.
And - as mentioned before - a degree of trust among chain-participants is a must; or, as a backup, at least a fast and correct dispute settlement mechanism.

More than food

The modern agro and food system is more than a chain that supplies food. Agricultural activities are part of a regional network, connect to other sectors of the economy: water management (uptake, discharge), energy (use, supply), transport (a third of lorries on our roads) and ICT to name a few. Next to that agriculture and all its related sectors are providing jobs and income for a large number of people.

Most of the green space in between the built-up area in the Netherlands still is farmland, to be managed under European (CAP) sustainability rules. Sometimes in tandem with non-governmental organizations aiming to preserve nature and biodiversity. Accordingly agricultural activities also provide cities with "breathing space" and the urban dwellers with a green environment in which they can recreate.

Dutch farmers therefore cannot be seen as purely individual economic actors, but inevitably are part of a larger whole. This point of departure marked the way in which agriculture is being developed and managed in the Netherlands. Awareness to belong to a larger system, constantly calls for consideration and for collaboration with others; it has become part of the success of Dutch agriculture.

CHALLENGES AND RESPONSES

Several global trends are heavily influencing the developments in the agro and food sector. The effects of these trends are complex, since most also influence each other. A good understanding of them as they present themselves today, is essential for an assessment of the potential of the agro and food sector in the future.

In the next chapter several authors describe the current state of affairs. Some look ahead, some even far. The overview shows that the challenges for the agro and food sector are already considerable at present. And it is safe to say that they will only increase in the coming decades. Together these trends describe the challenges that we have to face.

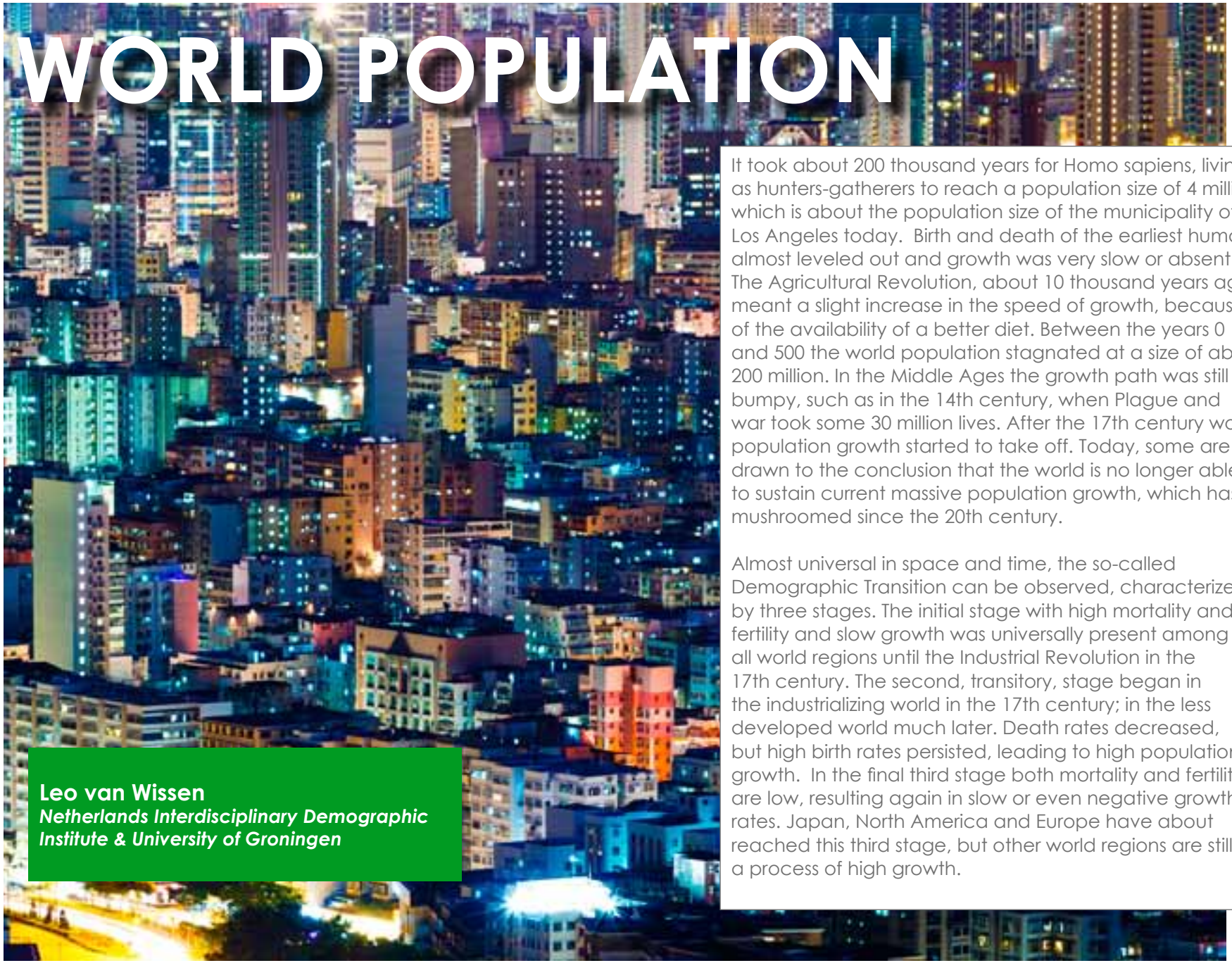
Indeed, feeding tomorrow's cities is a complex and daunting task, with the risk that policies will only be able to react afterwards. Policy making will help but can hardly provide the real life solutions by itself. At best create conditions for them. For that purpose it will draw on science and rely on enterprise to respond to new opportunities. It is for that reason we collected insights from both quarters in this book.

Some 15 contributors from the world of science or applied knowledge helped to cover most angles that need to be scrutinized. The other input we solicited from enterprise to compose an initial survey of companies and institutions that are aware of the importance of the topic. They all are willing to think ahead how their potential could help in terms of future solutions.

There too the response was more than encouraging. Some 40 companies and organizations present their potential and thoughts how to improve the agro and food system. This ranges from genetics, breeding and cultivation, via processing storage and trade to urban planning, finance and education. 6 applied science universities show their readiness to hook on.

With the description that follows, a kaleidoscopic overview of challenges and responses, this publication wishes to highlight the importance of an integrated approach. For science this means taking into account all relevant angles. For enterprise how to cooperate in the chain. In the end this country, its companies, schools and scientific institutes can jointly make a difference and contribute substantially to the feeding of tomorrow's cities.

WORLD POPULATION



Leo van Wissen
Netherlands Interdisciplinary Demographic Institute & University of Groningen

It took about 200 thousand years for Homo sapiens, living as hunters-gatherers to reach a population size of 4 million, which is about the population size of the municipality of Los Angeles today. Birth and death of the earliest humans almost leveled out and growth was very slow or absent. The Agricultural Revolution, about 10 thousand years ago, meant a slight increase in the speed of growth, because of the availability of a better diet. Between the years 0 and 500 the world population stagnated at a size of about 200 million. In the Middle Ages the growth path was still bumpy, such as in the 14th century, when Plague and war took some 30 million lives. After the 17th century world population growth started to take off. Today, some are drawn to the conclusion that the world is no longer able to sustain current massive population growth, which has mushroomed since the 20th century.

Almost universal in space and time, the so-called Demographic Transition can be observed, characterized by three stages. The initial stage with high mortality and fertility and slow growth was universally present among all world regions until the Industrial Revolution in the 17th century. The second, transitory, stage began in the industrializing world in the 17th century; in the less developed world much later. Death rates decreased, but high birth rates persisted, leading to high population growth. In the final third stage both mortality and fertility are low, resulting again in slow or even negative growth rates. Japan, North America and Europe have about reached this third stage, but other world regions are still in a process of high growth.

The resulting shape of the population size over time is an S-curve. Most developed countries are on the top of the curve but most developing countries are still on the steep upward slope. It is unclear where the top of the curve is going to be for countries still in transition. This uncertainty is at the heart of current world population prospects.

From prehistoric times until the middle of the 19th century advances in life expectancy were small, but since 1850 the highest measured life expectancy on earth has increased with about 2,5 years per decade. Initially, reductions in infant mortality have been the driving force of (statistically) increased life expectancy. In developed countries that mortality is currently so limited that further reductions can only be small. The top-ten countries with the highest infant mortality rate are all to be found in Africa, with Angola having 96 per 1000 the highest (Japan has a value of 2 per 1000). Clearly there is a world to gain here.

In prehistoric times, and until recently in the developing world, women had on average about seven babies to have a fair chance of keeping at least some children surviving to adult age. Fertility rates in the developing countries started to drop much later than mortality rates, as late as in the 1970s in the less developed world, and by the 1980s in the least developed world.

This lag is the single most important factor for the population explosion in these regions of the world. The key to reduction of the fertility is universal education, reproductive rights and family planning. Education has many benefits: higher incomes, better diets, housing and hygiene, as well as healthier lifestyles. This reduces infant and child mortality and therefore the need to have many babies.

According to the UN all countries will converge towards a value around 2 children per woman in 2100, but the uncertainty about this target value is very high. Especially in the least developed countries current levels are still far off from this target. Small differences in fertility assumptions will have large effects on projections. The World Prospects of the UN foresees that in 2100 the world will count 11.2 billion inhabitants. Most of the future growth will take place in Africa. In 2100 Nigeria, with 750 million, will be the third largest country on earth. However, when taking into account the mitigating effect of future levels of education for each country, the total world population may not grow to 11 but to nine billion inhabitants in 2100. The population of Africa will in that case increase with “only” 2 billion. That, of course, would be good news for this continent, and for the prospects of feeding its inhabitants in the coming century.

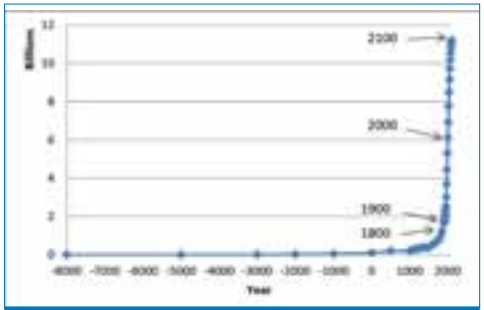


Figure 1:
The explosion of the world population size

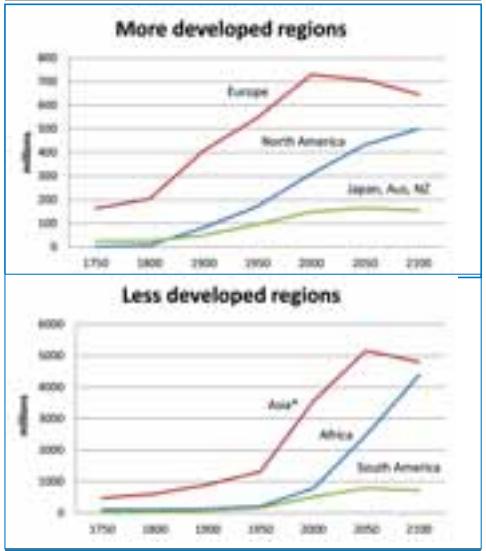


Figure 2:
Population growth in world regions 1750-2100

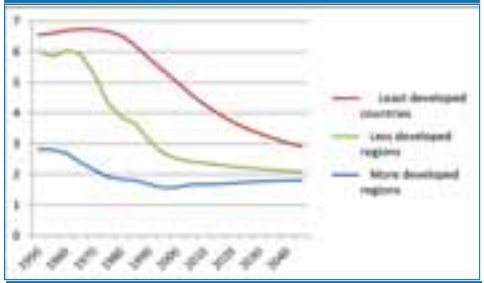


Figure 3
Number of children per woman by world region 1950-2050

AFRICAN URBANIZATION

Africa's population growth is stunning. After centuries of stagnation around 100 million inhabitants, the 20th Century meant an almost tenfold increase. Currently Africa's population is close to 1.2 billion. In 21st century it will most likely grow to 3 billion. Of course there may be dramatic epidemics, and many more victims of famine, wars and violence. But these dramas also hit Africa in the 20th Century and despite that, the African population exploded. Although the number of children per woman is gradually going down now, there are so many young women in Africa that even with lower average fertility the population increase will be higher than anywhere else.

An even more rapid population change is Africa's urban explosion. Around 1960 Africa was rural. Only 20% of its population (65 million) lived in urban areas. Currently there are 475 million urban Africans: a sevenfold rise. By 2050 there may be 1.2 billion. This implies that in the next 35 years urban services and livelihoods have to be organised for another 725 million urban dwellers. And while there were few cities with more than 1 million inhabitants in 1960, there are more than 50 now, and there will be many more in 2100.

Two remarks must be made to put these observations into perspective. First, weak statistical services and a very mobile population, of which many live both urban and rural lives, lead to notoriously unreliable data. Second, urban Africa recently became the engine of economic growth and urban incomes in Africa are rising steadily. Of course there are many poor people in cities, and the living conditions for many of them are appalling. But many other Africans live rather luxurious lives and it is not difficult to find urban areas of affluence populated by an emerging middle class with rising expectations.

Africa has been the economically fastest growing continent during the last few years, even faster than Asia. Although nothing is certain, it can be foreseen that the enormous social and economic energy created by many relatively young, healthy, well-educated and well-connected urbanites has created a momentum of self-sustained growth. Even if the global demand for Africa's resources will become lower than in the recent booming decade, this growth will continue.

Although Africa's cities do produce food (urban agriculture!), and although many African urban people do have family linkages to rural food suppliers, by far the largest part of urban food demand has to be provided from elsewhere.

Africa's agricultural growth figures reveal that during the last decades the production of basic food has rapidly increased almost everywhere, both in area and in yield. And also the production of luxury food such as dairy, eggs, meat, fish, fruit and vegetables shows very rapid growth in many places. Many opportunities exist for food providers in the hinterland of the major African cities to provide urban consumers with basic and luxury food. Thriving urban markets, shops and supermarkets are a testimony to that trend.

There are challenges that have to be dealt with. Food imports have risen sharply to partly provide for the urban food demand. And a proportion of those imports can be regarded as dumping that undermines the competitiveness of local production. On the other hand, substantial areas of African fertile soils are used to produce food for the global market, competing with production for the local demand. African governments hardly invest in the agricultural sector and the budgets for agro-support are much too low. All these challenges need to be taken into consideration when trying to provide answers on how to feed tomorrow's cities in Africa.

But there are also many opportunities for those who want to support the food boom in Africa. The current approach to support value-chain improvements is a step in the right direction. It could even be better if the approach would be widened to become an agro-innovation-system approach: connecting the energy of food producers (farmers and agro-industries; employers and employees), with the transport and trading sector, and with the many types of input providers, banks and insurance companies, food safety agencies, the agro-education, extension and knowledge sector, both public and private.

Ton Dietz
African Studies Centre

CHANGING DIETS

On-going economic development, increase in income, changes in lifestyle and urbanization directly affect food consumption patterns. One consequence of these changes has been the rapid increase in consumption of (i) non-grains such as meat, fish, dairy, oils, fruits, vegetables, (ii) processed products, (iii) prepared food consumed out-of-home, and (iv) dietary energy from non-staple food sources.

According to FAO data, annual meat consumption is projected to increase from 218 million MT in 1999 to 376 million MT by 2030, illustrating the strong and positive relationship between income and the consumption of animal protein. Overall average consumption in developing countries has more than doubled from 1964-1999, from 10.2 kg per capita/per year to 25.5 kg. This is expected to increase to 36.7 kg by 2030. Depending on the region, these trends differ however, with Latin America and the Caribbean, and East Asia evidencing especially large increases.

In parallel, recent data from India and Indonesia show marked decline in consumption of the principle staple rice, both in rural and urban areas. And in India expenditures for fruits, vegetables and dairy products increased more in urban than in rural areas. Other data show that Chinese consumption of animal proteins has consistently risen among all age groups, with the highest levels in the more urbanized areas. The highest calorie levels per day consumed from pork, fish, eggs and poultry are noted in megacities. Also significant changes in cooking (more oil fried) and eating styles including an increase in snacking and eating away from home are observed. Urbanization proves to be a strong driver for the dietary shifts in China.

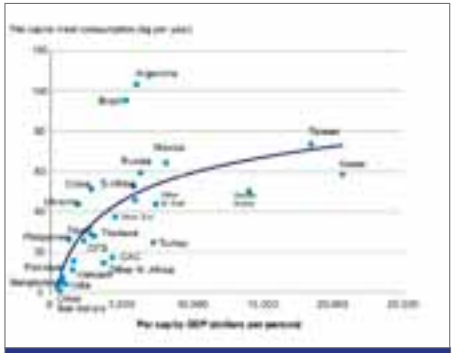
Similar changes in consumption and diet patterns are being reported for the richer and more urbanized in Sub-Saharan Africa:

a decline over time of grain/tuber staples, higher shares of fruit, fish and eggs. As expected, also the share of processed food consumed is increasing. More surprising is that processed food purchases rise very little with increased income – the poorer allocating almost as much as the richer. At the same time globally the composition of national food supplies have become increasingly similar.

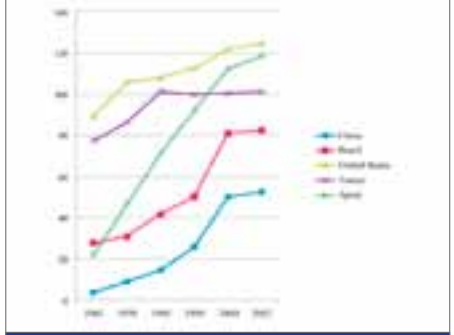
The complexity of current global challenges requires a fresh look at food systems. Are they providing a diet that meets nutrient requirements? And do they perform in a manner that is in balance with the world's natural resources?

The implications of recent diet changes are not yet fully understood. The changes are multiple and comprehensive analyses of drivers and mechanisms are still lacking. However, it is already recognized that impacts are likely to affect different parts of the populations in different ways. For example: the increased access and consumption of processed and energy-dense food has helped reducing malnutrition in remote rural areas. But at the same time this food is also thought to be contributing to the increased prevalence of obesity and non-communicable diseases, especially in urban areas.

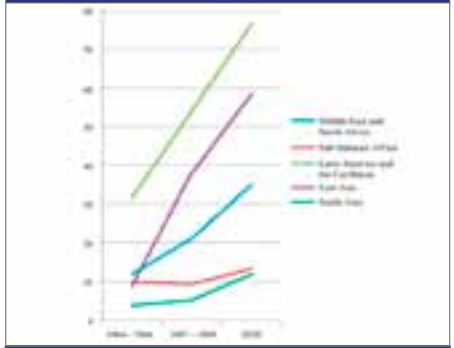
To address these issues interventions in the food system are needed, such as establish and implement national dietary guidelines, develop sustainable food system strategies, and set up appropriate school feeding programs. A basic condition that needs to be met in all circumstances is the development of efficient and inclusive distribution systems that are able to deliver the required food in the right place, and see to it that food waste will be reduced to a minimum.



Per capita meat consumption and income, by country, 3-yeaar average centered on 2010 (Source: USDA Economic Research Service)



Trends in meat consumption over time (kg/per capita/per year) – selected countries (Source: FAO)



Trends in meat consumption over time (kg/per capita/per year) – by region (Source: FAO)

Menu of Tomorrow: Vegetables, beans, grains and legumes

The Dutch NGO 'Nature & Environment' proposes a solution to the challenges the world is currently facing with regard to food production and consumption. Agriculture – and especially animal husbandry - has an enormous impact on the environment. Thus, a change in dietary habits can be a powerful solution to these problems. To reach this goal, the NGO proposes and stimulates the 'Menu of Tomorrow. This menu involves a dietary change, shifting away from animal protein towards the consumption of vegetables, beans, grains and legumes.

Adoption of this menu will help to achieve the following goals: (1) A substantial decrease in the emission of greenhouse gases. (2) Equal use of agricultural land and equal emission rights for all world citizens. (3) A halt to the expansion of agricultural land at the expense of nature. (4) Promotion of animal-friendly husbandry systems. (5) Increased consumption of sustainably harvested fish. (5) A healthy and nutritious diet for all.

Source: Sijas Akkerman, Natuur & Milieu, Utrecht

Guy Henry, Chris Bene and Elise Talsma
International Center for Tropical Agriculture (CIAT)

NUTRITION PARADOX

Currently, more than half of the global population of seven billion live in cities. 250 million of them do not have enough to eat. By 2045, the number of people living in cities will increase to 6 billion, adding 2 billion more urban residents. Over 25 cities already have a population exceeding 10 million inhabitants. Worldwide middle class is also growing fast, rising from 1.8 billion people in 2008 to more than 3 billion in 2020 and expected to rise further to 4.9 billion in 2030.

Largest increases in middle class households are registered in Asia (notably India, China and Indonesia), but also in several African countries (Nigeria, South Africa), in Brazil and Mexico, and in the Middle East. By 2030 over 70 percent of China's population will be considered middle class, consuming nearly $10 trillion in goods and services. In the next 25 years, India alone will add over 1 billion people to the global middle class. These developments are leading to a tipping point. The global middle class will strongly expand and the focus will shift from the West to the East, giving rise to dramatic changes in the global food provision landscape.

Most middle class households purchase their food from supermarket outlets, which offer convenience food while guaranteeing quality and safety. Supermarkets in Nigeria and Kenya serve up to 25-30% of the food market, whereas supermarkets in South Africa are rapidly expanding and register a 55% share in food retail. In East Asia (Korea, Taiwan) this share is beyond 65%, whereas in Southeast Asia (Indonesia, Malaysia, Thailand) it has grown to 35%. Chinese supermarkets already capture 40% of urban food retail sales. In the large Latin American countries the supermarket share of food retail sales ranges from more than 50% in Argentine, Chile, Costa Rica and Mexico to even 75 % in Brazil.

