From Freight Trains to Cold Chains

Building China's New Supply Chains for Fresh Food

October 2015

WAGENINGEN UR
For quality of life

Rabobank

前言

我们可以种植并收获水果和蔬菜，可以给奶牛挤奶，可以在海里捕鱼，也可以加工肉类。但是，如果要把所有这些产品以最新鲜的状态呈现给消费者，同时确保质量和安全的话，高效的物流才是重中之重。事实上，中国对新鲜、安全和优质食品的需求日盛，正超过自身生产和供应的能力，物流也因此变得日益重要。欧洲 – 尤其是荷兰 – 能够帮助解决这个需求。

与此同时，我们需要建立并深入发展一条环环相扣、运作顺畅且稳定可靠的物流链（包括冷链）- 不仅从欧洲到中国，还能在中国境内得到延伸。这将支持中国在“一带一路”倡议下铺就新丝绸之路的计划，同时也会支持中国加强和改善国内冷链业的相关政策。

打造和发展高效顺畅的物流链需要的是资金、技术、运营经验和支持性法规政策。同时，对消费者的相关教育也十分必要。尽管不是食品生产和加工中最直接的部分，供应链和物流在优化资源利用、减少损耗、提高获取食物便利、以及确保食品安全和稳定等方面扮演了至关重要的角色。

全球食品农产品行业和各国政府必须采取措施来加大食品供应、提高民众获得食物的便利、保障均衡的营养，以及稳定全球食物供应系统；只有这样，投资者才能取得合理的回报。

接下来的报告融合了全球食品农业领域两大领先机构 – 荷兰合作银行和荷兰瓦赫宁根大学的研究和分析。 这份联合研究报告完美诠释了双方长久而互利的合作关系 – 从商业及金融合作关系一直到在亚洲非洲进行的食品安全研究和项目，还有管理层代表人物之间的交流、绿色投资基金的合作、以及教育项目的共同开发。我们希望报告内容能够带给你丰富的“精神食粮”，展示中欧共同建立和深入发展强有力的物流链所能带给大家的机遇。

Wiebe Draijer 魏达睿
荷兰合作银行董事会主席

Prof. Arthur Mol 教授
荷兰瓦赫宁根大学董事会副主席

Preface

Fruit and vegetables can be grown and harvested, cows milked, seafood caught, and meat processed. But, to get these products to the consumer in a fresh state, with quality and safety assured, effective logistics are essential. Crucial in fact, as China's growing demand for fresh, safe and high-quality food is outstripping its ability to produce and deliver this. Europe—and in particular the Netherlands—is able to address this need.

Meanwhile, a well-connected, well-run and reliable logistical chain (including cold chains) needs to be established and further developed—extending from Europe to China, but also within China itself. This would support China's plans to build the 'New Silk Road' under its 'One Belt, One Road' initiative, as well as its policy programme to increase and improve the country's domestic cold chain sector.

Building and developing an efficient and effective logistical chain requires capital, technology, operational experience and supporting regulations. Supply chains and logistics play an important role when it comes to optimising the use of resources, reducing waste, improving accessibility, and ensuring the security and stability of food.

Global food & agribusiness and governments must take steps to increase food availability, improve access to food, ensure balanced nutrition, educate consumers and stabilise the global food system, so that investors receive acceptable returns on investment.

The following report brings together research and analysis from two global, leading institutions in food & agriculture: Rabobank and Wageningen UR. This joint research is a perfect illustration of their mutually benefitting, longstanding cooperation that ranges from a commercial and banking relationship to joint food security research and projects in Asia and Africa, exchanges of representatives at Supervisory Board level, partnerships in education programmes and in green and investment funds. We hope to provide plenty of 'food for thought' about the opportunities that strong logistical chains between Europe and China offer.

Wiebe Draijer
Chairman of the Rabobank Executive Board

Prof. Arthur Mol
Rector Magnificus Wageningen UR

WAGENINGEN UR
For quality of life

Rabobank

摘要

从普通货运到专业冷链: 为中国打造全新的生鲜食品供应链

中国对生鲜食品的需求不断增长，这给来自欧洲和荷兰的进口商品带来了巨大的商机。越来越多的中国消费者寻求更安全、更优质的肉类、乳制品、水果和蔬菜，而且他们普遍意识到了欧洲食品业良好的口碑，因此这个消费群体驱动了对欧洲产品的需求。中国生鲜食品网售的年增长率为50%，这进一步拓展了未来的机遇。欧洲出口商将发现他们的分销方式会有所增加，尤其是电商，能利用更迅速、更优秀的物流系统。

对于把生鲜食品（无论冷藏还是冷冻）出口到中国的欧洲出口商，连接鹿特丹和重庆的这条现代“丝绸之路”将为市场带来令人兴奋的新路线。 与船运相比，如今的列车线把运输时间缩短了30多天，各种贸易机会蜂拥而至 – 比如来自荷兰的浆果、圣女果、小牛肉和鲜花。随着新丝绸之路效率的增加，它很有可能将改变全球食品农业的贸易流。比如，中欧之间路线的缩短将改变其他国家：如美国、巴西和澳大利亚的竞争地位。一旦新丝绸之路成为中国食品分销网络不可分割的一部分，通过加强的竞争和贸易，它将有能力使中国的食品系统趋于稳定。

只有在供应链能保证质量和安全的前提下，中国生鲜食品消费的增长才能持续。在很大程度上，这取决于存储、处理和运输期间产品的温控是否恰当。中国的冷链行业相对落后，需要在质量和运力上进行改善。相应的投资将非常巨大：估计下个十年将陆续需要850亿美元。不过，中国的冷链行业自身可以得到改善，前提是冷链企业调整商业模式以适应价值更高的战略、来满足客户更高的服务需求。 国际物流企业 – 凭着自身的专业知识和运营经验 – 能够在这些发展中扮演关键角色。由于荷兰的物流业十分先进，荷兰企业完全可以把技术和服务带入中国。中国冷链行业的改善所能带来的益处不可估量。高水准的冷链行业可以把生鲜食品的损耗降低14% - 价值相当于75亿美元。另外，我们可以预见，食品价格的下降可以减少饥荒。最后，由于食源性疾病发病率的降低，医疗保健上的费用也随之减少。

所有这些都互有关联。欧洲进口的生鲜食品能够成为中国冷链进步的动力。进口产品可以把国际高水准与中国现有的冷链服务整合在一起。新丝绸之路为日益增多的生鲜食品贸易创造了很多机会，我们真的可以称之为前进的一大步 – 从普通货运列车到专业冷链运输的进步。

Executive summary

From freight trains to cold chains: Building China's new supply chains for fresh food

China's growing demand for fresh food offers huge opportunities for imports from Europe and the Netherlands. The Chinese consumer is increasingly looking for safer and higher-quality meat, dairy products, and fruit & vegetables—and is aware of the good reputation of Europe's food industry. An annual growth of 50 percent in Chinese sales of fresh food via online retail is further expanding the opportunities for European exporters, especially as online retailers make use of faster and higher-quality logistics.