Supermarket expansion is usually accompanied by large shifts in procurement regimes, whereby primary producers supply regional distribution centers that in turn stock the retailers. All links in the chain have to meet stringent quality and delivery requirements, and are contractually tied to maintain specific production, conservation and delivery practices. Agro-logistics organization and economies of scale and scope in storage and transport are critical for guaranteeing reliable procurement and to maintain (public and private) quality and safety standards. Reducing post-harvest food losses and use of secondary product streams represent major challenges.

People working and living in urban areas tend to adjust their shopping habits and change their consumer behavior related to their daily activities and income situation.

Large cities often show a more unequal income distribution than smaller cities. Poor people and emerging lower middle classes care for affordable food and convenient shopping, but are usually constrained in budget and time for shopping and cooking. Consequently, packed and processed foods and fast food menus become dominant in urban diets. This leads to the co-existence of overweight and obesity with under-nutrition and deficiency diseases across the life course. Malnutrition even gives rise to a double burden: under-nutrition early in life contributes to an increased propensity for over-nutrition in adulthood, which is underlying cause of many non-communicable diseases.

Combating inequality in urban food provision calls for nutrient-sensitive supply of affordable and healthy food to urban poor and emerging middle class, focusing on fresh fruit and vegetables, dairy and animal proteins. Also diet diversity must be improved and energy uptake from trans fats and sugar should be reduced, combined with an enhanced engagement in physical activities. Promotion of school feeding based on food purchases from nearby farmers and awareness raising are key for reducing food inequalities.

Ruerd Ruben
LEI - Wageningen University and Research center

CLIMATE CHANGE

The 2014 assessment report of the Inter-governmental Panel on Climate Change stated "warming of the climate system is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice and rising global average sea level." With so many people living in and moving to cities, urban areas are increasingly important in understanding climate change impacts and how to cope with them.

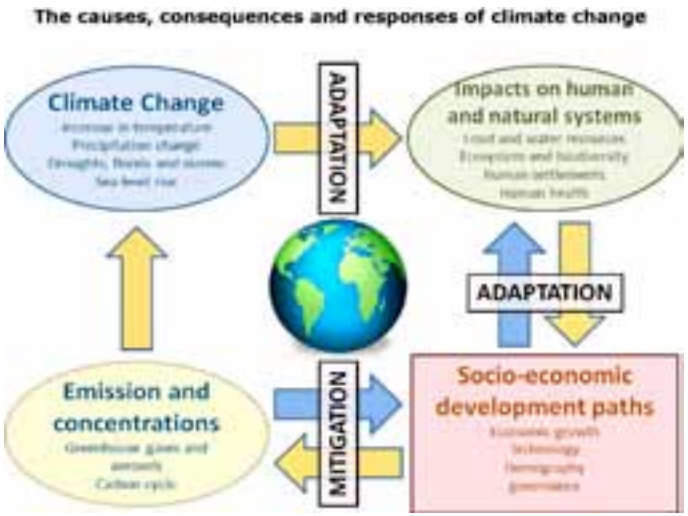
Climate change is caused by emissions of greenhouse gases such as Carbon Dioxide (CO2), Methane (CH4) and Nitrous Oxide (N2O). Cities can play a major role in mitigating the CO2 emissions that originate from the use of fossil fuels. Energy systems in cities are dense and often old, and their efficiency can easily be improved. In cities, distances are relatively short, investment possibilities are available and innovative capacities are present. These factors enable the rapid development and implementation of alternative systems, such as electric transport combined with smart grids.

International negotiations among countries to reduce emissions and mitigate climate change have stalled over the last decade and now only progress slowly. However, cities increasingly reveal a growing political commitment to actively engage in addressing the challenges. Eighty cities throughout the world (including Amsterdam and Rotterdam) have joined forces in the C40 initiative to innovate and shift to carbon neutral energy systems by the middle of this century. Their Mayors, businesses and citizens want to address climate change and other sustainability challenges, because they are very aware of the direct and indirect climate change impacts if adequate actions fail.

These impacts of climate change on cities are manifold. Higher temperatures likely increase the number and intensity of heat waves, amplified in cities because build-up areas absorb more heat, while high-rise buildings block cooling winds and green spaces that provide evaporative cooling, are lacking. The impacts of heat waves can be substantial, as was shown in the 2003 and 2010 heat waves in Western Europe and Moscow that led to thousands of casualties. Regionally, heat waves reduce crop productivity in agricultural areas surrounding cities, limit fresh water resources and induce wildfires.

As the atmosphere warms, it also holds more moisture. This leads to heavier rainstorms and immediate inundation if drainage systems are unable to rapidly remove the excess water. Currently, in many different cities archaic drainage systems are being replaced to deal with this challenge, but often not rapidly enough.

The oceans absorb much of the increase in temperature. As oceans warm, their water expands and sea level rises. Together with



melting ice from glaciers and Greenland, sea level has already risen by 0.2m since 1900 and IPCC expects it to rise additionally by between 0.3m and 0.8m during this century. As many cities lie in coastal deltas, they are exposed to this threat. Even if effective levees and barriers are constructed, dangerous flooding might still occur when barriers are closed during high tides and simultaneously extreme river runoffs strike in delta-areas or vulnerable estuaries. Such synergetic situations are not uncommon. Especially in the tropics, warm ocean water also feeds energy to storms, hurricanes and typhoons. Katrina in New Orleans, Sandy in New York and Haiyan in the Philippines, for example, swelled their devastating strengths due to warmer ocean water.

Impacts of climate change on food production are manifold and regionally specific. In dryer areas, changes in precipitation probably cannot offset the increased evapotranspiration at higher temperatures, so droughts will occur more frequently. This reduces water availability and crop productivity. In some places where surface or ground water is available, droughts can be managed by developing better irrigation schemes or water harvesting techniques (as developed in climate-smart agriculture projects). However, IPCC assesses that climate change undermines food security in dry areas. This immediately jeopardizes the food and water supplies to cities in these regions. In coastal areas, agriculture can be threatened by sea level rise and saline intrusion.

Warmer winters and summers have an impact on crucial timing of events in crop growth, such as germination, growing and flowering. Extremely high temperatures, for example, irreversibly stop grain filling and this can reduce yield by a large fraction if it occurs early in the seed-setting period. Warmer winters can limit some crop's vernalization (e.g. wheat requires a cold period to induce flowering). Drought periods in the early growing period limit crop growth and development. Rainstorms during harvest limit harvest practices, especially with heavy machinery. Some areas, however, will become more suitable to grow specific crops. An example is the expansion of vineyards in The Netherlands and England. Although IPCC also presents such positive effects, they conclude that the negative climate change impacts dominate.

As cities continue to grow and will incorporate 60-70% of at least nine billion people in 2050, cities' food and fresh water demand will also increase. All the above-mentioned climate-change impacts on food and fresh water supplies have to be dealt with. Improving the efficiency of supply systems, reducing waste streams and consuming less or shifting to less affluent diets all help to decrease demand and deal with lesser or less certain supplies. The innovative role that cities take in the transition towards renewable energy can also be applied to reduce the vulnerabilities of agriculture and water supply in and around urban regions. Other threats of climate change faced by cities may also benefit from a pro-active regional approach.

Rik Leemans
Wageningen University and Research center

WATER SCARCETIES

The reality of climate change and its enormous influence on water is widely accepted nowadays. Sea level rise, excessive rainfall and periods of drought result in floods as well as shortages of water, incidental and structural. Reactions upon this threat are still blurred. A carbon policy is accepted to avoid a temperature rise of more than 2 degrees, but this will have effects only in the long term. Thus, a policy of adaptation should be implemented. The Netherlands may offer an example how to deal with this.

Worldwide, even in dangerous delta areas, the introduction of adaptation policies seems to get stuck in talk and abstract ideas. But a wake-up call is necessary. The bulk of pinching water management problems is an effect of climate change. Demographic changes, economic development and agricultural practices are perhaps much more responsible and influence the situation in a very short term. An adaptation policy that seems to accept these dramatic and often irreversible developments may therefore be a dangerous course. Needed are policies that robustly intervene and are implemented rapidly. Water management should be combined with a better-controlled economic and agricultural development, as well as a rational spatial planning, especially in our urbanized delta areas. What is at stake? Where and how are water scarcities coming in? So where to react upon?

The entire world witnesses a rapid process of urbanisation. People move from the rural areas to cities, especially in delta regions. The related challenges are tremendous. Spatial planning is felt to be lacking, a planning that is integrated and law governed. Logistic systems get paralyzed, agriculture stagnates and cannot supply the market and water systems widely threaten to run short. And these challenges, moreover, are interdependent. What threats, specifically in the water domain, do we have to cope with in these urbanized areas? And how to tackle the problem?

It is a misunderstanding that most of the extracted water from lakes, rivers as well as groundwater reservoirs, is used for human consumption. The bulk is used for agriculture, mainly for irrigation in areas with water scarcity, and for processing agricultural produce. Especially the use of irrigation water causes major problems and need urgent attention. Just applying ample water to thirsty crops can be a threat by itself. In a hot climate much irrigation water tends to evaporate, leading to problems of salinization.

If irrigation techniques will not improve, millions of hectares will deteriorate and ultimately be lost for productive use.

Therefore, first learn farmers and extension agents to use better technologies - like drip irrigation. Of course this calls for education and training, as well as adequate capital investments. This preventive solution is not only necessary for saving the quality and productivity of soils but also for saving scarce water.

The second reaction has a more adaptive character: breeding of salt tolerant varieties for the major crops. Salt tolerance of crops will not only make salted soils productive again, it will also allow irrigation with brackish ground water. In The Netherlands, a lot of effort is being put into breeding and selecting the right varieties. Although this adaptive solution is needed, it should never replace preventive alternatives that will slow down the process of salinization.

Abundant use of water in agriculture leads to more than serious water level problems in rivers, lakes and reservoirs. Almost half of China's rivers end up completely dry – or heavily polluted. When the use of available water is not coordinated all over the catchments, downstream areas will be victims of upstream activities and profiteering. The same applies for the abundant extraction of groundwater for human use in urbanized areas that leads to rapidly sinking of ground water levels and land subsistence resulting in flood risks. Related to the predicted sea level rise, this is an acute problem that calls for revolutionary solutions. Saving water by investing in advanced and adequate technologies will be necessary. In urban areas the use of groundwater for private water supplies should be substituted as quickly as possible by a well-organized use of surface water. Meanwhile, adaptation is absolutely necessary, which means investments in dikes, dams and other infrastructural measures.

Delta areas urbanise at an increasing pace, putting pressure the capacities of agricultural supply. Surrounding agriculture needs to be modernized, not only in the use of technology, but also in developing innovative skills. Here we enter the arena of culture, governance and organization.

Often the problem is not the (non-) availability of techniques. It often is the inability to integrate them in water management and agriculture. Institutions, laws and governance practices need to be developed to address this issue. If not, the challenges mentioned will be very hard to cope with. The process of urbanization in delta areas should therefore be accompanied by the development of adequate governance. In the Netherlands a governance structure has matured over the centuries in that may serve as an example from which the wider world might learn.

Sybe Schaap
Netherlands Water Partnership

PLANT PRODUCTION

Continued population growth and urbanization pose new challenges to agro-food systems, and to the agriculture that must supply them. Put simply, the amount of resources (land, inputs etc.) available to agriculture is limited, meaning that the challenge of ensuring continued production growth, and therefore low food prices, is one of doing more with less.

Without agriculture, population growth, urbanization and increased prosperity are impossible. But they are also competing for natural and human resources and all contribute to and are affected by climate change. The result is an antagonistic system that must be resolved.

Climate change will lead to more extreme and erratic rainfall and temperature patterns, along with a general increase in temperature. Combined with declining groundwater resources these changing conditions will produce a 10 percent handicap to the yields of major cereals by 2050. Without further actions, wheat yield gains will fall below the level of 1.5 percent per year needed to keep up with demand.

Maize and wheat, along with rice, provide half of the world's food energy supply. Urbanization and prosperity are also driving an increase in meat consumption, with the livestock industry responsible for half the growth in demand for cereals, especially maize, the most efficient source of animal feed.

While the cities of the future will have greater calorific needs, the challenge is to ensure that available food also provides adequate nutrition while being affordable within the context of a culturally preferred diet. This means that agricultural science must be responsive to the needs of the market, industry and society, with a direct impact on our investigations right down to the genomic level.

In areas such as Sub-Saharan Africa, where the known gap between potential yields and actual yields is greatest, a great potential can be unlocked by proper application of current agricultural knowledge. Markets, information systems, local food industry and policies must be aligned to provide the conditions needed for improvements. Elsewhere, plant science will have to break new ground to address the decline in yield gains, while accelerating the development-adoption cycle of agricultural science to adequately respond to the significant challenges that lie ahead.

The falling cost of genotyping-by-sequencing has the potential to revolutionize the pursuit of plant genetic gains by introducing time and resource savings, especially in combination with marker-assisted breeding approaches. However, two bottlenecks persist: the ability to process and model all this data and the ability to phenotype plants in the field.

In the case of the latter, high-throughput phenotyping platforms using remote sensing technologies and modeling are already in widespread use in the private sector. These are able to rapidly collect data on crop performance over time while controlling for environmental and spatial variance. The challenge is to develop these platforms further and spread their use at low cost to the public sector and smaller private enterprises.

Coupled with freer exchange of germplasm and more international partnerships, crop breeding can move much faster to develop varieties with greater tolerance to drought, heat or waterlogging stress, and that make more efficient use of nutrients.

Gene editing technologies have emerged that promise a non-transgenic route to rapidly incorporating new traits and crops. In particular, the CRISPR/Cas method is proving to be more versatile and efficient than other methods, while being cheaper and easier to perform. This technology will help breeders broaden their understanding of the function of genes, and the powerful ability to alter that functioning.

Finally, important areas of research still remain to be explored, such as increasing plant photosynthesis efficiency. And in some cases, for example the development of hybrid wheat varieties, much greater collaboration within the private sector and with public research institutions will be needed to develop the base technologies required.

For these advances to occur, more investment in agricultural research is needed, in both the public and the private sector. Furthermore, greater use of collaboration and partnerships is required, both to pioneer new approaches to agricultural research, and to ensure that new technologies are adopted where they are needed. Only then will the global agri-food system be capable of feeding tomorrow's cities.

Martin Kropff
CIMMYT – International Maize and Wheat Improvement Center, Mexico

ANIMAL PROTEÏN

To secure nutritious food for the growing population, the livestock related production has been increased from 60 resp. 250 MT/year meat and milk of in the 1960's, to 300 resp. 700 MT/year of meat and milk nowadays. An increase in production is to be expected as more middle class people in developing countries can afford to shift to a more animal protein based diet. Livestock production also contributes to a better livelihood in poor countries by providing nutritious food, labor, capital and risk insurance, and to specific ecosystem services such as biodiversity, grassland ecology and soil carbon stocking. Urbanization provides better logistical perspectives for animal protein supply from intensive, sustainable farms in the metropolitan areas. For all these reasons it is expected that in 2050 about 450 resp. 1050 MT/year of meat and milk is needed in 2050. The trend to consume less meat in developed countries will hardly have any effect on this expected increase.

The Dutch livestock sector is well-known for its efficiency. The milk production per cow doubled since 1960 to an average of 8000 liters/ year, with many cows producing 11000 liters/year or even more. On the other hand labor intensity is reduced by a factor 30, resource efficiency by 70% and methane emission intensity by 15%. Especially the latter is now under focus and even 40% more reduction can be achieved by improving integrated breed, feed, health and manure management. Another example is the broiler sector. Here a doubling of the production is combined with a 40% lower carbon footprint, a 60% improvement in resource use efficiency, 30% less land use, a 3-fold lower labor intensity, a 60%reduced use of antibiotics and a significant improvement of animal welfare.

The attention for improving efficiencies has led to a leading export position for dairy, meat and eggs to European and world markets. Stringent quality control safeguards the undisputed quality of these products. As a result, substantial volumes are traded for an orderly price. The sector is characterized by a high adaptive capacity to new technologies (genomics, biologicals, feed processing, barns, sensors,

robotics) and to societal challenges such as the need for climate smart production, health concerns, animal welfare and impacts on the environment.

This integrated approach is based on the scientific concept of "Livestock Farming with Care". The key to this Dutch livestock success is innovation as a result of a close cooperation between the entrepreneurial skills of the agribusiness, linked to supporting frontier science and a facilitating government.

Although the achievements of the livestock sector are already noteworthy, there are new challenges that call for attention. An integrated agro-ecosystem approach (crops and livestock production) is needed to optimize the Human Edible Protein production per unit of land, without depleting the soil quality. The closing of the biomass-loop is essential. Biomass produced for food production, and to "fuel" the bio-based economy, can be more fully exploited for its protein value. Nowadays, unused biomass stocks can be converted into nutritious feeds for ruminants (cows, sheep, goats) by using fungi; or for insectivores (like poultry) by using insects. For a genuine circular bio-based economy in the future, livestock is an essential link in the chain.

Another challenge is to fully exploit manure as a valuable source of raw materials, not just minerals and energy. Biological active manure contains expensive bio-enzymes, and – if appropriately ripened - can be used to improve the organic and biological soil quality. Trough this application, manure can even contribute to mitigate climate change by sequestering carbon in marginal and eroded agricultural soils.

Finally, increased understanding of the biologicals will lead to new technologies that can improve sustainability of livestock production by smart breeding applying gen editing and epigenetics. The application of apt biologicals will also improve nutritious feeding in prenatal and neonatal early live stages, leading to increased robustness and effective immuno-responses), as well as the ability to apply preventive health management using for example probiotics, bacteriophages, mucosal and adjuvant vaccines.

Land is the limiting factor for animal protein production. However, 70% of the earth's surface is covered with water. These aquatic and marine environments constitute a promising additional perspective. Seafood is a major source of essential proteins, omega-3 fatty acids and micronutrients. Currently, only 17% of the supply of animal proteins comes from seafood. Both fishery and fish farming are not optimally governed to use the marine and fresh water production capacity in a sustainable manner. Improvements in this area will lead to a promising source of animal proteins in the future.

Martin Scholten
Wageningen University and Research center

AGRO - LOGISTICS

Many decades ago, food products were consumed close to where they were produced. Due to increasing globalization and urbanization with the rise of metropoles, the distance between production locations and places of consumption has increased significantly. As a result the complexity is multiplying to get food products to the right place, at the right time and in the right quality. Demands on these points are ever rising, and so is demand for sustainability. Insufficient (cold) storage capacity close to the market does not help.

Currently urban food distribution is moving from traditional to modern market channels. Hyper- and supermarkets as well as convenience stores slowly but surely gain market share from the local (wet-) markets or small grocery stores. These modern channels require frequent deliveries of small batches of high and constant product quality that traditional supply chains do not seem to be able to deliver.

And so they increasingly rely on their own, newly set up, supply chains: independent and fully controlled. The recent developments in internet sales with direct home delivery fit this pattern. So do pick up points, where pre-ordered groceries can be picked up on the way home from work. On the other hand fresh market places in city centres also experience a comeback. After all, customers want to see or taste what they buy. As a result, there is an increasing differentiation of markets and related supply chains. They all require an effective logistics infrastructure, founded in a well tuned-in urban planning process.

In many cities the system for fresh food distribution is underperforming. The distribution in itself may already be complex. Add the number of transits and city-congestion, and high logistics costs as well as low responsiveness to customer orders are the result. Poor packaging, rough handling and inconsiderate transportation further attack product quality. And if cooling is lacking or insufficient, food safety is at stake not to speak of significant food losses.

Urban farming and other production innovations in the city itself can help relieve the pressure on logistics. For the food supply to tomorrow's cities, however, further innovation in food distribution is a first requirement. Facilities, infrastructures, vehicles, but also products themselves need to be redesigned to reduce quality loss and to increase transport efficiency.

Decisions need to be taken on the best location to add value within the logistic chain by packaging, quality-inspection, order-picking and bundling. But also on the establishment of cross-dock hubs and the location of pick-up points in case of internet sales. Standardized (modified atmosphere) containers should enable efficient transits and allow the choice of energy efficient multimodal transport options, using water or rail.
Shared and modernized cooling facilities in storage and transportation enable better cold chain management practices. Temperature control throughout the complete chain allows for product quality prediction and longest shelf life and for pro-active route adjustments if cargo-value is at stake. And last but not least, modern distribution requires appropriate ICT systems (with electronic tags and sensors) that enable alignment of logistics practices and complete tracking and tracing of food products.

Next to technological innovations mentioned, also organizational innovations are needed. Key is to improve the horizontal and vertical collaboration between supply chain actors. Only in this way the mutual trust can be generated that allows for smooth and well-aligned logistic practices, intensive exchange of information, consolidation and bundling of goods from various suppliers. Actors and employees in the chain should be educated and trained to handle the product, aiming for best product quality and safety. They will have to deal with many innovations arriving in parallel, backed up by monitoring systems that control the flow of goods and ensure their quality and traceability.

All in the interest of a viable and future proof logistic system.

Jack van der Vorst
Wageningen University and Research center

LOGISTICS NETWORKS

Figure 1: FDI into Logistics Activities of the Food Sector (2003 – 2011). Source Wall 2015, based on FDI Markets data

An important feature characterizing the global economy is the growing interconnectedness between different parts of the world. One indicator that reveals this trend is the increase of foreign direct investments (FDI). These types of investments have become a major driver of global, regional and urban economic development. FDI by food multinationals into activities in foreign locations is also increasing, leading to an expansion of global logistics networks (figure 1). Food centers (white nodes) control resources and production areas (grey nodes) and ensure distribution back to the core areas.

Besides being globally expansive, the food logistics network in terms of distances crossed is also growing exponentially. The yearly investments expressed in kilometers reveals a geographical expansion of 16% per year. Progressively food firms are operating at greater distances, with higher demand for transport. As a side effect these transport activities lead to increasing emissions of green house gases and thus an impact on the environment. Furthermore, as the world population is expected to rise to 9 billion in 2040, competition in global food markets will also increase thereby adding to a situation of uneven distribution and local food security. Therefore, a shift toward sustainable food production, transport and logistics is urgently needed.

Figure 2: European Food Sector FDI (outward = white), (inward = grey) in Logistics. Source Wall 2015

From the map in figure 2 it is evident that Europe holds a high concentration of logistics/transport hubs (white nodes), especially in NW Europe. The map also shows that numerous firms invest in European logistics clusters (grey nodes). It is interesting that Europe's logistics clusters, in most cases, are not located in the bigger urban centers, but rather in less-known specialized cities. These peripheral cities tie the big European urban centers together into the global food distribution network. Furthermore, the map also reveals the outward FDI from European control hubs (white nodes) to distant destinations, a sign of the relative impact of North West Europe on the global agro-logistical network.

Figure 3: China's Food Sector FDI (outward = white), (inward = grey) in Logistics/Transport. Source Wall 2015

One of Europe's main food investment destinations is Asia, especially India and China (figure 3). Smaller investors in China are the US, Japan and South Korea. Chinese cities (grey nodes) represent production and distribution centers of foreign firms, and are far more geographically scattered than in Europe. Furthermore, China itself is not very active in FDI, but this is expected to rise as food insecurity increases. A first signal is the increasing Chinese investment in food projects in Africa.

Figure 4: Beijing's concentrations of Logistics firms. Source Wall 2015, based on ORBIS data.

Within China, food clusters that serve the urban centers are highly concentrated. For example, Beijing is being provided by a concentrated set of food clusters, most of them within the city limits of the greater Beijing area (the green nodes on the map in figure 4). Large countries tend to give rise to monocentric cities. For Beijing this means that the food logistics clusters share the inner city's infrastructure, leading to supply chain inefficiency, over-burdened infrastructure, noise hindrance, and environmental pollution. Furthermore, it appears that Beijing's hinterland is not optimized for peri-urban horticulture and agricultural production, since hardly any food logistics activities are found in these areas.

Figure 5: The Netherland's concentrations of Logistics firms. Source Wall 2015, based on ORBIS data.

In small countries – like the Netherlands - an integrated system of diverse but proximate food clusters has developed (see map in figure 5). More importantly, the surrounding hinterland is well developed for horti- and agriculture and is clearly interspersed with medium concentrations of logistics activities. The co-existence of urban and agricultural zones leads to multiple road networks connecting urban clusters. The burden of this diverse network on infrastructure, society, economy and environment is moderate. Furthermore, this polycentric urban system promotes competition, which in turn leads to innovation, efficiency, diversity, density and knowledge spillover.

To tackle food security, several issues need to be addressed. First and foremost we need to shorten food supply chains. If governments are serious about meeting climate change obligations, they will need to adopt a far more robust approach to food logistics than is the case right now. International trade will always have a function in supplying seasonal products and commodities such as wheat and rice. Moreover, trade provides a failsafe to ensure food safety in case of crop failures or political and economic instabilities. Still an international policy structure needs to be put in place that optimizes freight movements. This would include maximizing the production of food in peri-urban areas, by developing polycentric systems that ensure innovative and sustainable production. Products that cannot be produced locally would be accessed regionally, and as a last resort globally. For these products, sustainable trade alliances and policies must be forged between governments. Furthermore, food technology advancement is needed to ensure healthier and more environmentally friendly production. In this way cities can merge competitiveness with sustainability, so as to enforce urban resilience.

Ronald Wall and Tiffany Tsui
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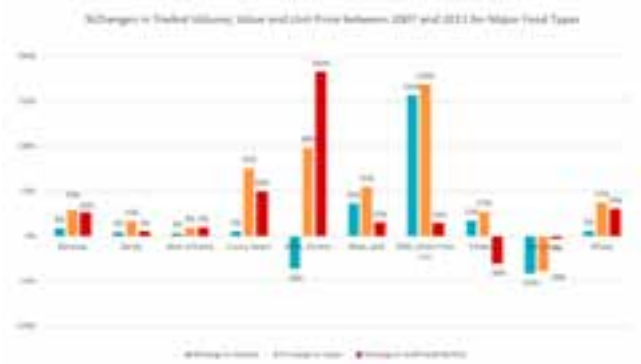
TRADE PATTERNS

General observations

A rapidly urbanizing world has complex implications for emerging and developing nations. But it opens on the other hand great opportunities for the global agro & food sector. Sustainable solutions are needed to provide accessible, affordable and healthy food for the burgeoning urban populations. But also to bridge urban and rural gaps, and to provide impetus for economic growth in emerging and developing nations.

Here often the agricultural economy lags far behind general economic growth. The shift from subsistence to commercial agricultural production requires funds. Compared to more established sectors such as textile or electronics, foreign direct investments (FDI) in the agro & food sector are underdeveloped. Funding often lacks in all parts of the supply chain and also the infrastructure for logistics shows too many bottlenecks to help leapfrogging agricultural productivity. Food related FDI exchange appears first of all a matter between US and Europe

As we all know recent years have seen increasing volatilities in the world food prices. Various factors may lie at the root: climate change, growing demand of bio-fuel, rapid urbanization to name a few. The fact that some countries have reinstated self-sufficiency as a priority in their policy outlook may have had impact as well. And inevitably there is always a degree of price-speculation.



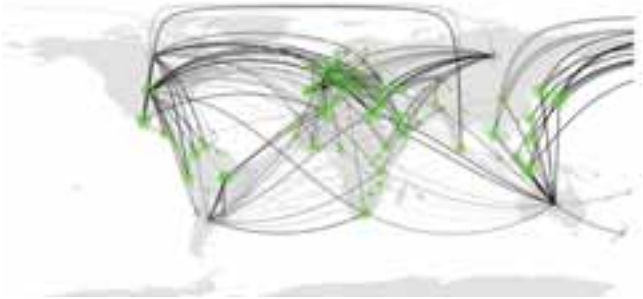
A survey of selected products

Trade patterns give us a rough picture of the forces of supply and demand. We highlight the pattern for three very different products. One a bulk staple food of almost strategic value that has wide reaching impact on the overall food supply chain. The other two more associated with middle class life style. All are subject to rising demand:

WHEAT

The price of wheat has gone higher than normal. Wheat is a basic bulk product for many other sectors and its price increase will have significant impact. In recent years low-income countries, i.e. roughly 1 billion people, spent on average 60% more on the import of wheat. They imported a total of 32 MT in 2011, which is more than the total export of the United States, the largest exporter of wheat.

The global network map of wheat trade shows that wheat is heavily traded around the world. Looking at the future, due to economies of scale the global trade will persist for a bulk commodity like wheat. The top exporting countries of wheat are the United States, Canada, France and Russia. In recent years Australia has seen a significant increase in the global share as it has abundant land supply. On the import side, in general many countries with limited cultivated land depend on imports and the demand has been doubling over the last years.



Grain is important for all countries. Given a supply that after all has its limits and prices being more volatile, more strategic cooperation will hopefully emerge to secure supply and increase storage capacity. Africa with its untapped land resources holds out most potential for increased agricultural production.

POULTRY

The price of chicken nearly tripled while the traded volume worldwide went down nearly 40%. This indicates that chicken meat is an increasingly preferred source for animal protein. Increased investment in the sector has followed. Middle-income countries are the main driving forces behind the increased demand for animal protein. As the income of their roughly 2 billion inhabitants goes up, less carbohydrate is consumed making place for increasing protein-rich diets. In the last five years total expenditure on imported chicken meat for these countries had nearly tripled. The increased consumption of animal protein of course increases the needs for animal feed.

The global trading network of poultry has shown a rapid growth of Brazil into the lead-position,

driven by the rising demand in Asia. The top exporters are Brazil and the Netherlands. Their export value has increased significantly.

Rising demand for poultry is seen in almost all parts of the world. In some developed countries such as Germany and UK consumers a switch to chicken can be attributed to health/ environment consciousness; emerging countries such as China and South Africa see demand rise in hand in hand with higher incomes.

TOMATOES

For the developed world, the consumption pattern shifts to fresh, high quality products, with trust and sustainability in the supply chain playing an important role.

Seasonality and freshness limitations make the trade of tomato mainly a regional matter, although new techniques help in transport and extension of shelf life. The Netherlands is a major exporter of tomatoes to neighboring countries like Germany, UK and France. On the whole the market for traded tomatoes has gone down, however. A shift from processed tomatoes to fresh and high quality produce may be at the root. But competition from local produce, dominance of large retailers in price setting and lack of clear brands and accompanying marketing strategies may also influence the decreased trading value.

The main tomato importers are the developed countries including the US, Germany, France, UK and Russia. Import values are down significantly for all these countries.

In summary, the analysis of the trade networks helps us to better understand consumption patterns and economic drivers. Future trade agreements will go beyond the traditional trade policy of tariff reduction measures, and adopt a 'supply chain focused approach'. Better infrastructure, IT and investment climate will be of prime importance for the urban food systems in emerging markets, where business and social amenities, as well as collaborative networks have much room to improve.

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URBAN METABOLISM AND DNA

Knowing that our most essential requirement in life is to keep drinking, mankind has always searched for new sources of clean water to secure its survival on Earth. Conversely, in their search for proof of life in the universe, scientists always are looking for evidence of presence of water. On Earth, water is the carrier of building blocks that each metabolism needs to continue to exist: minerals cannot be absorbed without water.

From this perspective, the historical success of urban developments in delta areas makes sense. People have always moved from arid rural areas toward the fertile riversides in the deltas. The trend for cities growing bigger and bigger can be seen as the development of a large metabolism. And each of them will be different because of its 'own DNA profile' which indicates the most logical driving forces for its development.
By observing large modern cities it is evident that almost always water tends to be abused and neglected in these growth trajectories. The need for and the importance of clear potable water appear to be underestimated. As a consequence we witness disasters such as flooding, diseases, and environmental catastrophes.

If one compares the development of big cities with that of an organism, the inner pressure and chemistry – the metabolism – define growth. Equally, the city-mass and composition define the further pathways and speed of development. Or put it differently, the mass should be balanced within the boundaries of the system. And of course, given that most human food also contains at least 50% water, the challenge for the metabolism of a future mega-city must support millions of people becomes very clear. Fundamental mistakes that have been made on that score in the past can no longer be hidden.

If the notion of '***water=food & food=water***' is commonly understood and rightfully becomes a guiding principle for the growth of the metabolism into a sustainable city, it follows that each city should make efforts to understand its DNA. Only then we can come to grips with the adequate conditions for growth in the given circumstances. We need to respect the role of water inside and outside the metabolism by specifying the balancing of incoming and outgoing mass flows.

As an example, if one compares the Netherlands (viewed as one big city) with Mumbai, New York or Shanghai, it's very clear how different the DNA profiles can be. Differences in climate, geography, historical developments, culture, political systems, economic systems and structure give them all their own DNA profile.

These big cities do also have some common characteristics:

- Situated in delta area - they need to protect themselves against flooding (whether it comes from upstream, from the sea or from severe rainfalls).
- They all need to feed 15 million of people or more, day after day.
- They need a well-functioning infrastructure to transfer all mass flows throughout the city.
- They need energy security for keeping the whole system working and prevent chaos to arise.

Because of these characteristics, maximizing sustainability during the growth and development of these cities should be seen as a prerequisite to maintain order in the systems and for the metabolism to function properly. Water in this context needs to be viewed as 'circular' within the city and not as a cheap waste flow, passing the metabolism's boundaries and exporting its discharge "over the fence". Balancing the availability of water and the use of it becomes as important as the balancing of people, traffic and goods.

Focusing on tailored solutions and enabling 'urban organisms' to operate within their environment in a sustainable way, we first need to determine the specific DNA of the local metabolism. Feeding tomorrow's cities in a circular way then becomes the main principle that drives investment in food and water production towards stronger, more sustainable business models, and changes awareness and behavior.

Wil Duivenvoorden
Royal HaskoningDHV

RIGHT TO FOOD

Cities cannot feed their own population, but depend on agricultural production in rural areas, processing and transportation. And not just from the surrounding areas but also from all corners of the globe. The challenge how to feed tomorrow's cities has rapidly expanded into a global issue that requires a high level of organization, adequate rules and procedures to begin with.

If - metaphorically speaking - feeding the cities is the game then the law can be seen as providing the rules of this game. And rules there are many at almost every level: global, regional and national. According to the philosophy of the 'rule of law', the law should provide the necessary competences to governments and protection to people. By indicating how things ought to be done, the law provides a normative yardstick for social interaction in general and for government policies in particular.

Global institutions contribute to framing this law. The UN International Convention on Economic Social and Cultural Rights articulates a right to an adequate standard of living, including access to food. The UN Food and Agriculture Organization (FAO) and several other institutions have put great effort into clarifying the meaning of this 'right to food' and into promoting compliance by the Member States. The right to food is realized where and when people have sustainable access to food in a quantity and quality that is sufficient to sustain an active life, that is free from adverse substances (i.e. is safe) and is culturally acceptable in a given society.
The Member States to this UN convention have committed to respecting people's ability to feed themselves, to protect them from external threats to their self-sufficiency and to put in place enabling policies including emergency relief. To fulfill this obligation many states have developed agricultural policies. The EU, for

example, within a decade after its inception turned itself from a situation of dependency to a situation of self-sufficiency and even surplus based on a Common Agricultural Policy.

The law is by far most advanced in protecting people from threats stemming from unsafe food. At the global level the Codex Alimentarius Commission provides models for good legislation addressing topics such as food hygiene through the application of systems based on hazard analysis and critical control points (HACCP). These models are adopted and modified for national use in all corners of the planet from the USA to China, from the EU to South Africa and from Russia to Brazil. Everywhere modern food safety law emerges.

Realization of the right to food not always comes without a struggle. Globally India has positioned itself as a champion in this regard by taking a firm position towards the WTO demanding leeway for food security policies to grant them priority over free international trade. Also, India has drawn the ultimate consequence of recognizing access to food as a human right. In India food security is not only a matter of policy for the good of all collectively. Also each individually can challenge the government in a court of law if in their case the government fails to live up its commitment to realize the right to food.

Some governments have the courage to follow this lead and submit their performance in realizing the right to food to scrutiny by their national courts of law. Among these are Brazil and South Africa. These countries set a shining example that deserves to be followed by all nations worldwide that through their signature have expressed their dedication to the right to food. The ability to feed tomorrow's cities will definitely be positively influenced by stimulating institutional arrangements and an accompanying rule of law that promotes and safeguards the right to food.

As outlined above a moral obligation gradually is becoming a legal one. Where the right to food is recognized as individual right, individual people are empowered to contribute to its realization through court proceedings. Shortcomings in realizing food security at the collective level, however, may lead to a more explosive situation. Governments, national or local, will want to avoid the risk that shortcomings in food supply upset the fragile fabric of urban security. Wisely they will anticipate both by developing local supply systems and by ensuring access to foreign resources, as a backup in case of need.

Bernd van der Meulen
Wageningen University and Research center

KNOWLEDGE & INNOVATION

As indicated in the introductory part of this book, in the Netherlands government has played a major role in guiding and funding research and development, which formed the basis of the current agricultural knowledge and innovation system. Agricultural innovation systems, however, involve a wide range of actors who enable, guide, fund, perform, implement, inform and facilitate innovation. Key players next to policymakers are researchers, teachers, advisors, farmers, private companies and consumers. Or labeled differently: government, research, industry, academia, other organizations, such as non-profit organizations, and markets.

Historically, the system consisted of a linear sequence of knowledge production (research) through communication and extension to education. All government initiatives in the sequence were considered to be key to the success of the agricultural sector. Extension, however, got privatized and is currently offered by a diversity of private providers. The system has ridden out the storm. Coordination between research, education and industry remained well in place and is still being strengthened. The resulting agri-knowledge base draws interest from multinationals, which invest in facilities and joint projects with education and knowledge institutions. Nowadays private sector, knowledge institutes and government jointly establish the research agenda. The role of the private sector has increased as it acts as full partner of the public sector in funding and implementation. The multiplying effect causes most public funding to be channeled through public-private partnerships.

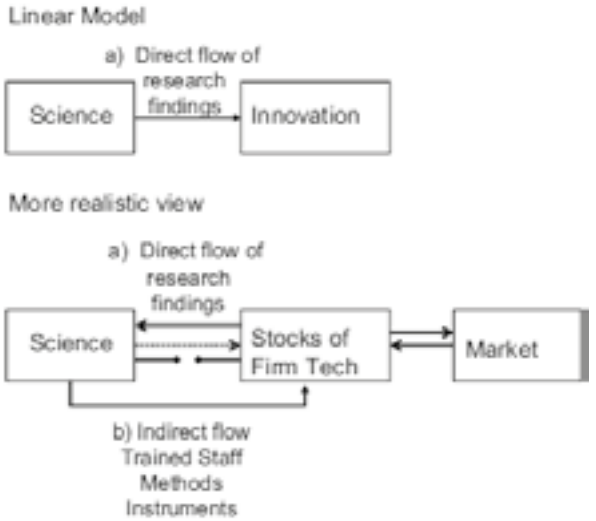
The Dutch agricultural innovation system performs well at both national and international levels. Over the years it has ensured strong growth in domestic food and agriculture productivity, with productivity of primary agriculture being one of the highest at EU level. On-going innovations have also led to world leadership in productivity-boosting technologies, in particular for the greenhouse sector. In the last two decades, the focal point of innovation has been on developing technologies and practices to improve the efficiency of input use, natural resources among them.

This agricultural innovation system owes its prolific performance to its long-standing and long-term investments and, especially last years, to the tripartite collaboration between education, research and industry. Both factors have led to a continuous supply of R&D, accumulation of intellectual capital, and a solid knowledge infrastructure. Together they spur international collaboration and the development of solutions adapted to the sector's demand.

As a consequence adoption of innovation in farms and firms is widespread; it is reflected by the high productivity performance of the sector and shown in innovation surveys. Well-educated farmers have access to a diversity of training and advisory services on a wide range of technical, organizational, management and marketing aspects. They are not shy to adopt innovation. Government involvement is limited to the co-financing needed to allow farmers to participate in the European programs for rural development and some government programs that support investment at different stages of innovation and thereby facilitate the market penetration of new ideas. Intellectual property protection is essential to attract private investment in innovation. By international standards the protection-level in the Netherlands is relatively high. For application in practice, benefits of course have to outweigh costs.

In the field of professional education, the agricultural universities of applied sciences and the agricultural colleges (technical and vocational training) are turning from schools into regional and international knowledge centers. They aim to contribute to lifelong learning, innovation and respect for sustainability, and the so-called 'license to produce'. Learning innovation networks involving various stakeholder groups are used as a policy instrument to address systemic coordination issues. Schools are expected to help firms with qualified employees and practical solutions. Finally, applied research institutes and the agricultural university have been merged into the mission-driven, and successful Wageningen University and Research Centre.

This survey of the Dutch knowledge and innovation landscape shows that institutional developments were the key factor to secure the needed coordination, collaborative funding, and yet demand-driven character of the system. The importance of such organizational aspects cannot be overrated in dealing with the challenges that lie ahead. Ensuring food security and safety to the growing population of tomorrow's cities depends on precisely those skills and competencies.



Huib Silvis
LEI - Wageningen University and Research center

HOW TO FEED CITIES

The western part of the Netherlands is a metropolis that is home to 7 million people. Like many other metropolises it is located in a fertile delta with excellent transport facilities. Through the ages the region has fostered interesting links between its farming community and the demanding citizens, resulting in a strong position of the agri & food sector.

One of the major challenges for all expanding cities in the world is the question how to feed the growing population. Agri-logistics play an important role in the solution, but also the organization of food production in agriculture. And questions arise. Are large production units needed, or should small family farms fulfill the growing demand? For policy makers who have to decide on these questions, the first option seems attractive: entice large investors for turnkey projects, let them buy up-to-date technology in countries like the Netherlands and leave the risks with these developers. The alternative of transforming smallholders into a productive family farm system often poses a bigger challenge since it requires intense policy development. However, such an approach can be rewarding as it provides livelihood for the farming community, so the temptation to relocate to the city will be less. Which option – or mix of options - will be most attractive depends on the specifics of the case. The sheer presence of these and other related questions makes it clear that governments have a role to play in feeding tomorrow's cities. They must decide to which extent the public sector it wants to be involved in the needed developments.

Adriaan Geuze, the internationally renowned Dutch landscape architect, recently made an interesting comparison of government reactions in this respect. In the 1920s the United States of America, Russia and the Netherlands made very different decisions on how to increase agricultural production as a reaction to rising prices in the previous decade. In the USA the development of the western plains was put in the hands of the private sector without much guidance from the government. It contributed to the dust bowl, an environmental disaster. In Russia the state went for full central planning, and that contributed to a food crisis with massive starvation. In the Netherlands the government reclaimed new areas from the sea with a mix of state and private

initiatives in a trial and error setting by taking small steps and learn from the process. In this way, large-scale disasters were prevented and a process of gradual improvements was made possible.

This is not to say that the Netherlands has no environmental problems or challenges in the area of climate change. But the rough comparison shows that The Netherlands has interesting lessons to offer on how to feeding the city by stimulating interactions between public and private stakeholders in the food chain. It is reflected in policies that made farmers organize themselves in producer organizations (cooperatives) and farmers organizations; in institutions that organize land markets and credit systems; in adequate tax laws for income taxes and inheritance of farm assets; in modernization policies like land re-allotment schemes and agricultural knowledge and innovation systems; and in governmental agencies for food safety and inspection services for product quality.

Everything changes over time. Neither nature nor agriculture is a static entity, so continuously new challenges arise. As a consequence, our agri & food system is still evolving. Recently, new technologies like ICT and genetics have shown major impacts on how we organize the agri & food system. The system that evolved over 100 years in the Netherlands cannot be just copied to other parts of the world. But the experiences and lessons can be adapted to local needs and help to speed up the developments that are needed for feeding tomorrow's cities. History shows that it is worth trying to work together to find the optimal mix between large-scale farming, between family farming and private initiative, and between public interests and governmental action.