For European exporters of fresh food (either chilled or frozen) to China, the New Silk Road—connecting Rotterdam and Chongqing—will provide an exciting new route to market. As the train corridor reduces transport times by over 30 days compared to shipping, opportunities are emerging—for instance for soft fruits, cherry tomatoes and veal, as well as for flowers from the Netherlands. And, as the New Silk Road matures over time, it has the potential to change global F&A trade flows. For example, a shorter link between China and Europe will change the competitive positions of countries like the US, Brazil and Australia. The enhanced competition and trade has the potential to stabilise China's food system.

Consumption growth of fresh food in China will only continue if supply chains deliver quality and safety. To a large extent, this depends on the proper cooling of products during storage, handling and transport. China's cold chain sector is currently lagging and the investments needed for improvement are huge: an estimated USD 85 billion is needed in the next ten years. Additionally, China's cold chain companies must start adapting their business models into higher-value strategies in response to the higher service needs of their clients. International logistics companies—with their knowledge and operational experience—can play a pivotal role in these developments. The strong logistics sector in the Netherlands means that Dutch companies are especially well-positioned to bring their technology and services to China.

The benefits to China of an improved cold chain sector can hardly be overestimated. A high-level cold chain sector would reduce the waste of food by 14 percent (a worth of USD 7.5 billion), reduce hunger as food prices fall, and reduce healthcare costs as the occurrence of food-borne diseases decreases. It becomes clear that all of this is connected. Imported fresh food from Europe can be the driver of cold chain improvement in China. The high-level standards seen internationally will influence China's existing cold chain services. And as the New Silk Road creates opportunities for the increased trade of fresh food, we can truly claim to be taking a big step forward—moving from freight trains to cold chains.

Table of contents

1. No shortage of demand ***7***

China's growing appetite for fresh food

2. Can the supply chain deliver? ***17***

Success depends on dynamics in logistics

- The YuXinOu railway: A case study ***Wageningen UR*** ***27***
- The future of China's cold chain industry ***Rabobank*** ***36***

3. A leap into the future

The potential impact of the New Silk Road and high-level cold chains in China ***49***

Rabobank

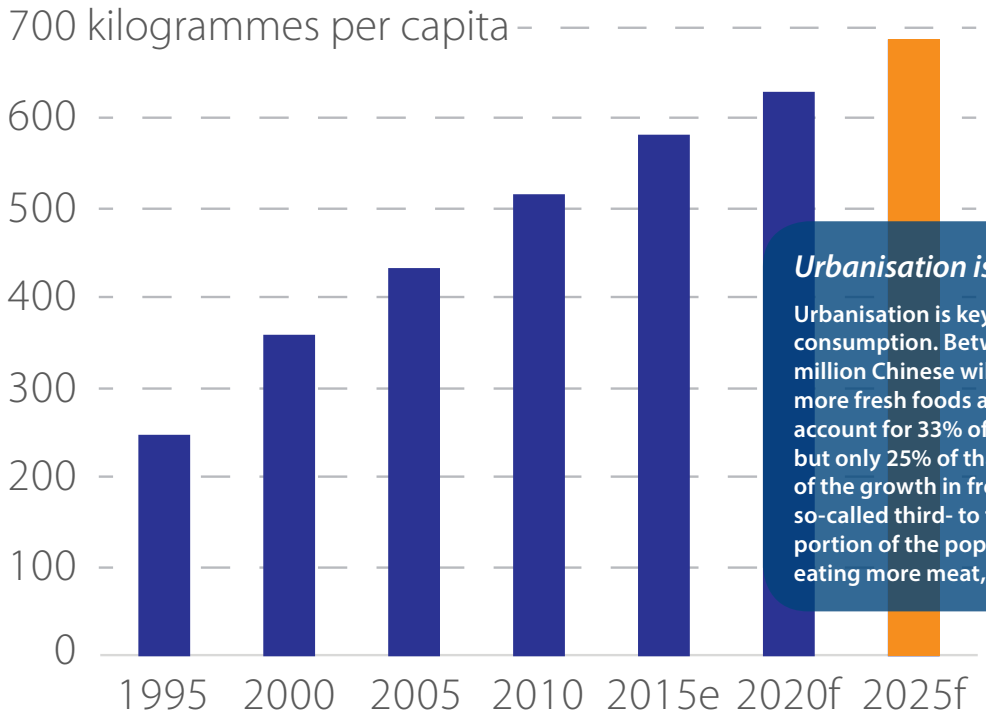
1 No shortage of demand

China's growing appetite for fresh food

Chinese consumers are hungry for fresh food

The consumption of fresh food, sometimes referred to as perishable food, is on the rise in China. Driven by continued economic growth and urbanisation, consumption of fruit & vegetables, dairy and meat is expected to increase by another 18% between 2015 and 2025. China's economy is expected to grow at 6%-7% annually over the next decade. As a result, another 38 million households will see their incomes double, as they join the upper middle class. The country is quickly becoming a consumer-based economy, and the growing demand for pork, beef, chicken and seafood, as well as dairy products and fruit & vegetables, is a key sign that change is afoot.

Per capita fresh food consumption is showing continued growth



Urbanisation is a strong driver

Urbanisation is key when it comes to fresh food consumption. Between 2010 and 2025, an additional 300 million Chinese will move from rural areas to cities, where more fresh foods are consumed. Vegetables, for example, account for 33% of urban residents' food consumption, but only 25% of that of rural residents. Regionally, most of the growth in fresh food consumption will occur in so-called third- to fifth-tier cities, in which an increasing portion of the population is joining the middle class and eating more meat, fruit & vegetables, and dairy products.

Source: China Statistical Yearbook, Rabobank, 2015

Suppliers of fruit & vegetables, dairy and beef will benefit most

China's high consumption level of fruit and vegetables aside, dairy looks to be one of the biggest drivers of fresh food growth—as the supply of safe and secure product is improving. In recent years, there has been a large expansion of domestic dairy farms, and this will help reduce domestic prices and improve consumption.

Animal protein consumption will continue to increase, but probably at a slower rate than in the past decades. Efforts to modernise pork production have driven a cull in China's hog herd, and many small producers have gone out of business. Imports are expected to help fill the void, but this rationalisation will take time.

Seafood remains a bright spot. Whereas land-based proteins experience most growth as a result of a growing middle class, seafood consumption occurs primarily at the top of the income ladder. This is the group that is driving the growth in China's imports of high-end mussels, oysters and other premium shellfish.