Krijn Poppe
LEI – Wageningen University and Research Center

FOOD FOR THOUGHT

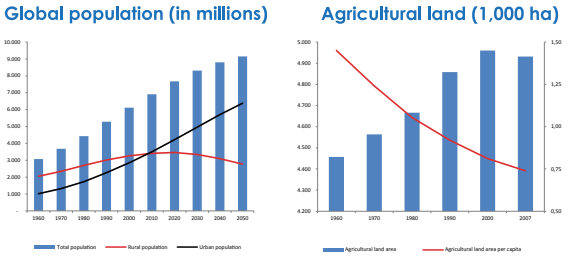
Mankind, having been provided with (only) one planet until today and with nature offering opportunities as well as challenges, is daily facing many choices.

Tried: A tree to be desired, to make one wise….

And how far can mankind go to change it? Genetic modification, 'healthy pesticides', 3D (food) printing, cultured meat, preservation through Pulse Electric Field, Ultra-High Pressure, Cold Plasma and other systems became available to help solve food security issues.

To get more and better food readily available, mankind is inventing consumer-friendly nutrition solutions and changing the natural structure of foodstuffs.

But does this benefit our health? We might be destroying the same generations that we are trying to preserve.



90% of population growth will occur in Sub-Saharan Africa (one billion or 49%) and Asia (900 million or 41%)

Source: FAO Stat, 'Framework for an Inclusive Food Strategy', Rabobank (2012)

Today:
"Eat to live, not live to eat" (Molière)

Will there be sufficient food? People may go as far as stealing bread, causing revolutions or massive migration when basic needs are manifest; in particular while effluence, indulging parties and food waste can be witnessed on the other side of the fence.

A growing population, sharing our one (and only) planet, challenges us to reduce food waste and produce more and healthier food on less land. With all these developments.. we might achieve that people reach '120 years' of age or even live forever.

But *can* our planet support even more than 10 billion people? Needed are new ways of thinking. Luckily there are many resources and developments, some discovered and available, some yet to be explored.

Tomorrow:
"We cannot solve our problems with the same thinking we used creating them" (Einstein)

Fundamental and applied research in the Nexus to Life (Elements, Water and Energy) will advance understanding of world food security and preferably provide integrated solutions. Lesser-known, basic elements from our periodic table are yet to be explored and may contain essential applications. In the same way electromagnetics and the wave-spectrum (between microwaves and far infrared especially) may hold potential for food preservation.

Innovative approaches however need to be functional and have practical implementation for use. The poor in the city generally don't own a fridge to keep their food stored, if already there is energy.

New initiatives

Connecting people, needs and opportunities, like *Silk Road Corridor* "*One way, one road*" and "*Out of Africa*" offer a global perspective. Demand in the Far East, as we call it, will continue to rise, as will the chances for knowhow and product exchange. So will the requirements in Africa, its chances to expand cultivation, to cover its regional needs and range itself among world suppliers that count.

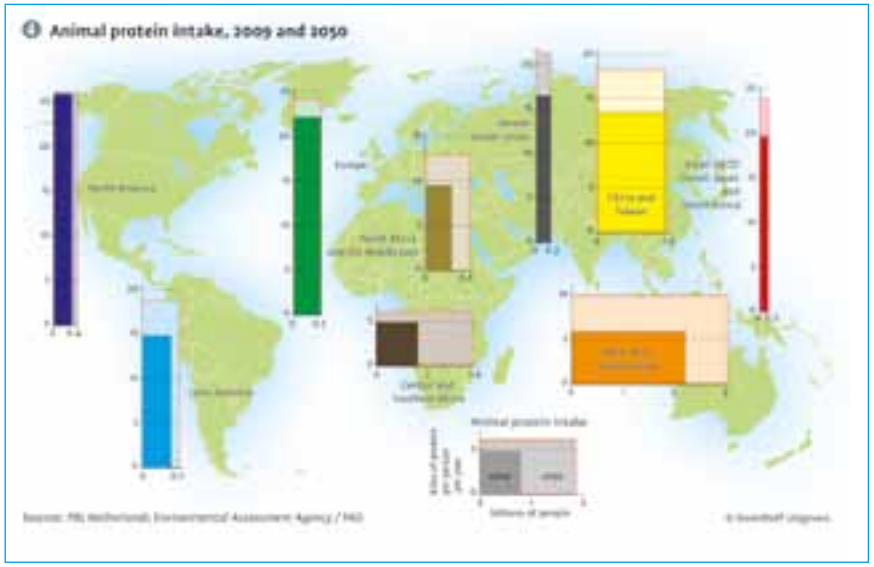
With over 75% of the population living in cities soon, the world will face increasing interdependence. Like the C40 initiative on climate, the urbanizing world may benefit from a joint international (city) initiative to secure Urban Food Security.

Jan Hak
Metropolitan Food Security

OUR VIEW ON *FOOD*PRINT

in 2025

Consumers in western countries are increasingly keen to reduce the psychological distance to their food. They set high criteria for origin, quality and sustainable production. These wishes are at odds with the increased demand for high-quality food that can be expected from the growing global population and rising prosperity levels around the world. Particularly the demand for animal proteins is set to increase significantly in the coming decades.



Keeping the agrifood chain efficient, affordable, sustainable and secure is an increasingly complex challenge. As a result, the prices of commodities remain subject to strong fluctuations. A stronger grip on the chains is crucial. The answer is not to bring the farmer to the city (rooftop greenhouses), but to concentrate even more on producing food where this can be done cheaply, safely and with the lowest possible ecological footprint. That could be 5 km away, but also 5,000 km. Sophisticated food supply logistics are key to achieving this.

The specific food logistics challenge is: connect the chain of producer, retailer and consumer to one another in a sustainable manner. Starting with the consumer. He decides where, when and how he consumes - which calls for a tailor-made service. Combined with the ongoing urbanisation, smart logistical solutions are required from farmer to city. And these solutions are available! The power of an interconnected ecosystem in which such diverse parties as government agencies, food producers, retailers, IT firms and logistical service providers team up with their expertise. That is the road to innovation. The future: controlled urban distribution from food hubs to delivery platforms via unmanned electric vehicles that are powered along purpose-built induction roads.

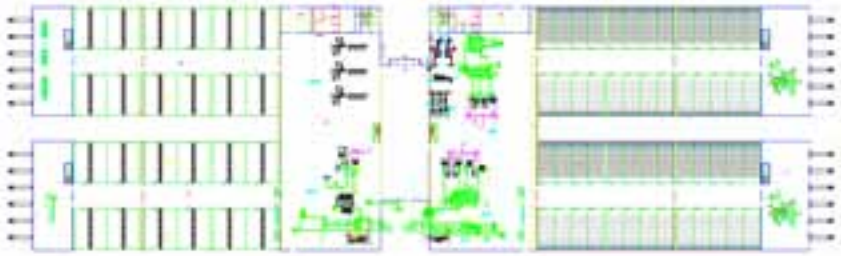
Existing, but as yet unutilised, transport capacity will be mobilised. City dwellers will play a role in their own food distribution. By linking fixed (commuter) routes via Apps to 'on demand' transport flows, we can create sustainable and cheap distribution capacity. Technology and IT are the driving factors that will accelerate the process of eco-innovation. Partnerships will evolve. The result: a chain that offers the consumer what he wants: safe, high-quality and cheap food with a logistical *food*print that is fitting for our world of 2020.

ABN·AMRO

More information:
https://insights.abnamro.nl/en/

EFFICIENT SOLUTIONS

for professionals in the food industry



How can APH Group contribute to “feed tomorrow’s cities”? It supplies knowledge, dedication and technology to both ends of the food chain.

APH Group can deliver the complete infrastructure for vegetable distribution centres. From cold storage to retail packaging it delivers and services the machinery, equipment and installations. Together with partners like construction companies and engineering firms, we can deliver turn-key solutions to the tail end of the food chain.

And early in the food chain, APH Group is present as well. Its knowledge centres “Field Equipment and Irrigation” are at work, demonstrating machinery and equipment to cultivate, plant, irrigate and harvest potatoes and vegetables. Efficient and sustainable production methods are essential in growing our food. And also in this field APH Group tries to find the most efficient solutions for its customers!

Background and track record count when it comes to partnership. With experience in Central- and Eastern-Europe, Asia, Africa and Latin-America, APH Group brings in a wide array of best practices learnt. Its agricultural Dutch background and word-wide outlook makes the group a solid and dedicated partner to setup large scale farming operations and professional distribution centres.

For as the demand for safe food in the world increases rapidly, very rapidly, the food chain will have to develop in tune. With its high knowledge level and integral approach APH Group wants to develop accordingly. With its 4 knowledge centres Field equipment, Irrigation, In-store Solutions, and Engineering it updates its professional partners. By offering integral and innovative solutions is wants to help increase their efficiency. And here helps the group’s own belief in the maxim of Nobel-prize winner Albert Einstein and the APH version of it: E = MC2

A universal value, also applicable to the irrigation, potato and vegetable business: Efficiency for the clients by:

- Increased yields (Mass)
- Improvement of quality (Create quality)
- Decreased costs of usage (Cost of ownership)

That is how the APH Group feels it can contribute to “feeding of tomorrows cities”.

APH Group

More information:
www.aphgroup.com

TASTY POTATO PRODUCTS

Every meal, every day, everywhere

With a history of more than 50 years, Aviko can claim to be well rooted in the European cuisine on processed potato products. In fact, Aviko is Europe's No 1 and has exports to more than 100 countries across the globe. The fine infrastructure within Europe and the port facilities in Rotterdam have facilitated our global market position.

The product portfolio entails French fries and more than 100 other fine frozen potato products.

Aviko takes a very serious approach to the current global challenges. A growing global community with approximately 10 billion mouths to feed in 2050, a growing number of demanding affluent people, more and more urbanization….. On top of this, we all have to deal with the fact that there is a growing scarcity of natural resources, i.e. energy and water supplies. Did you know that potatoes only use approximately as little as 10% of water during the growing season compared to rice? See graphic - Source: waterfootprint.org

Moreover, potatoes are a staple food full of natural nutrients like minerals and fibers needed for a healthy diet.

Aviko is determined to make sure that all people around the globe can get to know and enjoy potato products, in all continents, including people in Asia. It is with this in mind that Aviko has set up a factory producing french fries nearby Beijing. We want to be part of Asia's Golden Age….

Our mission:

Aviko brings pure enjoyment of tasty potato products to every meal, every day, everywhere.

Every day pure potato enjoyment

More information:
www.aviko.com

FOR FOOD. FOR FLOWERS.

For Sure. The certainty of Certhon.

Certhon. Specialist in the design and realization of complete greenhouse construction projects across the globe. Since 1896 its core business has always been the same – building reliable greenhouses and energy-efficient systems.

Certhon is continuously looking forward. Horticultural technology has for decades been solving key issues relating to energy, water and clean food. But by now also globally people are becoming aware of these problems. Metropolitan cities moreover face challenges how to produce food for their increasing number of citizens. Will it be possible to grow all needed food near the city? Will some of it have to be grown within? Projects for local food, city farming, vertical- or urban farming get high on the agenda. So is the need for higher yield, safer produce, lower use of energy and water.

All Expertise under one roof

Certhon believes in total solutions. That's why Certhon has all disciplines in-house to carry out a complete project – from design to execution – fully in line with the client's requirements. The greenhouse or growth chamber, with all its systems and installations, must be the ideal integration of very diverse techniques. The specialists of Certhon coordinate all aspects perfectly in order to create a profitable project for the customer.

Innovation

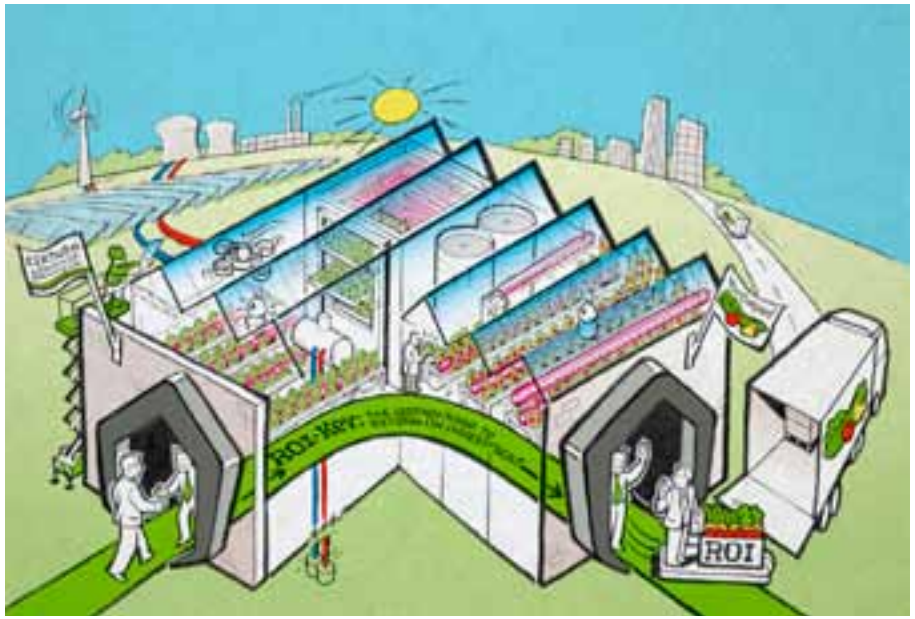
Innovative ideas and solutions help our clients to distinguish themselves from the competition. Solar panels and geothermal energy in Africa, semi-closed greenhouses in France and the US, ground-source heat pumps in South Korea and Multi –layer growth chambers for production or research in The Netherlands and the US– all proven trendsetting projects. Multi-layer cultivation systems are the next step towards developing daylight-free growth chambers. Proof that innovation is in our genes.

From Turn-Key to ROI-Key

Approaching a project with the turnkey concept is no longer sufficient. Certhon is setting the new standard: the ROI key. Your key to Return On Investment. From start to finish, Certhon guides the clients during the key decisions. Consultancy and agronomical support after completion of the project emphasises the ROI-key philosophy..
Our projects are challenging and different, every day. The customers remain the same and expect efficient solutions and a healthy return on investment (ROI).

The certainty of Certhon, regardless of crop or application.

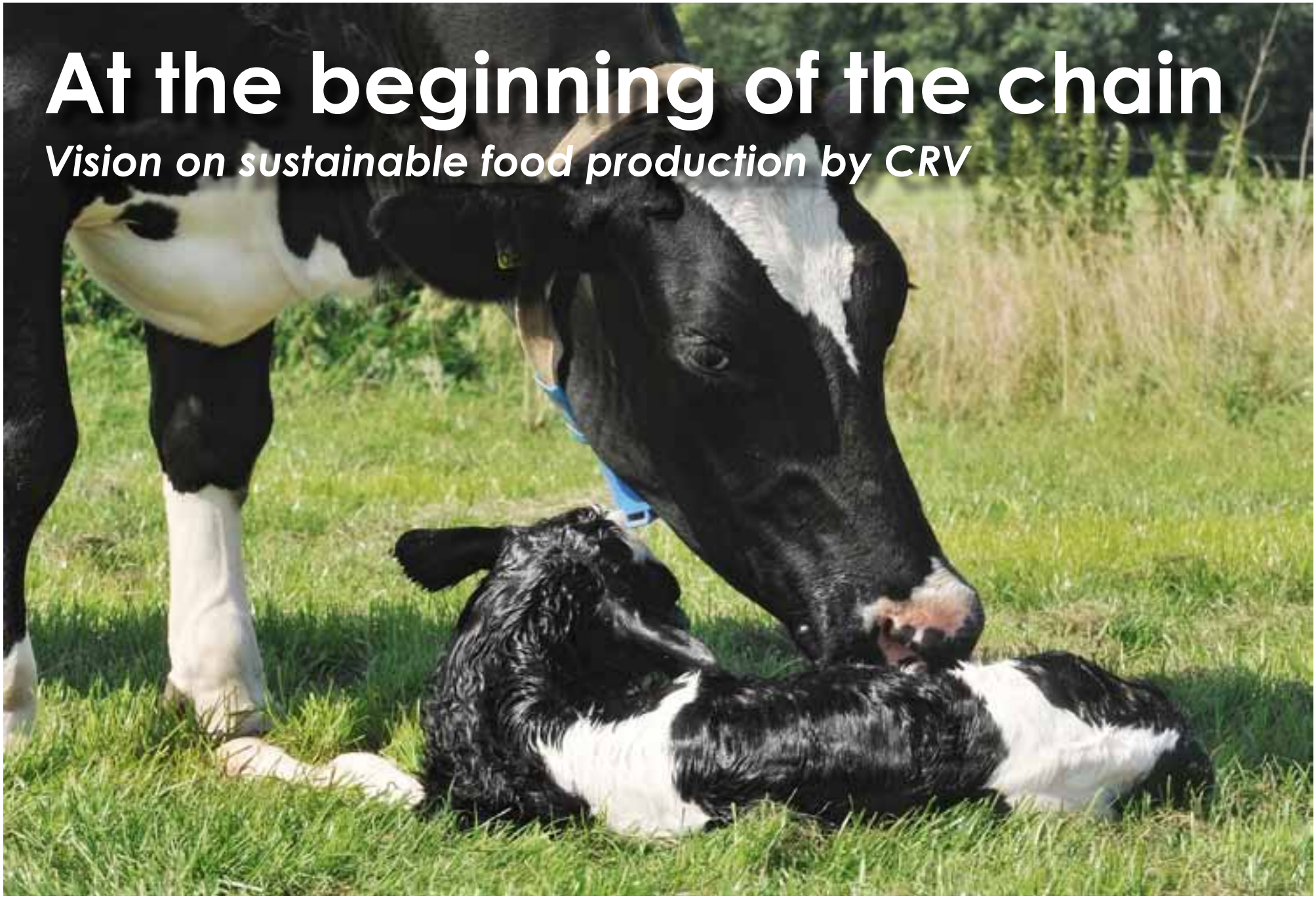
For food. For flowers. For sure.



CERTHON®

Greenhouse solutions

More information:
www.certhon.com



At the beginning of the chain

Vision on sustainable food production by CRV

Genetics and herd management

Looking at today's and tomorrow's world, we see a number of dilemmas that directly affect our and our stakeholders' business. A major dilemma is the growing demand for food for the ever-increasing world population.

Our position in the food chain is a special one, because as specialists in bovine genetics and herd management, we stand at the beginning of it.

We work closely together with farmers, chain partners and other stakeholders to search for ways to achieve efficient production with an effective use of resources, in a socially and environmentally acceptable way.

Responsible innovation

In our focus on sustainable and efficient food production, we haven't lost sight of our responsibility to secure the health, welfare and productivity of the cows and animals that are in our farmers' care. We develop innovative products and solutions to support farmers all over the world, so we have a special responsibility to them and to the animals they rear and care for.

Our breeding programmes utilise the results of the latest advances in technology and farming management techniques. We are adamant that this progress is not achieved at any cost: we are extremely concerned that animal welfare is respected and the intrinsic value of the animal is paramount.

Sustainable dairy and beef

As we are the starting point for sustainable beef and dairy production, we help our customers, the farmers, to breed and manage herds that have the capacity to meet the growing demand for food, sustainably.

By enabling the breeding and management of healthy animals that live longer, we ensure a combination of greater animal welfare, efficient resource use and an improved return on investment. This is a win-win situation for all our stakeholders.

By carefully combining all these elements, we serve both our farmers and our planet, achieving sustainable dairy and beef production.

CRV

More information:
www.crv4all.com

PROACTIVE APPROACH

The world's finest

Dutch Horticulture is one of the most dynamic sectors of agricultural production in Europe, if not worldwide. A remarkable fact: the sector largely consists of family owned businesses. Sometimes companies are small and niche market targeted. Sometimes they are bigger, even quite substantial with dependencies elsewhere in Europe or the world.

Part of their success is explained by mutual cooperation. Jointly they try to develop new approaches. Jointly they try to respond to the challenges of a growing world population. Emerging markets in particular in Asia, Africa and Latin America are facing massive growth of their cities and the corresponding surge in demand and scarcity of resources.

Scientists predict that rising urban income may lead to a rise in demand of animal proteins.
Equally probable is a rise in demand of high quality horticultural produce, well taken care of in transport, handling and distribution.
This implies respect for standards of food safety and high sustainability criteria in the production process. The use of scarce water resources is a case in point. So is the use of pesticides, which in Dutch growing practice has largely yielded to biological pest control.

The Dutch Horticulture Trade Board (DHTB) is an expression of this tradition of cooperation.

In line with present policy thinking in the Netherlands, the Board generates international public-private partnerships where business experience and scientific knowledge can be usefully combined. Where locally horticultural products are improved and new varieties and practices introduced.

Focus of DHTB

The main themes of DHTB's focus are:

1. Fresh Food Networks (feeding cities)
2. Liveable, healthy cities (greening cities)
3. Adaptive innovation (smart local innovation)

Ad 1) Fresh Food Networks (feeding cities) refers to the issue of chain-management that comes into play when entering a foreign market. Local production and sale is often quite possible. Proper completion of the marketing chain, however, and of the entailing network almost always encounter major practical bottlenecks. Dutch companies, actively working on this item are a.o. Priva (China), Hoogendoorn (Mexico) and Holland Knowledge Center/ Lentiz (Poland).

Ad 2) Liveable, healthy cities (greening cities)
Urbanization is a continuous and autonomous process. However, it is not obvious that the " green" (landscaping) component grows accordingly. Nevertheless, it is an important aspect of the wellbeing of the urban population. Greening is an issue that has been put high on the agenda of FloraHolland and of tree nursery and bulb companies, such as Artemis, and their branch organization Anthos.

Ad 3) Adaptive innovation (smart local innovation) In many respects Dutch horticulture is quite high tech. Not always its technology level fits the situation of demanding countries. In those countries it is important to develop the technological capabilities gradually, based on the local conditions, applying and prolonging the technology and knowledge of the country itself. Ridder/Hortimax is an example of a company that specifically focuses on this subject.

The Dutch Horticultural Trade Board in this context helps to stimulate international consortium building. By preparing leads and formulae for consortia constructions it tries to position local companies best for international business.