Fruit & vegetables are growing most—beef is growing fastest

Per capita consumption in kilogrammes	*2015e*	*2025f*	*Δ million tonnes*
Beef	5	7	3
Dairy	26	35	13
Fish	40	50	14
Chicken	9	11	3
Fruit & vegetables	332	384	73
Pork	42	46	6

Source: China Statistical Yearbook, Rabobank, 2015

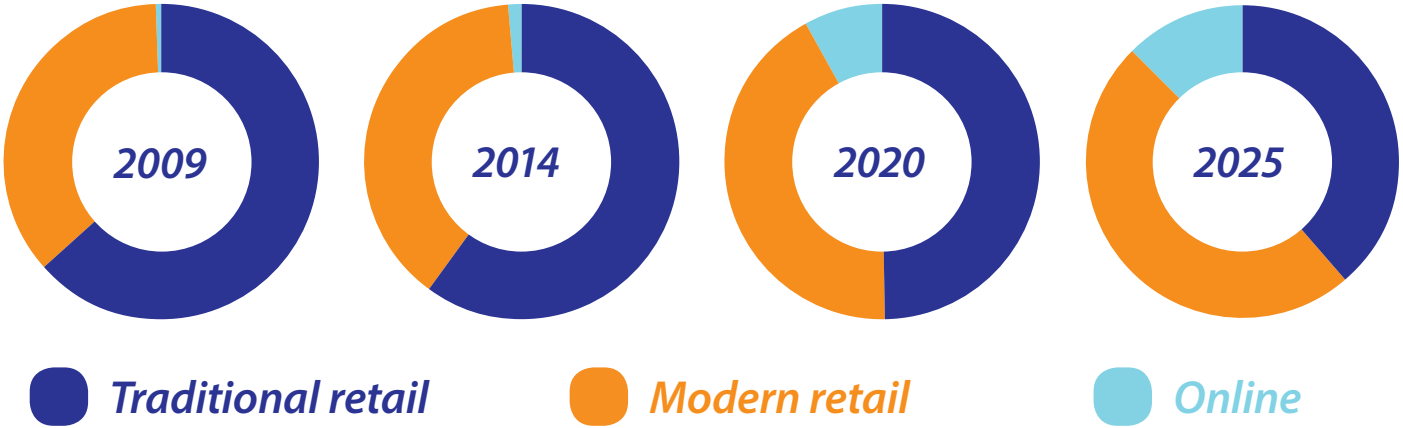
Modern retail requires improved cold chains

Although fresh food is not the profit centre in many retail stores at the moment, it is an important category. It upgrades the store's image, attracts consumers and shows competitiveness. The challenge for modern retailers is to improve consumer satisfaction by offering freshness, competitive prices and comfort. At the same time, they need to standardise and streamline a distribution system that is currently inefficient due to the numerous layers of wholesalers and suppliers in China.

Changes in distribution reflect the need for food safety and convenience

Fresh food is increasingly reaching Chinese consumers via modern distribution channels, which have experienced rapid growth in the past 20 years. These include supermarkets, hypermarkets, convenience stores and food service. Urbanisation, food safety concerns, and higher demand for quality, convenience and freshness are the driving forces. To meet these consumer demands, modern retail uses the cold chain, which is the logistical chain for the distribution of chilled and frozen food. The change in fresh food sales via major distribution channels shows that modern retail and food service have grown steadily, while the traditional market—which includes the 'wet markets'—lost share from 2008 to 2014. In the coming years, the distribution structure will become more diversified.

Fresh food distribution channels are changing



Source: Euromonitor, Rabobank, 2015

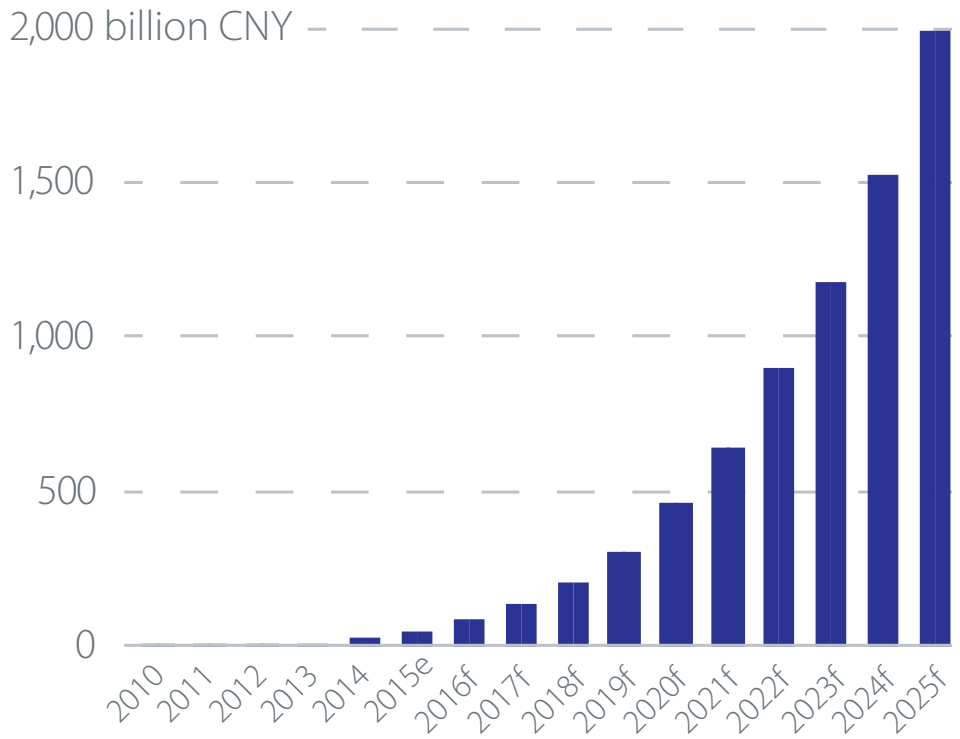
Online can accelerate imports of fresh food

In China, online retail has emerged as the fastest-growing distribution channel. Fresh food currently only accounts for a negligible share of 1% in total online retail sales. But in the past three years, fresh food has become the focus for many online retailers, increasing sales at an astonishing pace. Womai (an online shopping platform owned by COFCO, China's largest food company) has doubled its fresh food sales each year for the past two years and is set to continue to grow 200% annually in the next five years. Fresh food via online retail is expected to show annual growth rates of above 50% in the coming years. This is faster than average online retail growth, estimated at 40%. And although fresh food still only makes up a small portion of total online sales, in food-focused online retail (with players like Womai, Yihaodian and Yummy77), fresh food will become the dominant category in three to five years.

Online fresh food sales are growing at an astonishing pace

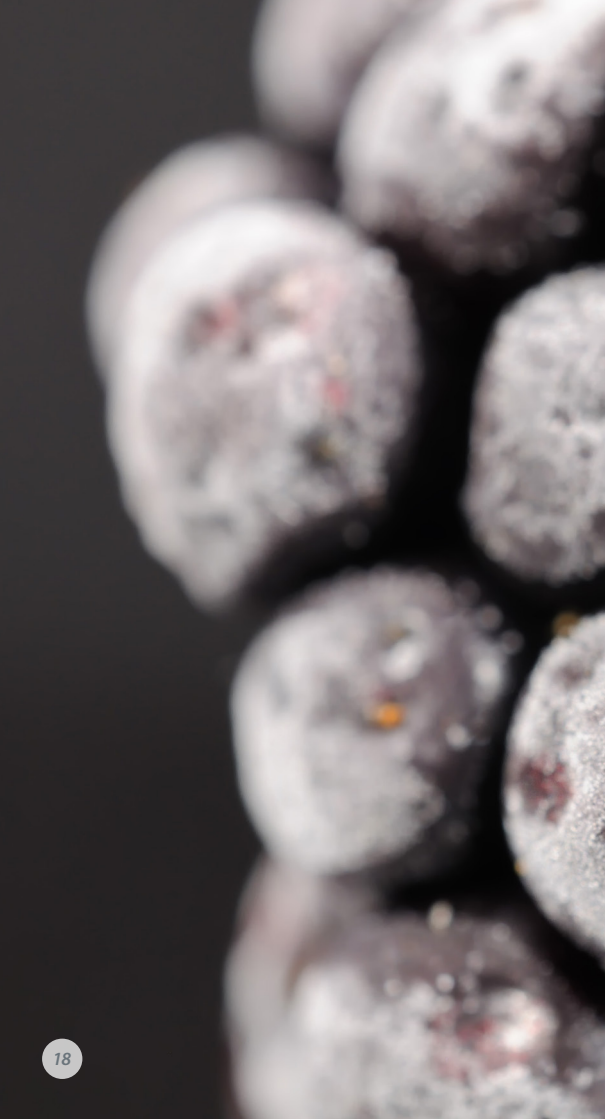
Opportunities for imports are increasing

With 13% of total value, imported foods sales top online food sales in China. As a result, all major online retailers advertise that they're able to supply imported food such as seafood, beef or fruit. Many online retailers with direct sourcing strategies have built their own cold chain infrastructure to secure distribution.



Source: China Statistical Yearbook, Shenyin Wanguo, Rabobank, 2015


Rabobank
WAGENINGEN UR
For quality of life
2
Can the supply chain deliver?
Success depends on dynamics in logistics



Demand for fresh food will be met by growing imports

China's overall agricultural trade is expected to grow in coming years. As domestic agriculture struggles to keep up with economic growth, imports will grow faster than exports. Rabobank expects food safety to remain one of the biggest concerns for the Chinese population, fuelling further imports of fresh produce, dairy and animal protein. China currently imports USD 6 billion to USD 7 billion of fresh food from Europe each year—mainly pork, dairy, fruit and seafood.

Europe will increase export volumes

About 22% of China's food imports currently come from Europe, while North America and South-East Asia both have a 20% share. 2014 was the first year that Central Asia exported fresh fruit to China—including cherries, melons and pomegranates. Going forward, China looks set to increase imports of meat, dairy products, fish and fruit from Europe. Europe has passed the US to become the largest pork supplier to China in 2015. China will also increase fresh fruit imports from Central Asia.

Rabobank

Opportunities are increasing for exporters of fresh food to China

thousand tonnes	*2015e*	*2020f*
Beef	**360**	**430**
Pork	**670**	**730**
Poultry	**480**	**590**
Fresh dairy products	**160**	**290**
Fruit	**3600**	**4300**

Source: OECD, Rabobank, 2015

OBOR to support Eurasian fresh food logistics?

In September 2013, president Xi Jinping announced China's 'One Belt, One Road' (or OBOR) strategy, a development framework focused among other things on increasing and broadening trade in Eurasia. The strategy supports the further development of two trading routes between China and Europe (one by sea and one by land) and can improve China's export possibilities but also create new opportunities for imports.

The YuXinOu railway: A case study

The land-based component of OBOR consists of several routes and corridors between China and Europe, connecting different regions. One of the most advanced routes is the YuXinOu railway, also known as the 'New Silk Road'. It is this railway especially that could bring new opportunities to the trade of fresh food.

WAGENINGEN UR
For quality of life

The New Silk Road reduces transport time by 30 to 40 days

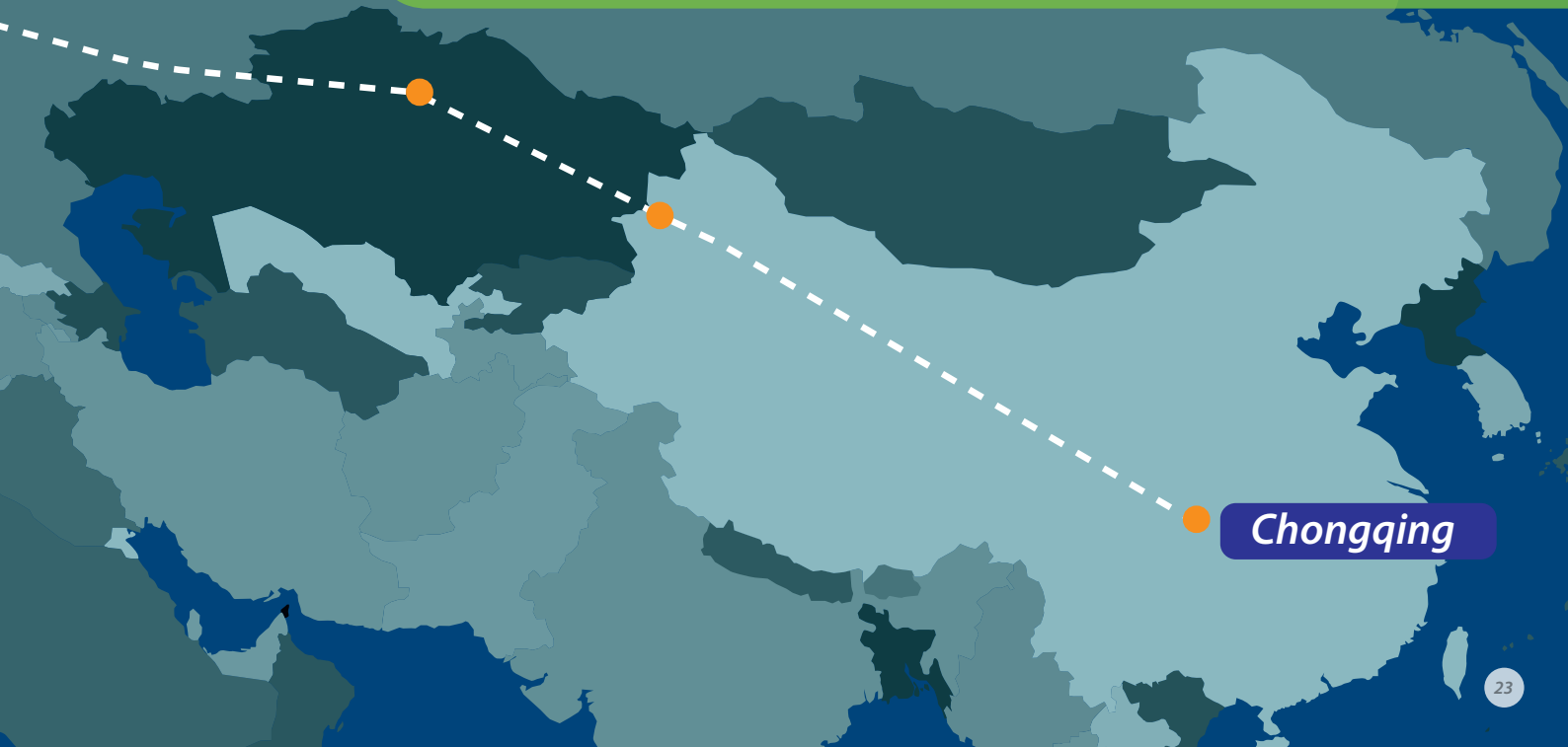
The YuXinOu railway officially started operating 19 March 2011. YuXinOu is a Chinese abbreviation for a railway connecting Chongqing and Europe. 'Yu' refers to Chongqing, 'Xin' refers to the Xinjiang Uygur Autonomous Region, and 'Ou' refers to Europe. The railway is 11,179km long. Starting in Chongqing, it runs westward to the Alataw (Alashankou) border, then through Kazakhstan, Russia, Belarus, Poland and Germany, to arrive in Rotterdam, the Netherlands.