Greenport Holland
Dutch Horticulture Trade Board

More information:
www.greenportholland.com

DUTCH POULTRY CENTRE

Serving the poultry planet by the Dutch approach

The world's finest

The Netherlands has an excellent international reputation as a poultry country. Producing top quality poultry meat and eggs with guaranteed food safety, at a competitive cost price takes a great deal of expertise and knowledge. Dutch Poultry Centre is the network organization of almost 100 Dutch companies active in the poultry sector. They are our Preferred Partners, the world's finest innovators in their field of expertise within the poultry production chain: animal housing, breeding & hatchery, feed, feed ingredients & additives, healthcare, processing and meat & egg production.

Mission

Dutch Poultry Centre's mission is to share quality, knowledge and innovation of its Preferred Partners on a worldwide scale and contribute to create business opportunities for them. Our Preferred Partners cooperate and co-create for the benefit of innovations in the poultry industry. By joining forces and strengthening the reputation of the Dutch poultry sector, we try on a worldwide scale to be the portal for expertise where farmers and companies can find solutions for their businesses: from building a poultry meat- or egg production facility, building high-tech housing to designing state-of-the-art slaughterhouses.

Dutch Approach

In each segment of the production chain our Preferred Partners are showcasing the 'Dutch Approach'. This is an integrated approach towards the production chain in which every link has an effect on the others. Food safety is the first link of the chain. Animal health and wellbeing is another. Dutch companies have a strong international focus and able to match prevailing circumstances in local situations with the quality requirements of the international market. They know how to add value and further improve the international poultry production with a clear view on consumer needs in terms of product safety and taste.

DUTCH POULTRY CENTRE

More information:
www.dutchpoultrycentre.nl

CHALLENGE OF URBANIZATION

For the food industry

Urbanization is a global trend. Therefore also prevalent in the emerging economies as their population becomes more wealthy, as relevant UNFPA data confirm. The Economist already predicted in 2012 that by 2050 about 64% of the developing world and 86% of the developed world will be urbanized.

Hand in hand with the increasing urbanization, dietary profiles will almost certainly profoundly change. As the adoption appears likely of a more Western food pattern, for significant parts of the population it will mean a change from too little food to too much processed food rich in energy and poor in nutrients.

As their economies grow and a welcome affluence spreads, this change of dietary behavior will confront Asian countries such as China and India or countries in Latin America with similar health problems as presently the Western World: Obesity, diabetes, cardiovascular disease etc.

Powerful nutritional solutions will therefore be required to provide appropriate, healthy food to the increasing populations in the cities. We see it as a duty for the food industry to engage in providing such food and develop corresponding food products; nutritious food high in (micro)nutrients and low in fat, sugar and calories. And food supplements to address the gaps.

It's the role of governments to provide the appropriate regulatory framework; to allow for appropriate innovative solutions and to make sure that the required standards are met in order to protect the consumers. And last but not least also the consumer will play a crucial role. As they encounter novel product solutions they need to be educated or orient themselves to be able to make the appropriate health-conscious choices.

In summary all key stakeholders throughout the food and nutrition value chain have to take responsibility to align and act collaboratively in order to successfully overcome the nutritional challenges of urbanization.

DSM and WFP partnership: Improving nutrition, improving lives

Both DSM and The United Nations World Food Programme (WFP) envision a world in which everyone benefits from the right nutrition. They share a belief that Public Private Partnerships are an effective way to achieve this aim. DSM has set up a partnership with WFP in 2007: DSM brings nutrition expertise, R&D and product formulation to the partnership, while WFP operates on the front line in the fight against malnutrition in the developing world, providing critical interventions to vulnerable populations. Through the partnership with WFP, DSM products are now helping to improve the nutrition of more than 25 million people each year particularly in Asia and Sub-Saharan Africa focusing on mother and child initiatives and school-feeding programs.

DSM
BRIGHT SCIENCE. BRIGHTER LIVING.

More information:
www.dsm.com

SMALLHOLDER FARMERS

Feed the World

The story of East-West Seed

After Dutch Seedsman Simon Groot resigns from the family-owned seed company in the early 1980's, he decides to apply his knowledge of seed breeding to tropical vegetable breeding.

On an earlier business trip to Indonesia, he had seen that local smallholder farmers were hardly able to support their own families, let alone make a profit. Simon Groot used his experience to provide the knowledge, technology and good quality seeds that were lacking to produce high quality crops and create a profitable business.

In the 33 years that followed, East-West Seed has developed into a world-class vegetable seeds company. It's seeds and knowledge have helped millions of smallholder farmers in the tropics to develop profitable businesses, after years of poverty. They have become entrepreneurs that contributed to the remarkable economic growth of Southeast Asian countries.

East-West Seed serves farmers with better seeds for better yield

East-West Seed helps to improve the income of farmers in tropical areas. We produce the seeds and provide the knowledge and technology that enable tropical vegetable farmers to increase their production and the quality of their crops. Vegetables realize higher value and profits than other crops. This makes vegetable farming attractive for farmers in urban areas, where land is scarce and expensive.

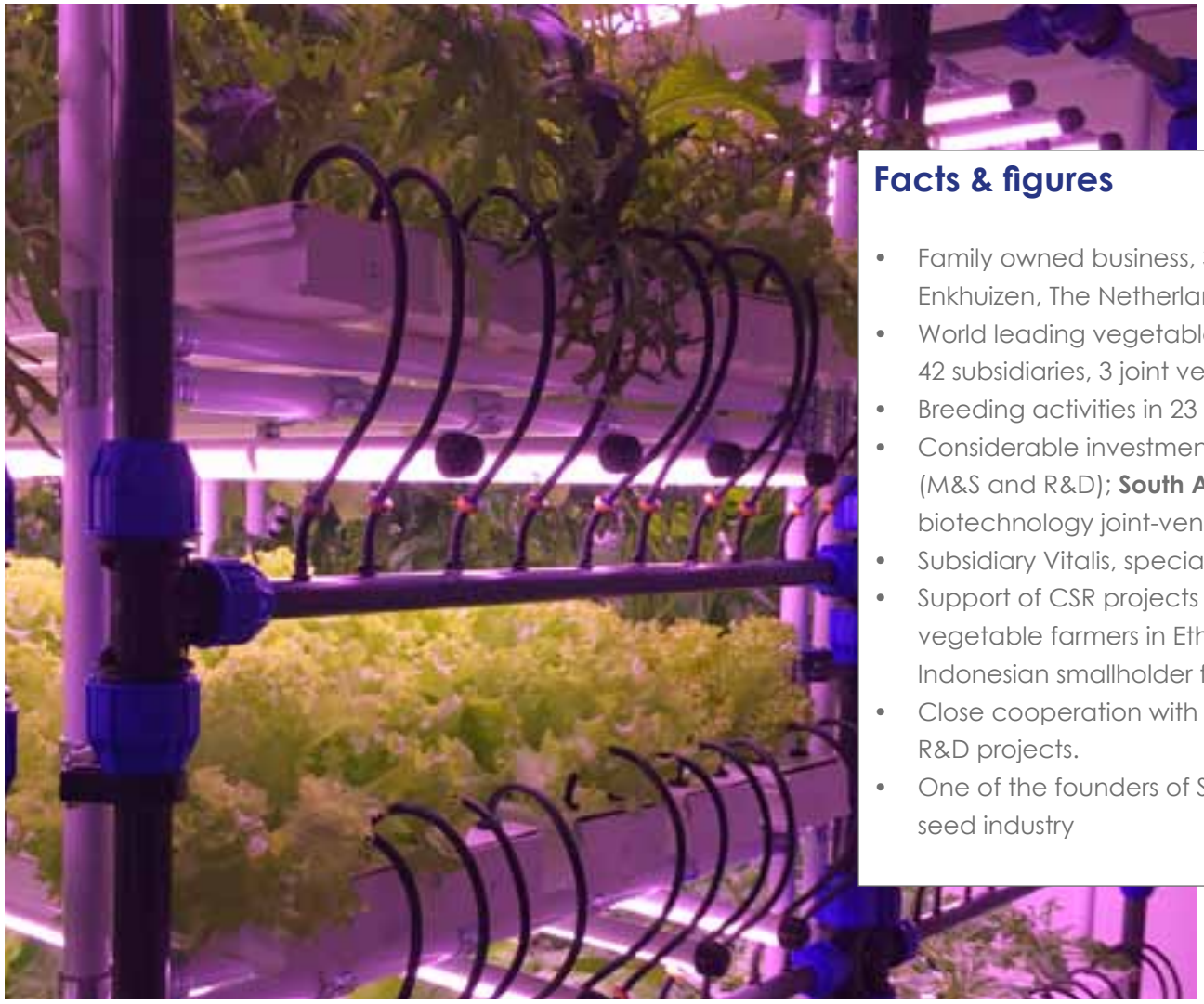
East-West Seed breeds tropical vegetable varieties that leverage the highest yield and quality in tropical conditions. Our extension workers share best practices with farmers that help them to improve their farming methods and production.

Our headquarters are located in Bangkok, Thailand, with subsidiaries in the Philippines, India, Indonesia, China, Guatemala, Tanzania, Vietnam, and Myanmar.

EAST-WEST SEED

More information:
www.eastwestseed.com

BREEDING TO FEED THE WORLD



Facts & figures

- Family owned business, 3rd generation, founded in 1938 in Enkhuizen, The Netherlands
- World leading vegetable breeding company, 2.000 employees, 42 subsidiaries, 3 joint ventures in 24 countries
- Breeding activities in 23 crops, total number of varieties 1.100
- Considerable investments in markets like: **China**: 3 stations (M&S and R&D); **South Africa**: 2 stations (seed production and biotechnology joint-venture Westcape)
- Subsidiary Vitalis, specialised in organic seeds
- Support of CSR projects around the world: **Fair Planet:** supporting vegetable farmers in Ethiopia; **Yayasan Foundation:** supporting Indonesian smallholder farmers
- Close cooperation with worldwide universities and institutes for R&D projects.
- One of the founders of Seed Valley, the epicentre of the Dutch seed industry

For over 77 years, family owned company Enza Zaden breeds vegetables attuned to the specific needs of the market and climate conditions. The breeding company provides people access to healthy, varied vegetables worldwide.

Enza Zaden believes that feeding the world starts with the right varieties and the right seeds. Through the decentralized, multi-local approach the company empowers employees to make a difference.

Enza Zaden's breeders are strongly committed to create added value like increased productivity, disease resistance, nutritional value and authentic flavours using the latest technologies available. Its varieties are developed for open field, greenhouses and hydroponic systems like vertical or city farming.

The results?

Worldwide higher production of quality vegetables, an increasing sustainable agriculture and a healthier, more varied vegetable assortment for the consumer.

ENZA ZADEN

More information:
www.enzazaden.com

FLOWERING THE WORLD

Planting Seeds of Opportunity for our Members

FloraHolland is the world's largest cooperative of plants and flowers. In 2020, the year of Floriade, floriculture will be blossoming. Plants and flowers, even more than they currently are, will be the way for consumers to express their emotions. Flowers, with their exuberant forms and vibrant colours, are expressions of beauty and feelings. Plants contribute to an attractive and healthy living environment. They give character to cities and grace the inhabitants with surroudings of beauty and pleasure.

FloraHolland is for many the center for innovation, knowledge of consumer behaviour, and knowledge of the floriculture supply chain. Professional parties in floriculture acknowledge us as the number one marketplace and knowledge partner - in 2020- as they already do now.

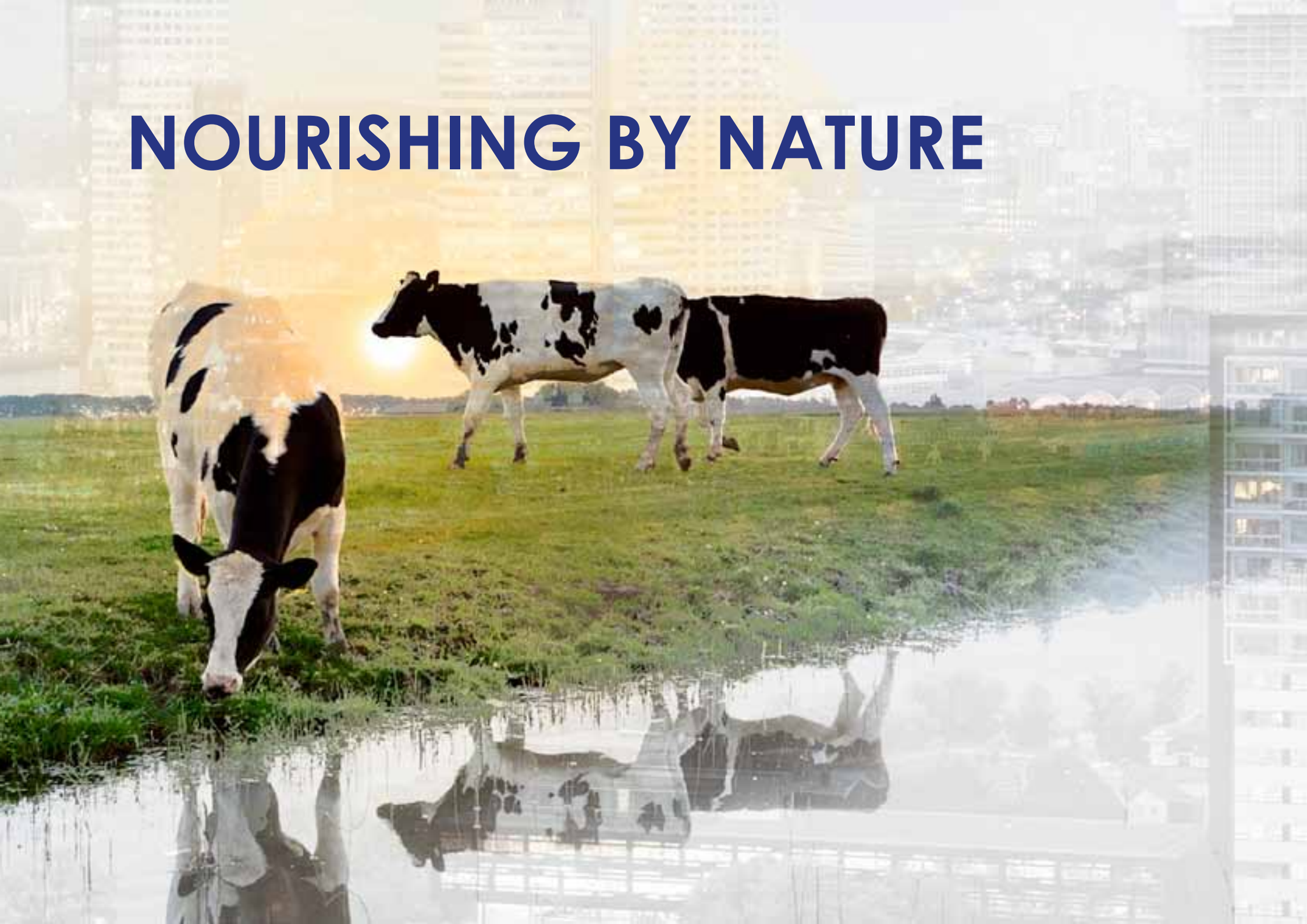
Our cooperative

The world around us is undergoing profound changes. Some things, however remain as they have always been. In 1911, growers decided to combine forces to achieve the best possible market positioning for their products. Since that beginning, our cooperative has developed into a global marketplace. The cooperative provides opportunities - and protection - in good and bad times. Together we are strong, together we can find partners to compete and cooperate with: FloraHolland is a cooperative and primarily of, by and for its members. But we are only successful when not only our members but also their customers and our connected suppliers are doing well.

FloraHolland

More information:
www.floraholland.com

NOURISHING BY NATURE



The majority of the future consumers of FrieslandCampina will live in one of the megacities in Asia or Africa. Food-security and safety will be an important topic given future risks of scarcity of food. If current trends are an indication a person will not only be interested in the food quantity and safety but also in its convenience and quality in terms of health. An increased interest in preventive healthcare and persistent demand for convenience will completely change the way people choose, order and prepare their food. Is 3-dimensional food printing ever to be a practicable solution?

As indicated by the FAO, to safeguard food and nutrition security for the growing world population, it is important for people to start to consume a sustainable diet A sustainable diet is a healthy diet, adequate in nutrients and energy, with a low environmental impact. Sustainably produced dairy products are part of a balanced healthy diet. Milk, by nature, contains essential nutrients, such as proteins, vitamins B2 and B12 and minerals such as calcium. A rural dairy sector around cities will contribute considerably to fill the gaps in the local food requirements.

It is FrieslandCampina's purpose to nourish by nature, to provide better nutrition to the world and to secure a good living for its member-farmers for now and for generations to come. Every day millions of consumers around the world enjoy FrieslandCampina's innovative and tasty dairy products. We strive to fight malnutrition with our products but also with school milk programs and the Drink.Move.BeStrong campaign that encourages an active lifestyle amongst children in South-East Asia.

FrieslandCampina aims to limit the pressure on natural resources and the environment for the next generations. Dutch dairy farming has a high standard with its high quality products, and with a low CO2equivalent emission per liter milk compared to the world average. And with the cooperative model which is often at its origin and aims to ensure a good living for the member-farmers involved.

By offering trustworthy and tasty dairy products FrieslandCampina wants to help safeguard food and nutrient security wherever the opportunity arises.

FrieslandCampina

More information:
www.frieslandcampina.com

TURN KEY COLD STORES

Worldwide

Our markets:

- Food industry:
  meat, fish, bakery, sweets
- Agriculture:
  vegetables, fruit and potatoes
- Flowers and flower bulbs
- Logistics: distribution storage
  at airports, sea harbors and
  road transport
- Laboratories

Our products:

- Cold stores
- CA/ULO cold stores
- Freezer stores and blast freezers
- Industrial Refrigeration solutions
- Doors
- Isolation panels
- PLC controls with application
  specific software

To get fresh produce you go to your butcher, supermarket or fish shop. And for colorful and scent full flowers to your flower shop. Not without reason they call themselves specialists in fresh produce. Actually we make sure, together with you, that they can label themselves as such. When in the morning the flowers, vegetables, fruits and potatoes come from the land, the fish has just been caught from the sea and the meat is being cut, our work starts. From that moment onwards we create the best available conditions to store and process fresh produce to keep it fresh a long time. In doing so, the produce is displayed in retail in optimum condition of freshness. With the best possible shelf life. And the consumer gets what he or she came for.

Geerlofs Refrigeration combines knowledge of fresh produce with engineering expertise. Our people have a vast experience in designing and building turnkey cold stores worldwide. Not to forget: 80 years of experience that builds a cold store or freezer cell for you.

GEERLOFS
part of the smeva refrigeration group

More information:
www.geerlofs.com

APPLIED SCIENCE

Never in the history of our planet has anything been more urgent

Our existence depends on the availability of safe and healthy food. A growing world population needs to be fed, growing cities need to be managed. In many places we are already running against the limits of what the earth can provide.

Dutch green education institutions believe that we can come up with the solutions to produce more and better food using fewer resources. We want to share our knowledge, our expertise and our experience.

We work closely together with partners in the food chain and have developed our connections abroad and overseas. Foreign students enroll in our courses. Abroad we team up with
our counterparts in traineeships, joint programmes and exchanges. And we are ready to do the same in projects generated by our partners in business. Let's try the experience.

…for we know that practical oriented education is the key!

Learn, act and produce sustainably

On a planet with seven billion people, the way in which our food is produced leaves little room for error. The supply of large urban conglomerates therefore requires particular attention and serious applied research.

That is why the Aeres Group's universities and institutions aim to help find forward-looking solutions for the complex food-related problems of our time. In cooperation with partners on all continents we provide education and consultancy services and cooperate in projects in the field of agricultural production, chain management and land management.

Our students and teachers travel the world. The world looks also to us for answers.

aeres groep

More information:
www.aeresinternational.nl

Growing without daylight

The Dutch HAS University is proud of its facilities for plant production, especially its state-of-the-art water culture systems, HPS greenhouses, LED top and interlights and its LED equipped climate chambers for growing without daylight.

HAS shares its experience in horticulture and vertical farming with students and industrial partners and develops new knowledge with companies like Philips, Priva and Rijk Zwaan. In the BrightBox-Venlo we work in close cooperation with partners like Botany and Philips.

HAS University is a participant in international projects like Nethwork in Central America and Fresh Academy in Vietnam. Our 'Growing without daylight' course is available as an online course in English.

has hogeschool

More information:
www.hashogeschool.nl

We supply the cities of Europe

The Netherlands was the first country in the world with more people living in town than in the countryside. Consequently the Dutch had to learn at an early stage how to feed and manage their cities. Today we supply and feed cities throughout Europe by road or through our main ports Rotterdam and Amsterdam.

Inholland's applied science universities combine their expertise in urban farming to address problems in local-for-local, street food, vertical farming, urban agriculture, city logistics, food safety and waste.

InHolland believes that by sharing expertise of this kind we can establish a worldwide knowledge pool and contribute to sustainable and robust urban and food systems.

inholland university of applied sciences

More information:
www.inholland.nl/inhollandcom/

A new kind of learning environment

Van Hall Larenstein uses the concept of the Living Lab to find solutions with which we can radically redesign metropolitan agricultural value chains and business models. This redesign demands collaboration and mutual learning of knowledge workers, entrepreneurs, social organizations and government.

The Living Lab is a new kind of learning environment and a promising instrument that can be used to bring about innovation in the agri-food sector. Living Labs, originally developed in ICT, create new and essential competences.

Van Hall Larenstein University of Applied Sciences has developed Living Labs in metropolitan areas in Pune India, Macedonia, Serbia and The Netherlands

Hogeschool VHL University of Applied Sciences

More information:
www.vhluniversity.com

Hands-on and practical

Lentiz Education Group specializes in green vocational education. Our business is modern agriculture, improving yields and efficient production. The approach of our teachers and instructors can best be characterized as hands-on and practical. But high-tech is very much part of the training, adapted to local needs and facilities.

The Lentiz Education Group offers a worldwide and extensive network in horticulture, floriculture, food processing and supply & cold chain management.

Lentiz has partners in China, India, Japan, Oman and India, is associated with Food Tech Holland and Greenport Holland International and participates in the Dutch Human Capital Agenda and Greenport Horti Campus. Lentiz is an accredited BTEC-provider.

Lentiz | onderwijsgroep

More information:
www.lentiz.nl

SMART HORTICULTURE FOR FRESH FOOD








Horticulture has its origin in feeding cities. Initially there was a direct connection between the city and the nurseries in the nearby villages. Crop specialisations amongst growers, technological innovations in seeds, new greenhouses and growing systems, efficient storage and distribution systems changed the way the horticulture and cities interrelated. Focussing on export markets became the prevailing model for many years. Yet both mature and emerging markets are looking for new business models to serve the customer. Local for local, sustainability and customisation are business drivers making horticulture return to its old tradition of feeding cities however in a much more complex environment than in the past.

Customers worldwide are expecting fresh produce in a wide variety of products and according to the latest food safety standards. This make the business requirement for today's entrepreneurs and organisation in horticulture complex and challenging. How to meet the demand, how to compete with international suppliers, how to meet the highest standards. That can only be done with a distinguishing strategy, a high performance organisation, a clear market position and last but not least a sound business model. It is our purpose to serve you with the highest standards in strategic consulting, organisation performance and business modelling. With our wide and in-depth experience in horticulture and our excellent network we can make your business grow.

Our expertise in food business is also recognized by policy-makers. Recently we executed an in depth study of the food sector around the city centre of Rotterdam, investigating the structure and opportunities in modern food supply. Part of the results of this study on behalf of the city of Rotterdam is public and can be found at **www.cityforliving.nl.**

Curious to meet our experts and become a member of our network?

See our website or order the Hillenraad100 magazine showing the top 100 leading companies in horticulture, our daily work and field of expertise.

Hillenraad
Partners

More information:
www.hillenraadpartners.nl/en

LED GROWN

vegetables and food logistics

A flourishing cooperation between businesses and the Amsterdam University of Applied Sciences (AUAS)

The Amsterdam University of Applied Sciences (AUAS) implements research on the topic of sustainable urban food supply. Its Urban Technology Research Program combines various disciplines: Technology, innovation, logistics and urban development. After all, reliable urban food supply depends on both smart technology and business concepts as well as logistics and spatial planning. Projects often reflect business cases and societal opportunities.

Research takes place in intensive cooperation with businesses. Together with companies, such as Philips, we develop innovative plant cultivation systems that make efficient use of space, resource materials and energy in the city. Small flexible grow modules are equipped with climate control and Power LEDs. They enable multi-layer cultivation, nutrient reuse and recovery from organic waste.

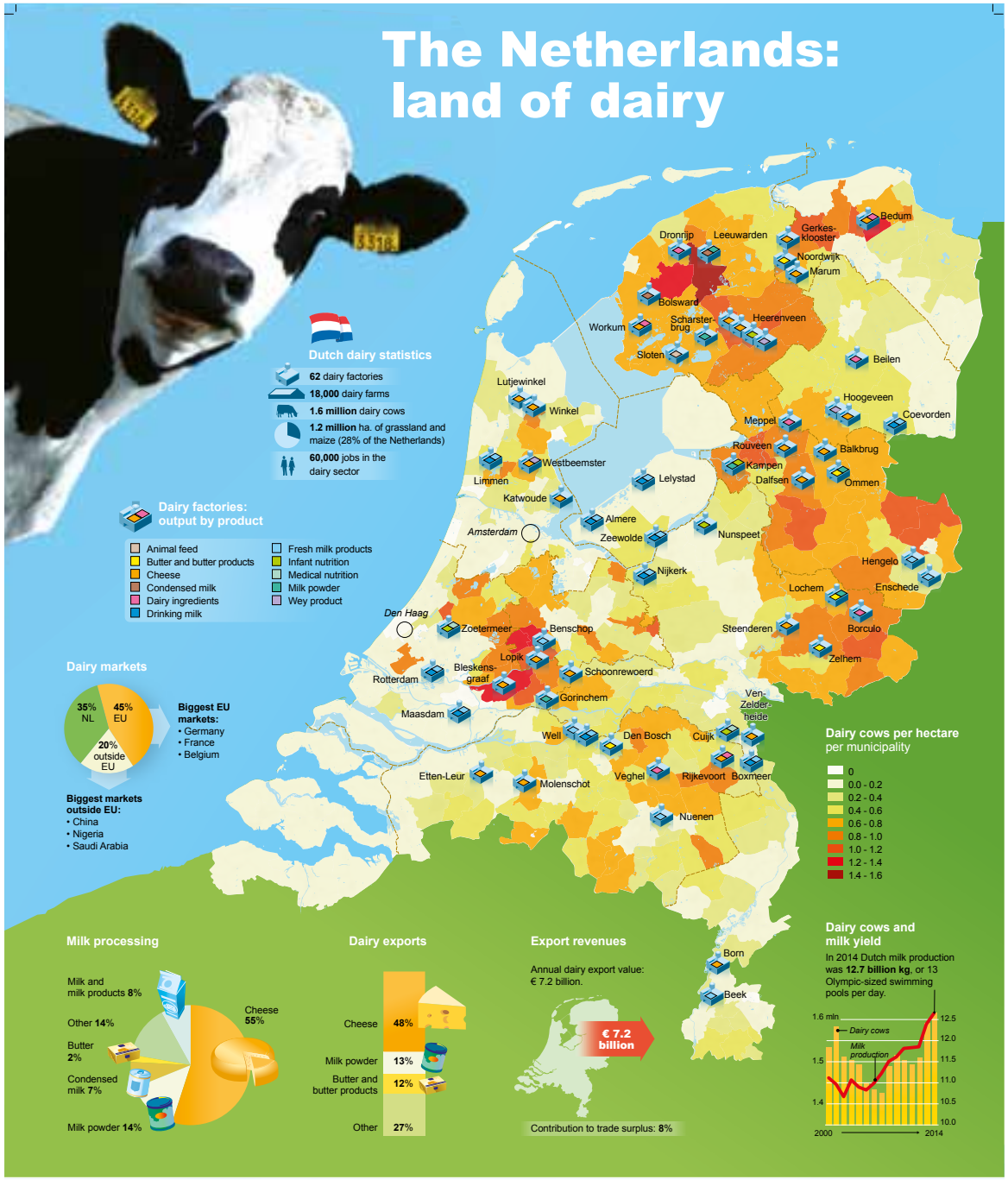
Efficient distribution of fresh food can be a challenge to companies that target consumers, the retail industry and the hospitality industry in densely populated cities. Within the cluster Agri/Food of the municipality of Amsterdam, we therefore work on a logistics roadmap.

Together with food processing companies such as Verkade and IOI Loders Croklaan we are exploring ways to sustainably supply the food processing industry in the future.

Students at AUAS profit from this type of cooperation. Through project assignments, internships and graduation projects, their work often results in innovative products and services.

Hogeschool van Amsterdam

More information:
www.hva.nl

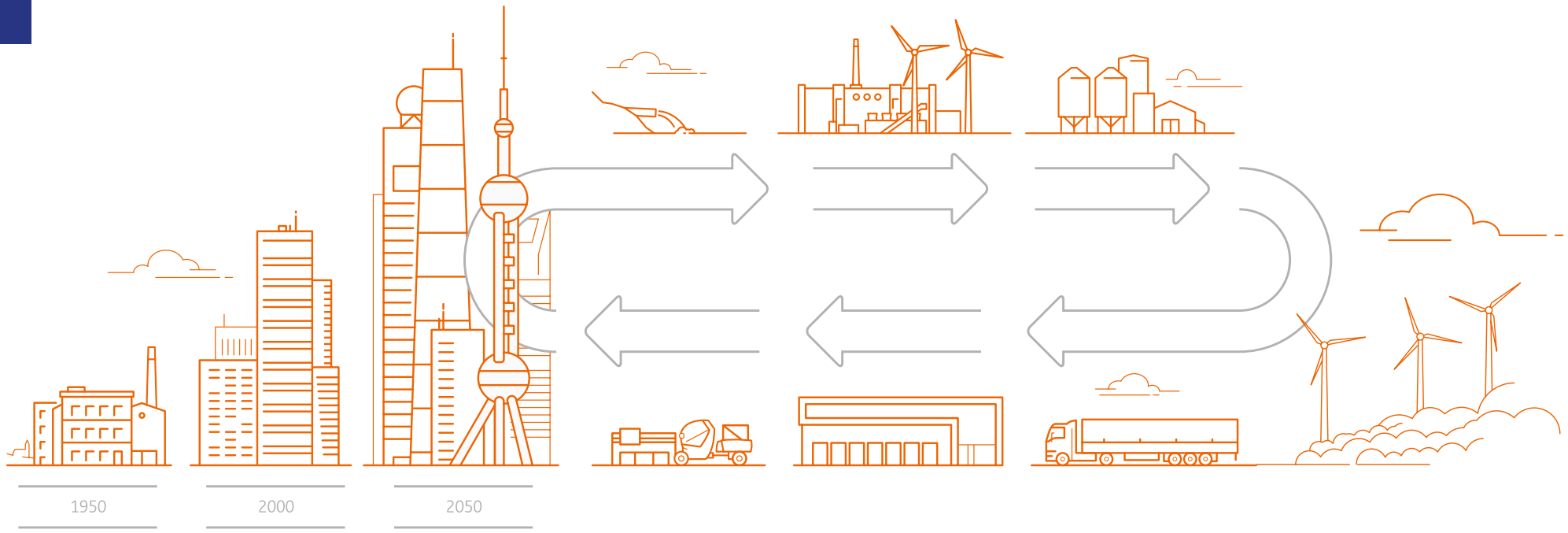


nzo

nederlandse zuivel organisatie

More information:
www.nzo.nl

Investment in efficient food systems



A growing, and increasingly urbanised, population is one of the defining trends of the 21st century. There are already 7.7 billion people in the world: the population will reach 9.5 billion by 2050, increasing demand for food and putting pressure on already stretched resources. Over the same period, the number of people living in cities will grow from 54% of the world's population or 3.4 billion people to 66% or 6.3 billion people.

Meanwhile, the percentage of people defined as middle class will rise from 23% – or 1.8 billion – to 52% or 4.9 billion people. "More affluent people consume more," explains Jurjen Witteveen, economist at ING. "Moreover, they usually consume products, such as red meat, that are more resource intensive than their previous diet."

These trends create a significant challenge for the world's governments, corporates, farmers and citizens. However, there are steps that can be taken to ensure the world's cities can feed themselves in the future.

"Governments have an important role to play in changing consumption patterns," says Witteveen. "For example, China's government is encouraging potato consumption rather than rice because potatoes require less water to grow." His colleague Marco Gulpers, Corporate Finance, Sector Head Consumer & Agri, adds: "Many governments are favouring chicken consumption as chicken has a feed conversion ratio of 2-to-1 – it takes 1.8kg of grain to produce 1kg of meat – compared to red meat's 9-to-1 ratio."

Technology and best practise can also help to increase yields. "Farming practises have not evolved in some countries. Multinational corporations, in the dairy industry, for example, are helping local farmers with techniques and technology in developing countries like Russia and China to secure supply of fresh milk," says Pieternel Boogaard, Structured Finance, head of Food&Agri Europe. "Countries such as the Netherlands have extensive knowledge of latest technologies in production, mechanisation and intensive farming that they can share with emerging market countries. In addition, retailers are driving innovation and …… the increased need of distribution centers and logistics to help feed tomorrow's cities."

More information:
ING Commercial Banking
www.ingcb.com

PARTNERS WITH NATURE

In order to feed the projected 9 billion people by 2050, farmers will need to produce more food with less input while maintaining and protecting natural resources. This is where biological and sustainable crop protection solutions can play a vital role.

For a number of years already our company prides itself with its quality reputation in greenhouse horticulture, where it provides the micro-animal husbandry that pollinates and combats invasive disease.

Koppert's most recent innovations focus on increased overall plant wellbeing in open field agriculture as well as protected agriculture. We have researched ways to increase the availability of beneficial microorganisms that have become scarce in many soils as a result of over-fertilization and intensive agriculture. Our microbial solutions increase crop resilience, improve access to nutrients, and result in improving soil quality. Farmers who have applied them realize higher yields and better quality crops. Following the initial years of research and testing, we introduced our first microbial product line for large-scale agriculture in 2015.

Sustainable and ecologically responsible agriculture has a direct impact on all our lives and the planet. Koppert Biological Solutions aims to make cultivation healthier, safer and more productive now and in the future.

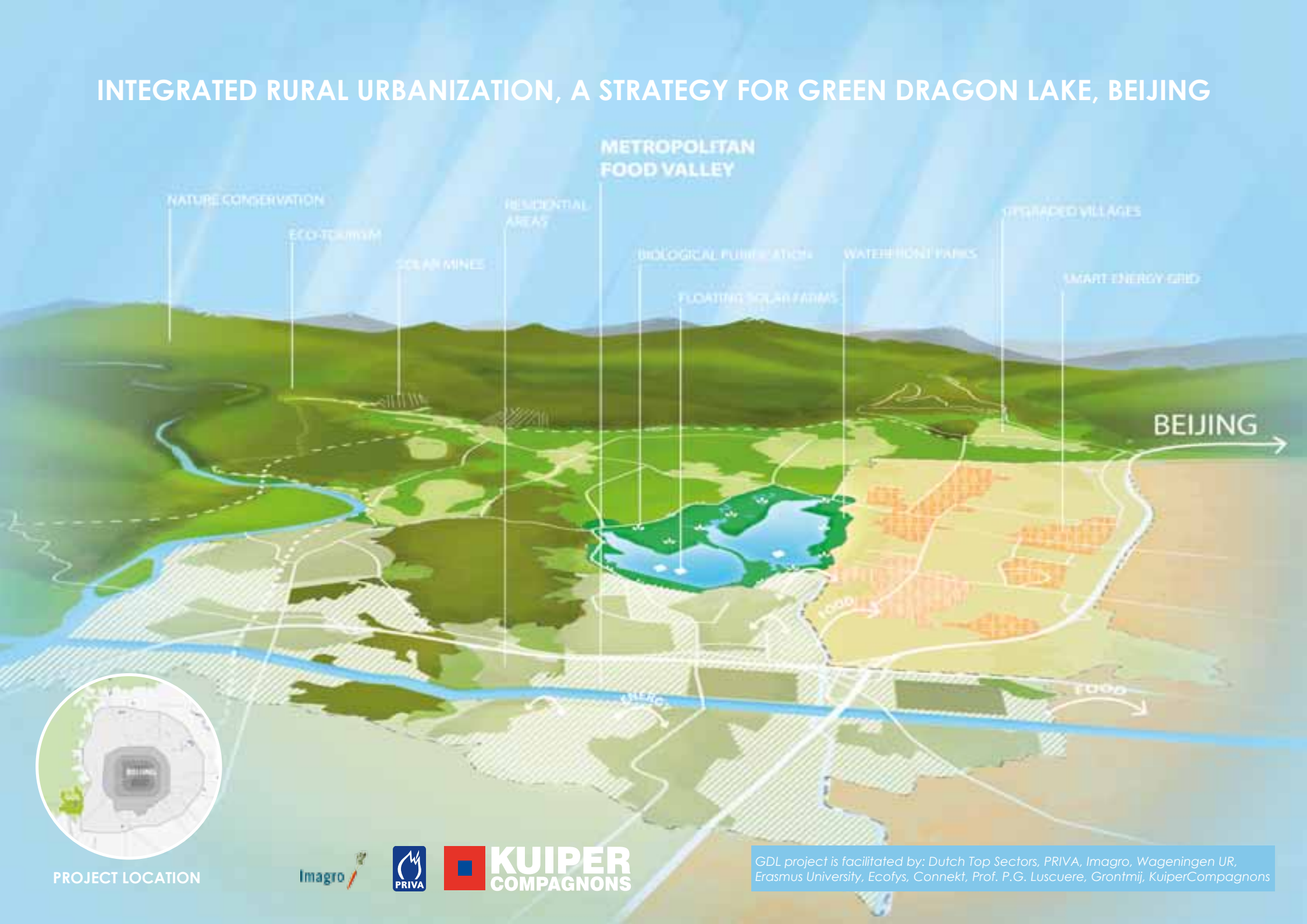
As our cities grow on some of the world's most fertile areas, so the agricultural land in those regions shrinks. Koppert Biological Systems is dedicated to maximizing the yield of the remaining agricultural areal, and contribute to a healthy planet that can provide for present and future generations.

KOPPERT

BIOLOGICAL SYSTEMS

More information:
www.koppert.com

INTEGRATED RURAL URBANIZATION, A STRATEGY FOR GREEN DRAGON LAKE, BEIJING



PROJECT LOCATION

GDL project is facilitated by: Dutch Top Sectors, PRIVA, Imagro, Wageningen UR, Erasmus University, Ecofys, Connekt, Prof. P.G. Luscuere, Grontmij, KuiperCompagnons

Integrated Rural Urbanization

This project entails a conceptual strategy for an area of 122 km2 at the edge of Beijing, called Green Dragon Lake (GDL). China Development Orient desires to sustainably develop this area, while creating new business opportunities between China and The Netherlands.

By 2025 70% of all Chinese will live in cities with more than 1 million inhabitants and there will be over 200 of such cities in China by 2030. Beijing in particular has challenges to achieve Food Security, therefore reliably and highly efficient food production in adjacent areas is required.

A Dutch consortium of Top Sectors, universities and companies developed a conceptual strategy as a first step for this new Sino-Dutch cooperation. The team proposes integrated solutions, innovations and proven technology from The Netherlands to be applied in GDL. The aim of this conceptual strategy is to focus on innovative yet pragmatic olutions that are profitable for both China and the Netherlands. A new equilibrium between city and landscape is achieved, this is called Integrated Rural Urbanization.

Harvest the Future

One of the major themes of the GDL project is to harvest the future. This means to utilize next-level agricultural technology from The Netherlands for GDL. First, high-tech greenhouses produce the maximum amount of fresh food with minimal resources and land surface. Second, the greenhouses reuse grey water and provide excess heat to the residential area. Finally, the fresh food is directly processed and distributed in proximity of the greenhouses. Thus Beijing residents will be able to enjoy fresh GDL products every day.

GDL will focus on vegetable and wheat production, dairy products and agriculture education. Production of food is transparent to the public and people will understand the origin of their food. This increases environmental awareness among city residents.

In short, GDL will create value for China's green economy by efficient and market responsive food production in a high quality living environment.

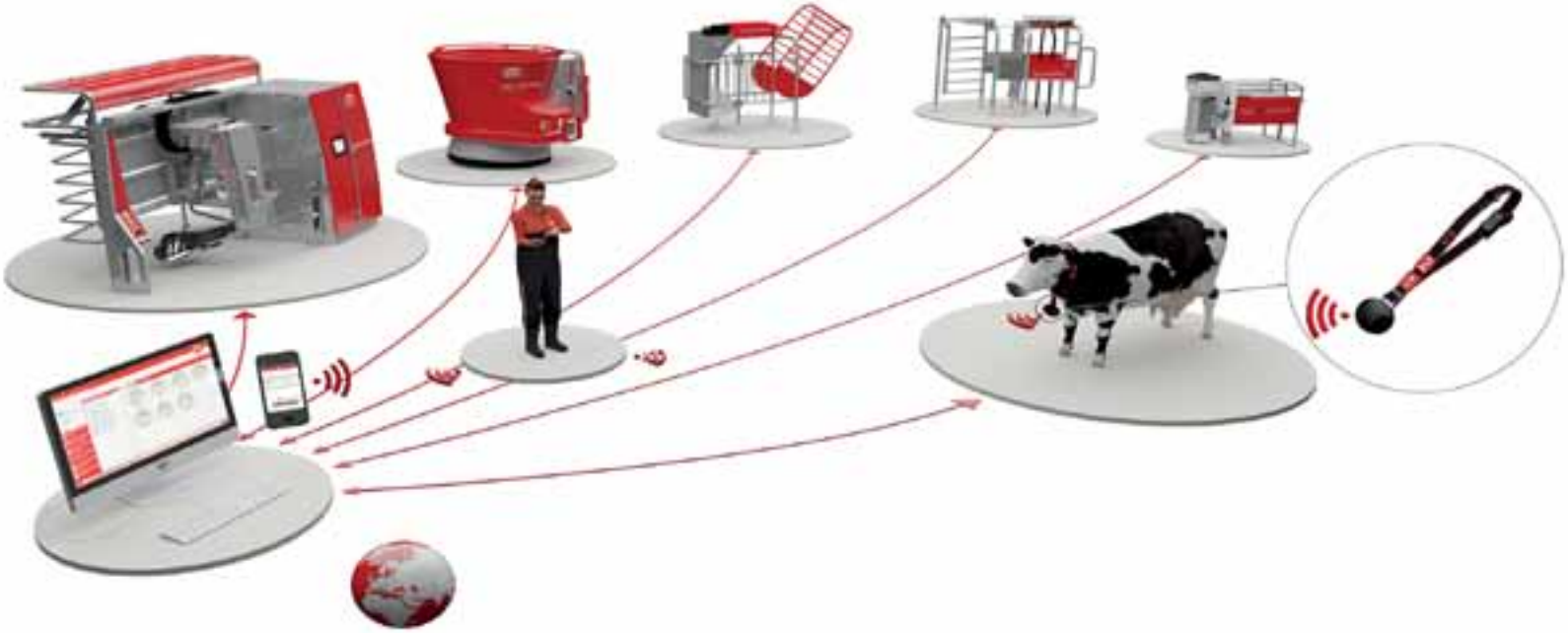
To Be Continued

The strategy concludes that there are mutual benefits for both China and The Netherlands in developing Green Dragon Lake. Therefore it is desirable to continue the Sino-Dutch cooperation and make Green Dragon Lake the leading example for the Chinese Dream. To achieve this, we are looking for future Dutch partners to help develop GDL. For more information please contact MNiesten@kuiper.nl.