The entire trip currently takes around 13 days—approximately 30 to 40 days less than ocean freight from China. The railway improves the connectivity and trade between continents, and serves as a shortcut for transporting freight from south-west China to Europe and back.

WAGENINGEN UR
For quality of life

Next step: securing eastbound cargo

YuXinOu was originally established to deliver IT products from mainland China (Chongqing) to Europe (Duisburg) for HP (Hewlett Packard). The line has attracted trade business from Chongqing and surrounding provinces. Currently, 40% of westbound cargo is collected from Shanghai and Guangdong. After the central office in Duisburg, three European liaison divisions (in Düsseldorf, Antwerp and Rotterdam) were set up by the Chongqing government to further develop the railway's potential and to secure eastbound cargo back to China.

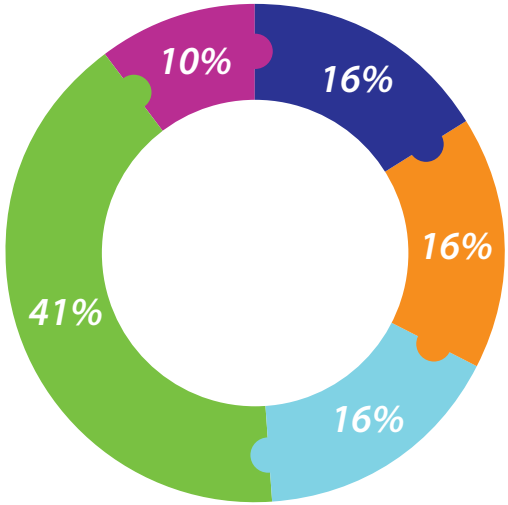


A strong partnership

When it comes to developing international trade, a well-developed logistics system is a must for an inland city like Chongqing. To coincide with the opening of the railway, an international Trans-Eurasian rail logistics company, YuXinOu Logistics Co., Ltd., was co-established 12 April 2012. It is a 'four countries, five parties' joint venture set up by four countries along the line, with an initial investment of USD 6m. Headquarters are located in Chongqing. The five parties hold different amounts of shares.

Optimising the railway route

The main activity of YuXinOu Logistics Co., Ltd. is to organise the regular transportation of container cargos on the route from Chongqing to Europe and bring more imports into China from Europe. The joint venture also helps to optimise the railway route and minimise transportation costs, as well as guaranteeing logistics services, such as transportation price negotiation and transportation security services.



Source: Wageningen UR, 2015

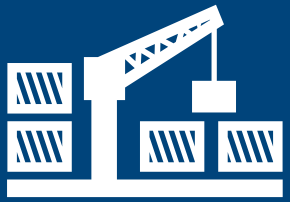
Smooth cooperation between players with different roles

WAGENINGEN UR
For quality of life

Railway operators

YuXinOu Logistics Co., Ltd.
KTZ Express

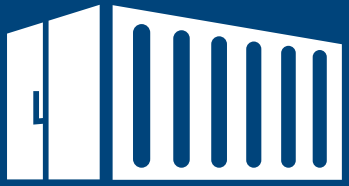
The YuXinOu railway route has two operators and is a joint venture between YuXinOu Logistics Co., Ltd., and KTZE, Kazakhstan's national railway. YuXinOu Logistics Co., Ltd., operates the Chinese section, while KTZE operates the route in the CIS (Commonwealth of Independent States) and European sections.



Logistics Providers

Minsheng Co., Ltd.

Minsheng Logistics Co., Ltd., is a large, modern, integrated logistics group. It is the main logistics provider to YuXinOu and provides value-added services such as international freight forwarding, integrated customs affairs, bonded services, warehousing & distribution. YuXinOu Logistics Co., Ltd., is mainly responsible for cargo in westbound trains, while Minsheng Logistics Co., Ltd., is responsible for cargo in the eastbound trains from Europe to Chongqing.



Container suppliers

Unit45 B.V.

With investment from HP Logistics and KTZE, Unit45's 45-foot diesel-electric reefer containers are built especially for YuXinOu rail, and are suitable for the intermodal market. The 800-litre diesel tank makes long-distance trips (20 to 25 days) possible, without refuelling during the trip. Container conditions can be monitored from the remote track-and-trace system. The unit can support eastbound/westbound cargo year-round, despite outside temperatures of -45°C in winter to 45°C in summer.

The current reefer container is Unit45's fifth generation. 200 were purchased and used last winter, with even more to be used this winter.

Rail transport costs will come down

A balanced number of trains is key

The price for transport from Chongqing to Rotterdam and vice versa using YuXinOu is approximately USD 6,000/40ft container. Per km cargo prices have fallen steadily over the past years: from USD 1/km/40ft container in 2011 to USD 0.55/km/40ft container in 2015.

Currently, the westbound block trains operate four times per week. There are still more westbound than eastbound trains. When there are not enough eastbound trains, containers and wagons have to travel back empty, which accounts for approximately 30% of total transportation costs. Therefore, lower transportation costs can only be achieved by balancing the amount of trains.

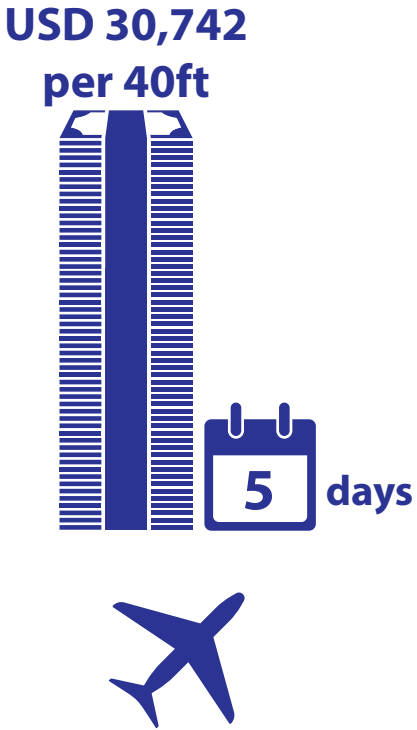
In each westbound train, up to 40% of the products are Chongqing-produced IT products. In other words: IT products make up the 'basic' cargo. Eastbound trains need similar basic cargo to ensure fully-loaded trains.

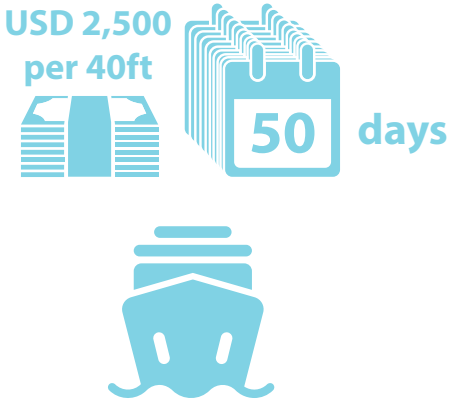
Rail has advantages over sea

Overland transportation could be seen as a safer means of transportation, as it avoids risks such as pirates and typhoons. Because of the shorter transportation time, less working capital and inventory costs are needed, compared to sea transport. In addition, inland transportation costs (from seaport to inland China) are largely reduced when cargo can be directly delivered from Chongqing to Europe.

WAGENINGEN UR
For quality of life

YuXinOu's current transport price needs to drop to become competitive





Source: Wageningen UR, Rabobank, 2015

Efficiency can be improved by harmonising rail infrastructure

The connection between western Europe and CIS countries is characterised by a difference in rail gauge. CIS countries use wide gauge tracks (1,520mm), while China and European countries use the standard gauge tracks (1,435mm). This means containers have to be transferred twice along the way. This only takes four to five hours, but coordinated investments in innovative technology are needed to speed this up.

WAGENINGEN UR
For quality of life

Platform lengths also vary between different sections. The platform length in European countries is almost half that of platforms in CIS countries and China, leading to a restriction in the amount of cargo per train. Currently, each train is restricted to only 41 containers due to the platform length in Europe.

Finally, wagon sizes also differ. In European countries, 45-foot reefer containers are commonly used on 90-foot wagons (supporting two 45-foot containers). But there are not enough 90-foot wagons available on the YuXinOu railway line. Most of the wagons in China are 60-foot wagons, leaving 15 feet of wasted space. The 60-foot wagons are not suitable for European railways, so empty 60-foot wagons have to be delivered back to China, accounting for approximately 30% of the total transportation price. To ensure optimal transportation price for exporters, investments in 90-foot wagons and 90-foot wagon handling equipment are needed.

	Distance	*Gauge width*	*Platform length*	*Wagon length*
Europe	**1,300km**	**1,435mm**	**450m to 650m**	**90ft**
	Customs transfer/exchange of gauge			
CIS	**5,496km**	**1,520mm**	**1,050m**	**90ft**
	Customs transfer/exchange of gauge			
China	**3,777km**	**1,435mm**	**1,050m**	**60ft**

Source: Wageningen UR, 2015

Designated ports for agriproducts need to be developed

There are two Bonded Port Areas in Chongqing: Lianglu-Cuntan Bonded Area and Xiyong Bonded Area. Lianglu-Cuntan is the designated port for imports of meat and fruit, while Xiyong is the designated port for IT products. YuXinOu terminal is currently only designated as a 'vehicle import' port as agriproducts can not be customs-cleared there. Feasibility studies for establishing imported meat- and seedling/bulb-designated ports have been finalised.

Chongqing focus on fast customs-clearance process

Customs-clearance speed is a big concern for many Dutch exporters. A short customs-clearance time at the destination port is attractive to exporters. Chongqing has an advanced customs-clearance speed. Once exporters have all the documents needed, paid the tax, passed the CIQ check, the 24-hour clearance rate is approximately 97%, which is much higher than China's average. The advanced customs-clearance time at YuXinOu terminal is due to smaller cargo volumes, compared with eastern coast ports.

Authorities are investing in next steps

WAGENINGEN UR
For quality of life

Political commitment is key for success of the railroad

Sino-European Secure Smart Trade Line (SSTL) Pilot Project (安智贸协议)

YuXinOu terminal was listed in the SSTL Pilot Project in 2011. The SSTL Pilot Project builds a safe and intelligent international trade logistics chain through cooperation between Chinese and European customs, and between customs and businesses. This is the first time SSTL carried out a pilot project on other means of transportation than the sea lane. When using the terminal, containers do not need to be opened for inspection or quarantine checks. One B/L document is sufficient for the whole trip, and only two customs clearances are conducted: by Chongqing customs and by customs at the destination (Rotterdam).

Are Russia's counter-sanctions merely temporary?

The success of the New Silk Road also depends on whether Russia sees the added value for its own consumers and traders. Currently, Russia's counter-sanction measures prevent the import of food categories such as meat, dairy, vegetables and fruits from the EU. Russia has extended these measures until August 2016. Some products are exempt and could be traded using the 'New Silk Road', e.g. baby milk powder and vegetable oil.

Photo: Chongqing Logistic Council, 2015

Dutch agricultural products will benefit from their strong reputation

There is no doubt that Chinese consumers are demanding high-quality and safe agri products. The Netherlands is the world's second-largest net exporter of agricultural products, yet export of Dutch agri products to China is currently very limited.

Current exports to China are the permitted Dutch pear and bell peppers (ongoing negotiations). Recent studies indicate that the following Dutch agri products are well-positioned to be transported via YuXinOu to China: cherry tomatoes, soft fruits (cherries and blueberries), flower bulbs, veal and baby milk powder.

The strongest selling point of all these products is the reputation of the Dutch agricultural sector in China. This reputation is one of professionalism and modernisation, which, in turn, translates into high productivity and food safety.