By MoU preferred service providers are, among others: Philips Horticulture LED Solutions KPN, ARS Traffic & Transport Technology, Arcadis, Ekwadrat International, ZON Energie, TNO, CAG Dairy Farms, , Royal Pride, Mijnwater, Inspired Ambitions, Evides, Capgemini, Tauw, Vialis. 'Imagine' image is courtesy of Imagro. Cartoon is courtesy of JAM Visual Thinking

More information:
www.kuiper.nl

INNOVATORS IN AGRICULTURE



As an innovator in agriculture, Lely is committed to the sustainability of tomorrow's food systems. By 2050, there will be more than nine billion people in the world. Eighty percent of them will live in cities at a distance, sometimes remote, from where their food is produced. Plus, it's not just the global population that's growing, so are its levels of prosperity. The increasing prosperity raises the demand for high-quality protein, such as dairy. We have therefore to find ways to increase our food production, even up seventy percent by 2050. Feeding the world in a sustainable way is one of the greatest challenges of the near future.

Lely aims to support these efforts with its solutions for precision dairy farming. Since the founding of our family-owned company in 1948, we've been striving to improve the life of farmers. In doing so, we've changed many traditional practices. Among our innovations are the ground-driven wheel rake (invented in the 1940s), the power harrow (1960s), the robotic milking system in 2012, and, most recently, the automated feeding system.

Our solutions streamline farm work. They help dairy farmers run their businesses in a more sustainable and enjoyable way. Beyond that, we develop business concepts to ensure energy-neutral operations in the dairy sector and reduce its carbon footprint.

Data

Along with efficiency and automation, we're increasing data-collection.

Data are crucial for the reliability of future global dairy supply. We are now linking all aspects of dairy farming, from forage harvesting and milking to feeding and breeding. We connect input (feed) with the output (milk) through automated systems of feeding and milking.

Automation and data collection will enable dairy farmers to take the next step in farm management: a dairy business with 200 to 300 cows able to be run with no external workforce. Operating with increased productivity and leaving enough time for the farmer to enjoy a healthy work/life balance. As for the cows, with less human intervention, they'll enjoy more freedom.

Global and Local

We're exploring opportunities for small-scale dairy processing as well. This involves smart processing technologies to ensure the best food safety and traceability. But they will also enable the development of dairy products that are in tune with local markets. These technologies are in a way an expression of ideals, of sustainability, local production, and collaborative consumption. They will give urban agriculture the chance to pervade and find foothold in our metropolitan life. It's not bad to try to get agriculture and the city re-connected.

More Innovations and Investments

Together we need to strive for a world which promotes innovation and investment in the future of agriculture. Lely will do its part to help providing the world with nutritious, safe, and valuable milk and the related food that dairy farmers can produce.

innovators in agriculture

More information:
www.lely.com

MATCHING POULTY PROCESSING

With urban growth

As the worldwide demand for meat protein increases, innovative ways to produce the necessary quantities will be required. Being the global technology leader in poultry processing, Marel Stork is certainly challenged to respond to these rapidly rising production needs. At the same time food safety and sustainability are becoming key issues in an urbanizing world. Reliability, speed and hygiene have to respond to the most stringent requirements and only then the equipment can be operational in every single country of the world.

Hygiene

Knowing that even the smallest local contamination in the food chain can have a global impact, hygiene and safety in food processing have become extremely important. The main concern of Marel Stork is to supply solutions which guarantee a hygienic production and to support poultry processors in delivering the safest possible food. The existing techniques for advanced tracking and tracing of every single product are crucial assets in this respect.

By translating global expertise into local customized solutions, Marel Stork knows how to respect local regulations regarding hygiene, animal welfare or halal stunning, thus making poultry meat available to all urban residents.

Speed

By 2050, 70% of the world population will live in cities. In order to provide those citizens with sufficient protein-rich food, chicken meat, with its relatively favourable rate of feed conversion, will be one of the main nutrition sources. High-speed, high-tech, high-quality poultry processing will encourage this development.

In relation to population growth Marel Stork's focus on higher production speeds makes sense. In the future, large scale, industrial food processing is needed to respond to the expected massive increase in demand for protein-rich, affordable healthy food.

Sustainability and efficiency

Now that sustainable production is paramount on everyone's mind, the opportunities for advanced, innovative poultry processing are enormous. Marel Stork solutions enhance efficiency to the highest levels, adding maximum value to the end product, be it for human consumption, for animal food or for other industries; no useful resources will be wasted anymore.

STORK POULTRY PROCESSING

marel

More information: www.marel.com

FEEDING THE FUTURE

Today about four babies are born each second and by 2050, the world will have nine billion mouths to feed. With incomes rising as economies develop and people moving from rural to urban areas, the consumption of meat, fish, milk and eggs will increase. It is estimated that global food production needs nearly to double to meet this growing demand.

Yet we also live in a world with limited natural resources. The challenge is not merely to double food production, we also need to halve the pressure on the planet. It is simple: we need to produce more with less.

As a global animal nutrition and fish feed producer, Nutreco is in the unique position to contribute towards more sustainable and efficient animal protein production. Our innovation agenda is focused on nutrition related to animal health and welfare, nutrition of young animals and feed efficiency. With eleven research centers worldwide and over 60 global research partnerships, innovation is at the very core of our mission 'Feeding the Future'. We take pride in translating science into practical and applicable solutions.

In the 1990s 3,5 kilo of wild fish was needed to produced 1 kilo of farmed salmon. Nutreco's nutritional solutions have enabled salmon farmers to become net protein suppliers today. With our products that support the intestinal health of animals, we help to reduce the use of antibiotics in livestock farming and contribute to the global fight against antimicrobial resistance. Our research into the early life development of young animals stands at the basis of finding new, sustainable ways of improving productivity.

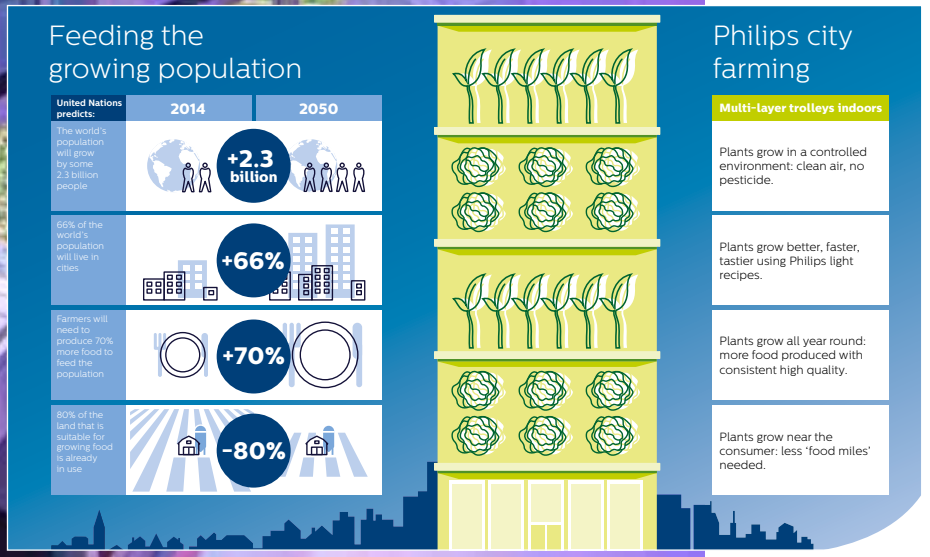
Nutreco employs approximately 11,000 people in 35 countries. Our advanced feed solutions are at the origin of food for millions of consumers worldwide and include products, models and services that enable our customers to optimise both their profitability and sustainability. Our two global company brands Skretting (fish feed) and Trouw Nutrition (animal nutrition) have sales in over 90 countries.

nutreco

More information:
www.nutreco.com

INDOOR CITY FARMING

A new era



LED ‘light recipes’ help optimize crop yield and quality

Indoor farms grow vegetables sustainably and locally in areas where traditional field farming is not possible; lighting system uses 85% less energy than traditional systems

How do we feed an increasingly urbanized world without damaging the planet? Flexible, controllable and energy-efficient light-emitting diodes (LEDs) have huge potential to help address this challenge. Drawing on fundamental knowledge of the role of light in plant biology, Philips is turning that potential into reality. Its tailor-made horticultural lighting recipes help growers increase yields, cut costs and extend growing seasons. And that’s just step one. Philips knowledge of plants and light could help usher in a new era of city farming, where food is grown locally in limited spaces without natural daylight.

A new light

LEDs are highly efficient, produce light in very pure colors (i.e., with a narrow spread of wavelengths) and are available in varieties across the visible and invisible spectrum from far infrared to ultraviolet. LEDs have huge potential for horticulture, as they deliver almost complete freedom of choice which allows optimized lighting solutions to bring greater value for growers – whether that is higher yields, lower running costs or more control over when plants are ready to go to market.

Light recipes

By choosing different types of LEDs, you can very specifically define the spectrum of light plants receive – so there are no wasted wavelengths. Also, LEDs run cool, so they can be placed very close to the plants, ensuring complete illumination with no shadowing and no danger of scorching. And they are completely controllable – you can turn them on and off, and change the brightness as you wish.

It’s clear that LEDs and optimization recipes already have a big role to play in modern horticulture: improving yields, cutting energy consumption, letting us enjoy our favorite produce year-round and increasing nutritional value. But they could do much more. In fact, Philips is investigating how they could be used to help the horticulture industry address the biggest food challenges facing the world in the coming years.

The United Nations predicts that the world’s population will grow by some 2.3 billion people between today (figures 2014) and 2050 and close to 70% of us will live in cities. Worryingly, 80% of the land that is suitable for growing food is already in use. This is driving the emergence of city farming which involves growing plants indoors in multilayer stacks with no access to natural daylight at all. City farming has great potential to address both different consumer needs as well as the challenges of an ever more urbanized world.

PHILIPS

More information:
www.philips.com

GOOD SEEDS

The key to feeding metropoles

The Netherlands sector for seeds and planting materials already plays an important part in feeding the cities around the globe and is perfectly positioned to continue to expand its role.

Seeds and planting materials lie at the root of every food value chain. Seeds do not only determine to a large extent the success and sustainability of farming systems. They contain traits that are important for consumer appreciation and health. But seed based traits also contribute to intermediate chain parties such as transporters, food processers and retailers. Seeds have to be optimally adapted to the various supply systems that feed the city, be it intensive production of fresh products, more extensive and large scale production of grains, and supply of regional specialties often produced by smallholders. Seeds also determine food quality aspects, enhancing nutrition values and adapting products to consumption patterns, that are continually changing in metropolitan settings.

The Netherlands – global centre of adapted varieties and quality seeds

The Netherlands, being one of the densest populated countries in the world, has a history of some two centuries in selecting varieties of horticultural crops in peri-urban settings. We developed the knowledge to maximise farm output largely because of the limited availability of arable land. This history has made the Netherlands the global number one exporter of plant reproductive materials. Our top-position is attained particularly in vegetable seeds and seed potatoes, but also involves grass seeds and seeds and cuttings of a broad spectrum of ornamentals that are important for greening cities and colouring homes and gardens.

Combining global and local

The companies in the Netherlands select plant varieties by matching the global scientific developments with the local needs of consumers and growers. They have stations in different countries, close to all major metropoles in the world. This enables them to take into account all the local needs and preferences and select the best seed production locations globally. Their base in the Netherlands provides the required scientific knowledge for breeding and seed technology; as well as the seed quality control procedures applied to all seed lots to assure an excellent start of crop production. Their presence in many countries contributes to sharing knowledge and economic benefits. This effect logically is most noticeable in countries that protect breeder's rights, have favourable investment conditions, and apply effective regulatory mechanisms for the international movement of seeds.

Seeds of success for farmers

Particularly for fresh products produced in intensive horticulture, it is imperative that the very best seeds and plants are used to get a return on the high investments in labour and production facilities such as protected cultivation technology, irrigation and crop protection. Varieties that resists pests and diseases reduce the need for chemical crop protection. This contributes to both product safety and to a better and more appealing product. Varieties that are optimally adapted to differential production conditions and technologies, that can withstand different climatic hazards and that fit in the particular production facilities, contribute to the farmers' success in crop production.

Seeds for chain partners and consumers

For the further links in the value chain, varieties are needed that best withstand post-harvest handling, reduce losses in the logistical chains and in food preparation. Products of similar shape make packaging and transport more efficient. Varieties for specific use improve product quality: different potatoes qualities are needed for fries, starch or table consumption; different types of tomato increase consumers' choice and create value in retail. The availability of a choice of varieties contribute to product quality and diversity, and consumer satisfaction and health. Good seeds thus contribute to profitability throughout the value chain.

Plantum

More information:
www.plantum.nl


SUSTAINABLE
URBAN DELTA

Priva: leading the way in feeding the city

Worldwide, 180,000 people move from the countryside to the city every day. It is estimated that within 15 years over 60% of the world's population will be living in metropolitan areas. Many of these areas are located in a delta, because water gives opportunities for trading, logistics and food production. These delta cities are confronted with increasingly complex challenges in the field of energy, water and mobility.

And where so many people live and work in close proximity, more and more food will also have to be produced. There are 'mouths' to be fed and job-opportunities to be made available to the workforce. But equally water needs to be recycled and new energy grids are to be built. And if supply chains are shortened and neighborhoods get green and clean, this process will transform such cities into superchargers of sustainability and innovation: Sustainable Urban Deltas in which quality of life will become more important than economic growth.

Priva and Urban Farming

Efficient and local production of healthy food is an important part of the sustainable urban delta.

Whether it's about rather 'traditional' horticulture in the green belt around the city, greenhouses on the roof of a building, or about advanced closed environment multi-layer cultivation systems (a.k.a. City Farming), there's always a need for climate optimization and water management.

In this field, and after almost 60 years of experience in (greenhouse) horticulture behind it, the family owned company *Priva* has become world leader in development and production. It represents a unique and proven combination of software, hardware and services for horticulture, building automation and anything in between. With its technology for the optimization of environmental conditions and process management, the company provides solutions that result in a lower use of scarce natural resources such as energy and water. This makes *Priva* the perfect partner for all projects related to food production in the urban area.

Priva is a family owned company and has offices in ten countries. The company is represented worldwide in over 100 countries via an international network of certified *Priva* partners.

PRIVA

More information:
www.privagroup.com
www.sustainableurbandelta.com

FOCUS ON VALUE CHAIN

Development In Food

QuaTerNes integrates a portfolio of companies, which worldwide give advice to and manage Agri & Food development and investment projects. The Group combines expert knowledge in all segments of the Agro, Food & Technology Sector.

The companies and value chain economics

QuaTerNes' activities cover the world's main food crops. Our activities take a unique market-oriented approach with focus on optimal organization of the complete value chain. We provide assistance in every stage: from seed breeding and large-scale multiplication to agronomy, post-harvest handling, up to added value creation and logistics. The approach results in maximum integration of activities in the chain and in the lowest cost of final products.

Contributions to Food Security

We concentrate our efforts to on the supply chains for potato, healthy fruit, chickpeas, sesame and dates.

The potato for example, has the potential of offering the highest dry matter production per surface. It can significantly contribute to world food security, doubling or even tripling world production on existing area using less water and chemicals. Moreover, losses in the value chain can be greatly reduced through proper storage and the creation of added value, while end products increasingly acquire a strategic value.

QuaTerNes

More information:
www.quaternes.nl

THE NETHERLANDS 'LIVING LAB'

A 25 billion Euro opportunity

Banking for Food

In line with its Banking for Food strategy, Rabobank provides access to finance, knowledge and networks to clients and their communities, helping them to contribute to feeding the growing world population sustainably.

The Netherlands is a world champion when it comes to producing food efficiently and sustainably. Our small country feeds the Randstad, Germany's Ruhr region… actually, all large metropolitan areas in the London-Paris-Berlin triangle, come to think of it. So it's not surprising that large, rapidly growing cities in Asia, Africa, and Latin and South America come to us, seeking council with the challenges they face in order to feed their population. In addition to over EUR 70bn of annual exports of agricultural products, the Netherlands will sell more F&A knowledge, expertise and technology in the coming decades.

If all global agricultural land and livestock would render similar yields to those in the Netherlands, the world would produce three times more food than it currently does. And only a fraction of the water, fertilisers and agro chemicals would be needed. With an eye on the worldwide population growth, ongoing urbanisation and rising scarcity of natural resources in the coming decades, the Netherlands holds an important key in feeding the world sustainably by 2050.

The Netherlands is a 'living lab': a unique test ground. We can show the success of innovations and new business concepts easily thanks to close cooperation between corporations, knowledge institutes and the public sector. Rolling this knowledge and expertise out internationally provides market potential of some 25 billions of euros a year for Dutch companies.

Fast-growing metropolises will need to invest multiples of the billions that the Dutch F&A sector spends annually to maintain its own production capacity. A formidable potential market for our F&A industry. Opportunities for cooperation will mainly be found in fields like applied knowledge (circular economy, sustainability), innovations (drought tolerance, biological herbicides) and cooperation with other sectors (water, logistics, hi-tech, chemical, life sciences and energy).

In line with its Banking for Food strategy, Rabobank provides access to finance, knowledge and networks to clients and their communities, helping them to contribute to feeding the growing world population sustainably.

Rabobank

More information:
www.rabobank.nl

FOCUS ON FUTURE, NATURALLY

Rijk Zwaan is a fully independent vegetable breeding company with 30 international subsidiaries.

The family-owned company is headquartered in De Lier, the Netherlands.

Responsibility

Rijk Zwaan develops vegetable varieties and sells the seeds produced from them to growers worldwide. The new varieties may have a better flavour, shelf life or appearance or they may be bred to offer better traits from a grower's perspective. Rijk Zwaan's work brings with it a considerable social responsibility because the world's population is expanding at a rapid pace and a growing number of people must be fed using a finite number of natural resources. Furthermore, obesity is becoming an ever-bigger problem globally. Vegetables in new shapes and colours can create extra consumption moments and preparation opportunities. For example, Rijk Zwaan has developed a 'convenience lettuce' and a snack cucumber, two products which can make a valuable contribution to increased vegetable consumption and a healthier lifestyle.

Research and development

Because consumer preferences and climates vary around the world, Rijk Zwaan has breeding locations in all major climate zones. Thanks to continual advancements at cell and DNA level, Rijk Zwaan can take an increasingly targeted approach to its development work which in turn speeds up the time to market for successful new varieties. The company invests 30% of its revenue in research and development each year. In order to help customers maximise the yield from their varieties, crop advisors from Rijk Zwaan continually share thoughts and ideas with growers. Rijk Zwaan is not only focused on its direct customers, however, but also on traders, retailers and vegetable processors through its international network of chain managers. By working together, they can develop vegetables, product lines and concepts which perfectly address market needs.

Healthy future

Rijk Zwaan is a family-owned company with 2,500 employees and a corporate culture which revolves around people. Working together and open communication are very important, not only between employees but also within the numerous external collaborative relationships. Rijk Zwaan purposefully focuses on sustainable partnerships – with research institutes and NGOs as well as with commercial partners. Providing local training to smallholders enables them to secure a better livelihood for themselves in the long term. A higher crop yield per m2 and new and improved disease resistances enable agricultural land to be utilised more efficiently and reduce the amount of crop protection agents needed. These are just some of the ways in which Rijk Zwaan can make a significant contribution to a healthy future.

RIJK ZWAAN

More information:
www.rijkzwaan.nl

INNOVATION,

A company culture

Helping societies in transition

Our world is in transition. In the face of the challenges created by scarcity of resources, climate change, urban redevelopment, traffic management and more, new ideas and new ways of thinking are more than welcome.

Our company strategy and action programme focus our response to the demand. They are centered around four main issues: Mega cities and strained cities, transport of people and goods, water availability/ flood protection; the environmental impact of industry. We try to respond through innovation, our projects are embedding smart solutions, pioneering technologies, resilience, flexibility and future functionality for businesses and communities across the world.

Smart solutions

Innovation is integral to our business. We question, explore alternatives and we challenge ourselves and others. In this way new ideas are born, new approaches created and applied across disciplines for smarter outcomes. Is inter-disciplinary confrontation in itself not very often the cradle of new thinking?

Being smart helps our business. We re-examen, renew and adapt our products, services, business models and processes. The resulting solutions, we find, often are quicker to implement, safer, of higher quality, or more sustainable. They may require less resources or produce fewer emissions.

Strategic agenda

We are recognised as a leading market party in innovation and want to maintain this position. Our company strategy, Vision 2018 offers the framework. In building the best teams, we are developing a culture which supports innovation and maximises co-creation with all stakeholders involved. We want to excel in our operations, do the right things in an efficient way. We are sharing and commercialising product and process innovations to achieve leading market positions.

Action programme

Innovation in our midst is valued and stimulated. In our company culture we recognise it, cheer individual achievements and communicate them across our business. Our annual internal Da Vinci competition challenges colleagues around the globe to submit innovative concepts, both for unproven ideas and for those already implemented.

We highlight our innovations through examples and insight, which we share with clients and partners. But through our innovation funnel we also try to develop a true innovation pipeline: an ideas bank, procedures to channel ideas from concept to the stage of implementation and a management tool, criteria based, to assist in decision making. These efforts show what innovation means to Royal HaskoningDHV, as do the industry awards that we regularly enter into and win.

But never to be forgotten is that innovation is a collaborative process, inspiring our colleagues and our associates. We work in partnership with clients, universities and knowledge institutions and are applying for grants and funding to extend our involvement in ground-breaking research.