The recent opening of the Dutch consulate in Chongqing boosts the political dialogue between both sides. The Rotterdam Commercial Representative Office (RCRO) in Chongqing brings Dutch businesses into direct contact with potential partners in Chongqing, particularly in the field of agrilogistics.

These new developments stimulate business cooperation and investment opportunities between Chongqing and the Netherlands. All in all, it is arguable that Dutch agriproducts could be offered as the 'basic products' for eastbound YuXinOu trains.

The New Silk Road—opportunities abound for Europe and China

The YuXinOu railway can deliver fresh agriproducts from Europe to Chongqing, with:

- Much shorter **transportation times** than sea transport
- Much lower **transportation costs** than air freight
- A reliable **railway operator** and **logistics providers**
- Ready-to-be-implemented container **technology**
- Advanced **customs-clearance** times at Chongqing terminal

Chongqing can act as a multi-functional agri-logistic hub in South-West China. This calls for:

- A strategic **master plan**: spatial design, functional regions, seamless chain, political commitment
- Upgrading of different **transportation systems**: railway, river, air freight, highway
- **Closer collaboration** between different transportation departments

Investment opportunities:

- Investment in Eurasian rail **infrastructure**: gauge, wagon, electrification, etc.

  Potential investors: Silk Road Fund and Asian Infrastructure Investment Bank

- Investment in **cold chains** in Chongqing: cold storage, controlled atmosphere—both in scale and in technology

  Potential investors: commercial banks and private investors

- Investment in **talent**: professional and academic training programme

  Potential contributors: universities and research institutes in agro-logistics

Step forward:

- Agri product trials in **simulation environment**: Dutch pears
- Agri product trials in **reality**: baby milk powder (not on the sanction list)

WAGENINGEN UR
For quality of life

The future of China's cold chain industry

Cold chain infrastructure needs to connect the New Silk Road with the Chinese consumer

The success of fresh food (officially perishables) trade using the New Silk Road will not only depend on removing the barriers of the train corridor. To reach the Chinese consumer with high-quality and safe products, the supply chain requires the presence of a well-functioning cold chain infrastructure.

Cold chain logistics capacity in Chongqing is growing. For instance, Chongqing Care Cold Chain Logistics Industry Park is the first cold chain logistics park in Chongqing, and the only inland facility that has been authorised to register and apply for phyto-sanitary inspection on site. It cooperates closely with inspection authorities. The park offers a 50,000m^2 storage area, 30,000m^2 trade area and 80,000m^2 processing area.

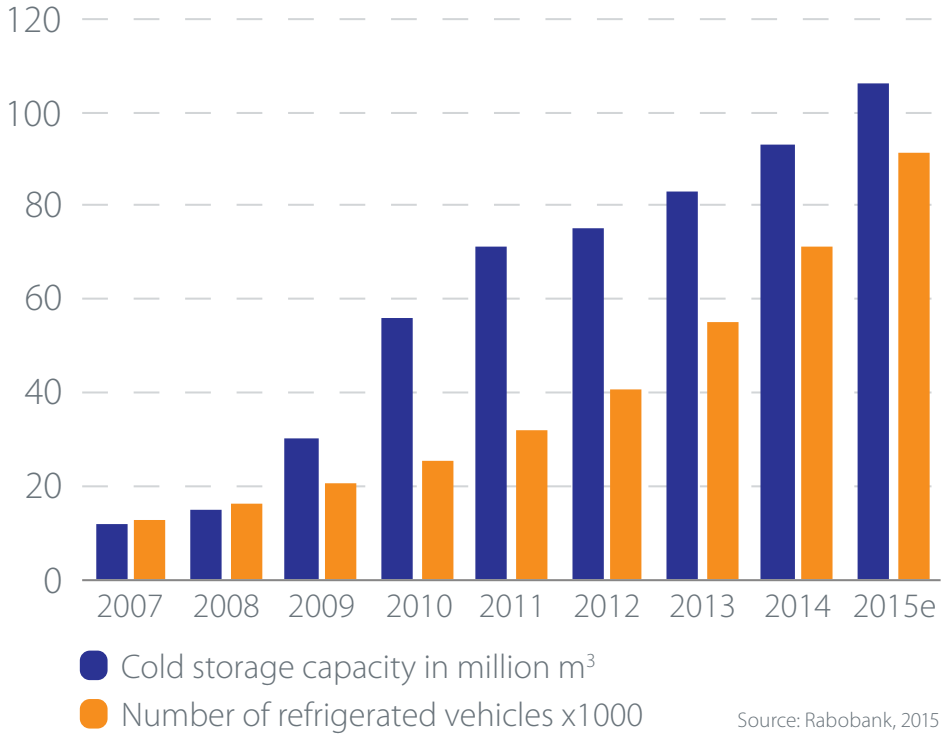
Optimised supply chain solutions are vital to attracting investments and exporters. Chongqing's top-notch hard infrastructure and smart logistics infrastructure are however currently still lagging. For example, there is no cold storage at YuXinOu terminal. In the coming years, the Chongqing cold chain sector needs to expand its hardware, upgrade its software and gain experience in optimising cold chain management. In fact, this challenge is true for China in general.

Rabobank

China is investing in the cold chain sector

Fresh food consumption heavily depends on an adequate cold chain between farm and fork. So to support the growing consumption of fresh foods and the expectations for food quality and safety, China has been investing heavily in cold chain infrastructure. Supported by central and local governments, storage capacity has grown from 12 million cubic metres in 2007 to roughly 100 million cubic metres in 2015, while the number of refrigerated vehicles grew from 13,000 to 90,000. As a result, the cold storage and transportation market is now generating about CNY 100 billion, or USD 14 billion, in annual revenues.