Royal HaskoningDHV
Enhancing Society Together

More information:
www.royalhaskoningdhv.com

STRAIGHT FROM THE HEART

The company

- Since 1946, Staay Food Group has delivered a wide range of fresh fruit and vegetables, worldwide. Our vision is to provide the highest possible quality and to cope with the growing international competition within the fresh produce sector. Key tool is our efficient and transparent network that allows us to operate globally, 'Straight from the heart'. In response to supply chain integration, SFG has positioned itself closer to cultivation by cooperation and holdings. Our regional offices enable us to closely monitor the cultivation process and to direct special deliveries to our customers.
- Our customers are retail organisations, trade and food processing companies and food service companies. The suppliers of fruit and vegetables are mainly our own growers, and production companies, grower associations and cooperatives guided by SFG. The company performs a regulatory role between producers and customers.
- SFG itself produces a wide range of convenience products for supermarkets throughout Europe, such as ready-made consumer products, freshly-cut vegetables and ready-made salads. Their revenue contribution within SFG is increasing rapidly, in line with the increasing demand for ready-made products on supermarket shelves.
- Our worldwide turnover is around EUR 600 million; we have more than 600 employees in the Netherlands and approximately 2,500 employees – mainly seasonal workers – at our affiliated growers abroad.
- All companies within SFG are certified according to international standards (HACCP, IFS, BRS, Global Gap).

Innovations

- SFG is involved in several innovative and sustainable production and processing projects, such as the cultivation under LED in environmental chambers (without natural light). This concept is also known as "Cityfarming'.
- SFG is also active in sustainable packaging concepts for use in supermarkets.
- Since mid-2015, SFG has been able to market the first melons under the RainForrest Alliance-label, which is unprecedented in the international fruit market.

Market developments

- Both the sourcing and the sale of fruit and vegetables are highly internationalised. SFG's growth, and that of its establishments, is international . In "fresh", the Netherlands play a global and pivotal role. The growth in sales mainly originates outside Western Europe.
- 'More local consumption of local products' and 'convenience and health' are current trends in the market.
- Supply chain integration is on the increase; more cooperation (partnerships) within the chain.
- Supermarkets remain the main sales channel (approximately 70%). Delivering concepts to them is becoming more important. Food service companies are increasing their share.
- Pricing in the fresh chain shifts from pricing by supply and demand to pricing on the basis of negotiation or open cost calculation.

StaayFoodGroup

More information:
www.staay.nl/en

A VIEW ON FEEDING THE CITIES

From large scale to taste tailored

Shelf life; shelf stable

For nearly a century Stork Food & Dairy Systems has been world wide active in extending the shelf life of different types of food. Our systems have traditionally been well received in the markets for (i.a.) milk, flavoured milk, pudding, creams, as well as for soup, sauces, and juices with particulates and for nutraceutical markets.

With our UHT sterilizers and our rotary and linear, ESL- and aseptic bottle fillers, customers are able to market shelf stable products.

Recent trends

During many years we have seen trends in our industry linked with consolidation & concentration: food producers operating more and more on a global scale, large scale production, capacities of production lines increasing.

However, more recently we started to discuss with these same food producers trends like population growth, urbanisation, food safety and health awareness. A recent symposium, which we organized for our customers, adressed these topics with a highlight for the prevention of food waste and mass customization.

Feeding the cities with Stork Food & Dairy Systems

As a specialist in supplying equipment to preserve food we see a clear role for long shelf life products. But you could try to combine it with individual taste. You could think of long shelf life base products that will be diversified close to the customer, or even for every individual customer.

Being able to select a drinking yoghurt with a flavour of your choice might ask for shelf stable bulk production. But in shop complemented with shelf stable flavour dosing and filling equipment, highly flexible for the type of pack and product. We think it is one of the trends in modern city life.

We would very much like to share our vision and ideas.

STORK®

Food & Dairy Systems

More information:
www.sfds.eu

CLIMATE CONTROL

Like no one else does

Years of experience in storage and processing

Tolsma and Grisnich both have a rich history of more than fifty years in respectively storage and processing of potatoes, onions and carrots.

Jointly, Tolsma-Grisnich provide smart solutions for growers, processors and industrial packers of agricultural products worldwide. Together, we offer innovative and intelligent total solutions for the entire cycle of unloading, storage, processing and packaging of agricultural products.

All the expertise that both companies have built up is based on practical knowledge from farmers all over the world and scientific research from universities and knowledge institutes; at disposal to improve your agribusiness in an intelligent way.

Optimizing the food supply chain

Intelligent storage technology helps to reduce after harvest-losses; quite rightly considered to be a major obstacle in securing adequate food supply. Computerized climate control, moreover, optimizes wound healing, drying, cooling and heating by controlling e.g. fans, hatches and refrigeration systems. Additionally it minimizes energy consumption.

Product quality is the focus of our client-specific installations for unloading, transporting, bunker storage, cleaning, grading and packaging. They can be supplied turnkey and allow an optimal use of labor potential.

Ambitious, innovative and intelligent to feed tomorrow's cities

Tolsma-Grisnich has an ambitious R&D department. Teaming up with renowned partners, we develop clever solutions to reach highest storage efficiency. An ongoing flow of innovation helps secure best options in the chain of unloading, storage, processing and packaging.

We like to supplement our unique state of the art technology with tailor-made advice of our experienced advisors.

The combination of expertise and focus on chain optimization, with best solutions for storage and processing, puts Tolsma-Grisnich in the forefront the process to help feeding tomorrow's cities.

Sustainable and worldwide.

Tolsma Storage Technology

Grisnich

Members of the Tolsma-Grisnich Group

More information:
www.tolsmagrisnich.com

GENETICS AND FEED EFFICIENCY

Basis for sustainable, no loss, pig farming

Topigs Norsvin is one of the world's most innovative pig breeding organisations. Our genetics enable efficient and high-quality production with an eye for animals, people, environment and the economy. Breeding and in this way improving the quality of the herd is the major contribution to meet world's rising demand for meat. I.e. without the need for additional resources. Some examples:

- Good animal health reduces the need of antibiotics and improves food security and animal welfare at the same time. We therefore breed robust pigs with a higher immunity, less vulnerable to illness and less dependent on antibiotics. We also use modern techniques like genomics to select new generations with a social behaviour that fits the production system.

- Feed costs are the biggest expense for pig farming and feed production inevitably has an environmental footprint. We use an integral approach called Total Feed Efficiency to ensure that every kilo of feed in the entire chain is optimally used and 'feed leaks' are prevented. Topigs Norsvin genetics ensures the highest feed efficiency from farrowing pen to slaughter. This effective use of nutrients also reduces the pressure on the environment as it leads also to reduction of the production of manure.

- Consumers want to know the origin of their meat. This can now be done rapidly by comparing DNA from a meat sample with stored DNA profiles of sows and terminal boars.

Topigs Norsvin
PROGRESS IN PIGS

More information:
www.topigsnorsvin.com

FOOD SECURITY

According to the United Nations data one in nine people in the world presently does not get enough to eat. There is a risk that this situation will get worse as the global population rises towards the predicted 9 billion by 2050. For some time, therefore, it is accepted that the world needs to double its agricultural production in the coming decades and simultaneously mainstream sustainable agriculture. Next to doubling the output, this implies at the side of the inputs using half the resources we got accustomed to employ. This is the best way we can help to end hunger, achieve food security and improve nutrition.

This issue matters to Unilever because we are a substantial supplier of food and food ingredients and because half of our raw materials come from farms or forests. Of course recognition of sustainability values has been a gradual process. Unilever has taken up this challenge and we have used our experience, built up over 20 years, in developing sustainability standards. We are sharing these in partnerships with industry suppliers, governments and NGO's. At both ends of the stick this extends from the co-creation of the Sustainable Agriculture Initiative (SAI) Platform, with over 60 members, to the development of a Food Waste policy coordinated by the Consumer Goods Forum. For let us not forget that the quantity of food which is wasted is estimated at 1.3 million tons a year, a third of the food that is produced.

In recent years, we have further activated our partnerships across the entire value chain through the Unilever Foundation, with a focus on improving the quality of life through the provisions of hygiene, sanitation, basic nutrition and access to clean drinking water (WASH). We are investing in livelihoods, sustainable sourcing and women's empowerment together with our partners Acumen, Clinton Giustra Enterprise, the Ford Foundation, the Global Alliance for Improved Nutrition (GAIN), Oxfam, Population Services International (PSI), Save the Children, UNICEF and the World Food Programme (WFP).

As Unilever we are undertaking a school meals programme with the World Food Programme that provides nutritious meals to schoolchildren in Bangladesh and Indonesia. We have a specific commitment in addressing under-nutrition through our participation in the Scaling Up Nutrition (SUN) movement that unites 55 countries, civil society, donors and business in a collective effort to improve nutrition.

We need to ensure that the food system works better for all. Industry has a key role to play in producing safe and nutritious food in a sufficient and sustainable way. Adequate processing and storage will contribute to this objective and will allow reducing the waste that occurs in food production from harvest to the level of consumption. As Unilever we have supported global initiatives like the UN Zero Hunger Challenge and UN Sustainable Development Goals.

Ending Hunger and ensuring Food and Nutrition Security have rightly been identified as a high priority goal for the coming years. Unilever wishes to be in the heart of the matter.

Unilever

More information:
www.unilever.com

DUTCH QUALITY VEAL

Where animal husbandry has taken roots, young offspring usually faces quite different "career perspectives". In the dairy industry females are primarily reared for milk production. The young males for slaughter, some at a very early age, some at the age of maturity. And in the end slaughter is the fate of all. In many cultures newborn bulls are culled soon after birth as meat prices are too hazardous a risk to offset the cost of feeding and rearing. Due to tradition and geographical circumstances the Netherlands has developed a most prominent position in the Western Europe dairy industry. Not only as milk producers, but over the years also with a collateral bonanza that took time and dedication to mature: the production of veal.

Consumers really appreciate veal cutlets, but the product has had a bumpy road to contend with. The origin of the young animals, their transport, feeding, veterinary care, housing and animal welfare, just to name a few of the aspects involved. And most important, the trust that feed - and by consequence meat - quality are beyond reproach and suspicion. Over the years, the Dutch family business the VanDrie Group managed to earn that trust and its present standing.

With an annual turnover of approximately €2.2 billion the VanDrie Group is the largest private agribusiness group in the Netherlands. It is the global market leader in veal, and calf milk powder. The VanDrie Group is an integrated producer that manages the entire production chain, including, calf feed, calf husbandry, raw dairy products processing, slaughterhouses, calfskins, marketing and promotion.

Its phenomenal growth largely had to do with "trust". The VanDrie Group developed a unique full-service quality system, called Safety Guard. Throughout the production chain Safety Guard assures food safety, animal welfare and environmental management. Safety Guard is based on ISO 22000 and incorporates IFS and BRC. The key feature of Safety Guard is its traceability system. Each individual animal has an earmark - its ID code - that remains associated with the animal and its meat throughout the chain. Even when a cut of meat is reduced further at the deboning plant, it continues to be associated with its ID code and can thus be traced back to the individual animal it came from.

As the global demand for animal protein rises, new and innovative ways to produce the necessary quantities are required. The VanDrie Group is confident to be able to meet these requirements

The VanDrie Group's methods are based on innovation, know-how and craftsmanship. Part of the company habit, and second nature for generations, is respect for people, animals and quality. As a family business and as world market leader, the VanDrie Group has the ambition to be leading as well where social and environmental developments in the industry are concerned.

It is convinced that veal, so often considered a by-product, has a role to play in addressing food needs worldwide. Chefs and discriminating consumers like it as tender, juicy and is easy to digest. Veal fits perfectly into many different meals and diets. But thanks to its many nutritional qualities, it also plays a central role in balanced nutrition. Key is controlled quality. The VanDrie Group, like its product, is ready to help addressing food needs worldwide, and to perform as reliable provider to the future (and discriminate) urban consumer.

VanDrie Group

CONTROLLED QUALITY VEAL

More information:
www.vandriegroup.com

FLORICULTURAL PRODUCTS

Smart Trade

VGB, the Dutch Association of Wholesalers in Floricultural Products.

Ornamental plants do not necessarily contribute to "feeding cities" although exceptionally some do. Nevertheless they have earned themselves a place in the perception of the modern citizen in terms of wellbeing. The Dutch used to say – and some still believe – that "flowers love people", not the other way around.

Next to the almost classical trade in flowers and ornamental plants, metropoles more and more want their cities to be "green". For good reasons city-governments are prepared to invest in landscaping and in tree-lining their streets. A green city is associated with wellbeing, human health and high-value living environment. Parks are not only "lungs" for the inhabitants, but also barriers to pollution and degradation of climate. Plants, in- and outdoors, fit in this trend. They are specialty of Dutch wholesalers, and their association VGB.

VGB represents the Dutch wholesalers, exporters and importers of flowers and ornamental plants. We represent more than 65 % (€ 3.5 Bn) of the total turnover in the Dutch wholesale of flowers and ornamental plants trade. VGB's mission is to enhance the competitiveness of Dutch floricultural trade and thereby the position of its member-companies, regionally, nationally and internationally. Improving efficiency, turnover and innovation of the floricultural trade is part of our strategy. It is also meant to please clients and ensure optimal quality and best shelf life for the individual consumer.

As a member of the international flower trade organization Union Fleurs, the VGB supports the elimination of international trade barriers and promotes free trade.
VGB as an organization focusses on issues and activities like market access, sourcing and trade policy, supply chain development and auction relations. Lobbying, promotions and public relations, human resources, statistics and market information also belong to its field of interest.

As an association VGB is committed to represent the interests of its members.
Its characteristics are: collective, pre-competition oriented, innovative, project targeted; all on behalf of and with involvement of its member-entrepreneurs.
A strategic market view aims at further efficiency in the supply chain, added value for companies and the availability of a broad and "deep" assortment of products.

VGB initiatives have resulted in crucial, innovative developments in the sector. The project organization VGB Trade Services developed and develops innovations projects, in the field of logistics, ICT, sustainability, product quality to name a few. Market information, promotion and public administration are also part of the package. And, in the perspective of city-growth and road-congestion, successful multimodal transport projects have been launched, with flowers and plants in containers on ships and trains.

VGB, therefore, for smart trade!

VGB

More information:
www.vgb.nl

FACTORY AUTOMATION

In Agro&Food

Viscon Group specializes in mechanizing & automating production processes in Agro & Food all over the world. We provide equipment in Fresh Produce, Horticulture, Poultry & Warehousing. Viscon is all about making life easier for our customers through innovation, quality products, expertise and reliability. We specialize in standout layouts and delivering turnkey in all our sectors, including all required tracking & tracing software for optimal food safety.

Viscon Fresh Produce is your partner in the delicate and intricate handling of greenhouse grown vegetables. Viscon delivers solutions to meet your needs ranging from the arrival from the greenhouse, up to packed, and palletized product, and everything in between.

Viscon Group also supplies all solutions required for the production of young plants, in the company Visser Horti Systems. Visser Horti Systems has designed and manufactured machines and complete production lines for both large and small horticultural nurseries since 1967.

Viscon specializes in storage facilities for your product as well, in our company Viscon Logistics. Our automated systems take care of the entire product flow inside the building: ranging from the infeed of the sorted goods up to the outfeed of the order and everything in between. Storage systems are available for pallets, crates and boxes. We can also work with temperature-controlled products. Built in temperature zones even allow mixed storage of ambient, cooled and frozen products. The integrated software sorts and mixes every possible order on demand.

Viscon Hatchery Automation is dedicated to improve our customers profitability by providing cost effective, hygienic and reliable hatchery automation. Viscon is your partner in 1 day old chick production at high level automation.

Please contact us for any factory automation project in Agro & Food!

VISCON GROUP

More information:
www.viscongroup.eu

SMART, SOCIAL FARMING

Southern Agricultural and Horticultural Organisation (ZLTO)

The ZLTO is founded at the end of the 19th century as a social movement aimed at the social and economic emancipation of small farmers. At that time farmers in Western Europe had to cope with a deep agrarian crisis. The organisation started with the mobilisation of the farmers at grassroot village level. The pioneers or innovators at that time understood the meaning of two basic principles for a succesfull farmers organisation: high trust and shared profit.

The organisation started with the building of an effective and accessible network of schools, cooperatives like the Rabobank and services for individual members. This complex of organisations, cooperatives and knowledge institutions has been and still is highly responsible for the succesfull modernization of Dutch agriculture.

The ZLTO always had a high degree of member-participation. The core values of the ZLTO are connecting farmers, innovation and entrepreneurship. Together with the members and the stakeholders in market and society the ZLTO works at a sustainable future for farming and farmers households. The ZLTO believes in cooperative innovative farming for future, in two directions.

The first one is ‘smart farming’with the focus on new technology: precision farming, agrobiotech, green medicines etc. The challenge is more output with less input, transparancy and societal responsability. The second direction is ‘social farming’: farming in connection with society and environment. Social farming is about food, energy, water, care, nature, culture. It brings farming in the cities and citizins to the farms. Together with our farmers we work on entrepreneurship and innovations in both directions.

ZLTO

More information:
www.zlto.nl

SYNTHESIS: CREATE MORE THAN THE SUM OF THE PARTS

Feeding tomorrow's cities represents a complex challenge. Numerous trends have an influence on production, processing, transport and marketing of daily food in the expanding urban regions. Addressing merely one of them will most likely have an unwanted adverse effect. If only attention is paid to – for example – food availability, what will become of quality, water and energy use, infrastructural complexities or equal access, just to name a few.

We need to take into account all those aspects and their mutual interactions if we want to improve the agro and food system. The overview of the challenges presented in this publication is far from complete. But even this selection shows that we must have our antennae out for the developments that have impact on the agro and food system, needed to feed tomorrow's cities. This in itself is already a thought-provoking assignment.

We ‘d like to see the most lucid minds to take up this assignment and deliver a framework that is integrated and delivers more than the sum of its parts.

Insight in diverse fields such as genetics, productive capacities of animals and plants, resource use efficiency, logistics and social justice is needed. Maybe we even do need to follow the path sketched in the contribution ‘Urban metabolism and DNA’ and start with assembling data that can help us to put diverging urban metabolisms in perspective. And again, we will only succeed in this task if we work together and make use of all insights that are available.

Developing a more comprehensive analysis will not do in itself. We also need more tangible and proven ways to provide solutions. The companies and organizations that present themselves in this publication all have a specific role in delivering parts of these solutions. But just adding up parts is probably not enough. We are dealing with an agro and food system. So, the real challenge is to transform these essential parts into something that is more than just the sum of them. And also here the way forward is to start collaborations between stakeholders. To compare experiences, to have disciplines interact. Together they can create, innovate and try to provide answers and solutions that neither of them can do by themselves.

With this publication we hope to have helped, perhaps only modestly, to push in this direction. It will take many more efforts to get closer. Feeding tomorrow’s cities is a cause that certainly deserves it.

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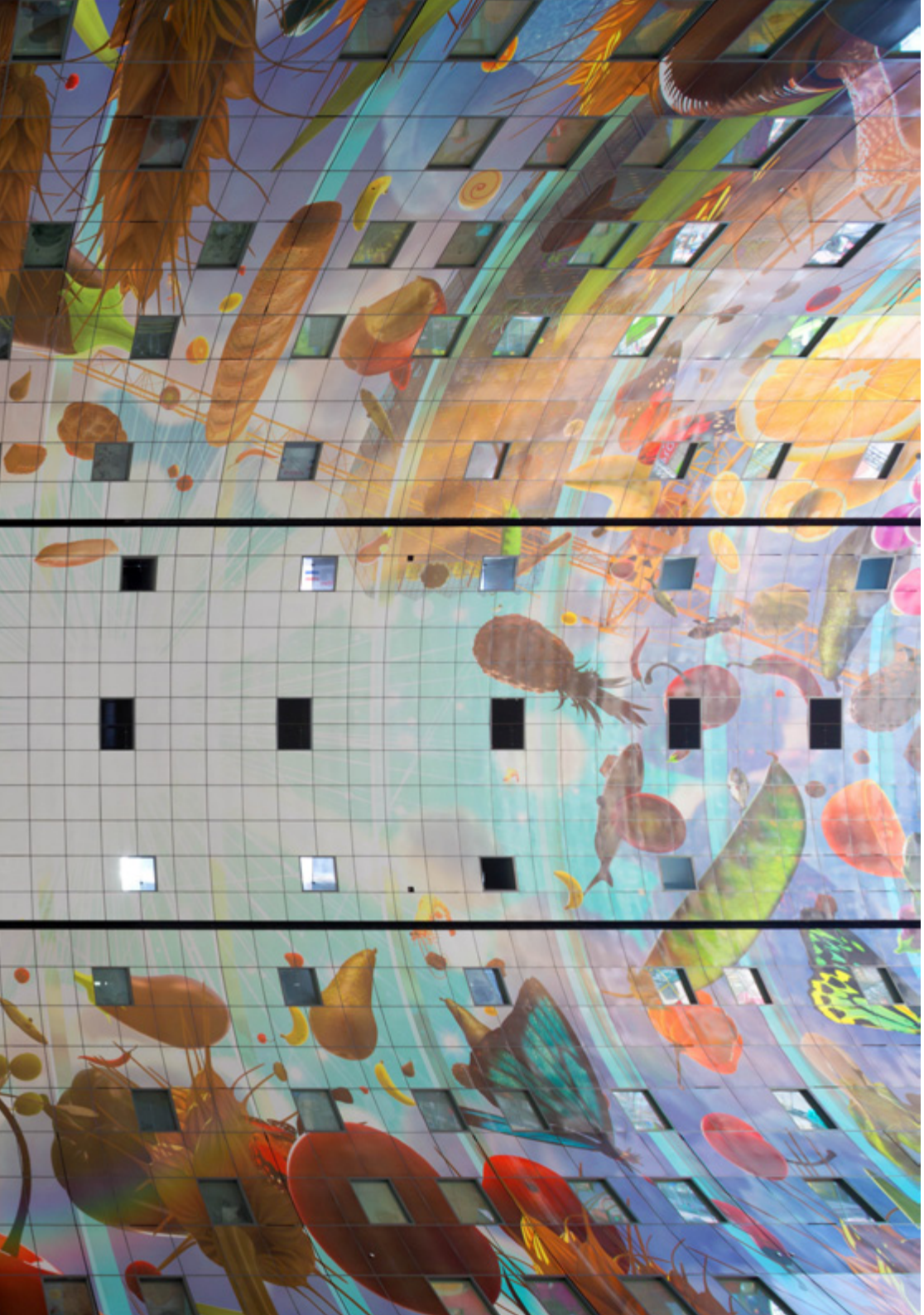

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