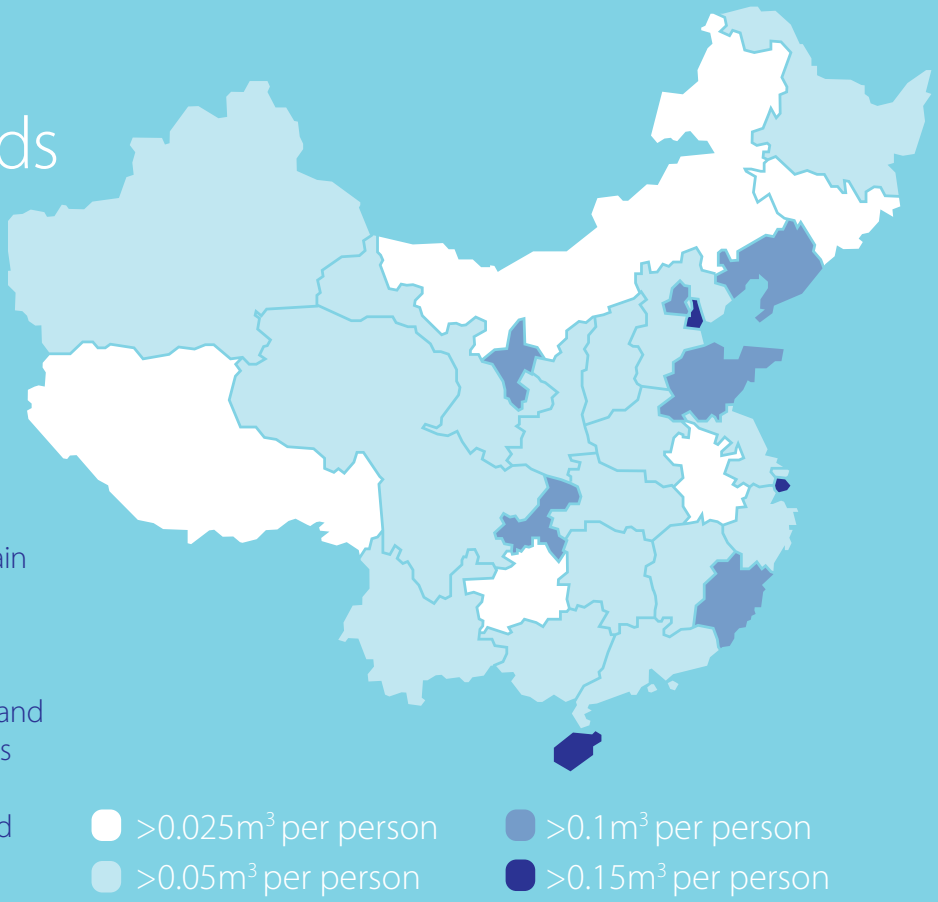
Cold chains are a hot investment item



Source: Rabobank, 2015

Cold chain infrastructure needs to head west

More than 60% of China's cold storage capacity is located in the eastern coastal areas. To improve the availability of perishables for consumers in second- and third-tier cities, the country requires significantly more investments in cold chain infrastructure in the west, south-west and north-east. But last year still saw 41% of new cold storage capacity being built in eastern provinces like Shandong, Jiangsu and Zhejiang. Positive exceptions are provinces like Chongqing, in the west, where cold storage capacity increased at a compound annual growth rate of 34% between 2010 and 2015—more than double China's average of 15% in the same period.



Source: Cold chain logistics development report, Rabobank, 2015

China's cold chain sector is fragmented and built on low-value business models

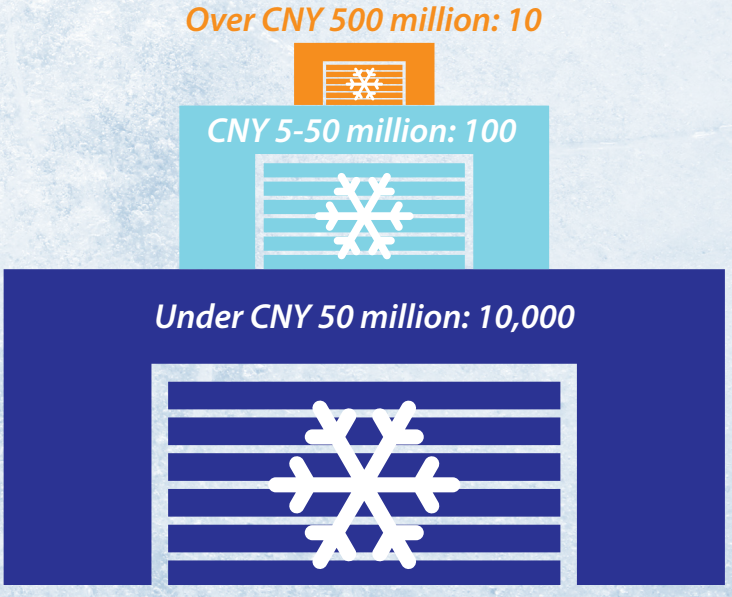
Rabobank

Despite growing customer needs, most of China's cold chain companies are still in early stages of development. As in many other countries with less-developed cold chains, the Chinese cold chain sector is fragmented, with many small-scale players offering similar services and products. Rabobank estimates that there are fewer than 20 companies with over 500,000m^3 capacity, but none of these have national coverage. As scale is crucial in reducing operational costs and in supporting a growing customer base, consolidation is expected. Currently, ownership is diverse: about 20% of companies are state-owned or state-controlled enterprises, 70% is privately-owned, and 10% is funded by large international corporations.

Finding economies of scale

Some of the biggest companies are international logistics players who may have 1 million m^3 of cold storage capacity. Others are owned and operated by large food processers or by (online) retailers. For them, operating cold chains economically is feasible, thanks to their sheer size.

It's lonely at the top: only a few companies are big players



Source: Cold chain logistics development report, Rabobank, 2015

China is closing the gap in cold chains... but more is needed

Despite recent growth in capacity, Chinese cold chain infrastructure is still lagging. To put things into perspective: today, each Chinese consumer has 0.07m^3 cold storage capacity available, while a consumer in India has 0.11m^3 and a US citizen even has 0.35m^3 of cold storage available. Further growth of cold storage capacity is an absolute necessity in China but increasing refrigerated transport capacity is perhaps even more important: it is indispensable when it comes to creating integrated cold chains.

As Chinese investments in cold chains continue, Rabobank expects the country to have 40% of its perishables distributed via cold chains by 2025 (versus 15% to 20% today). This will mark a major improvement, but will still be below the 60% to 80% use of cold chains in developed countries.

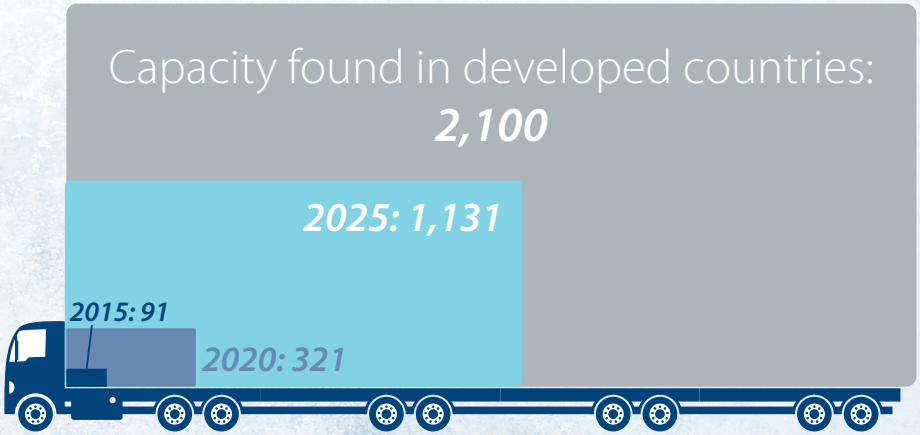
Differentiation of assets is required

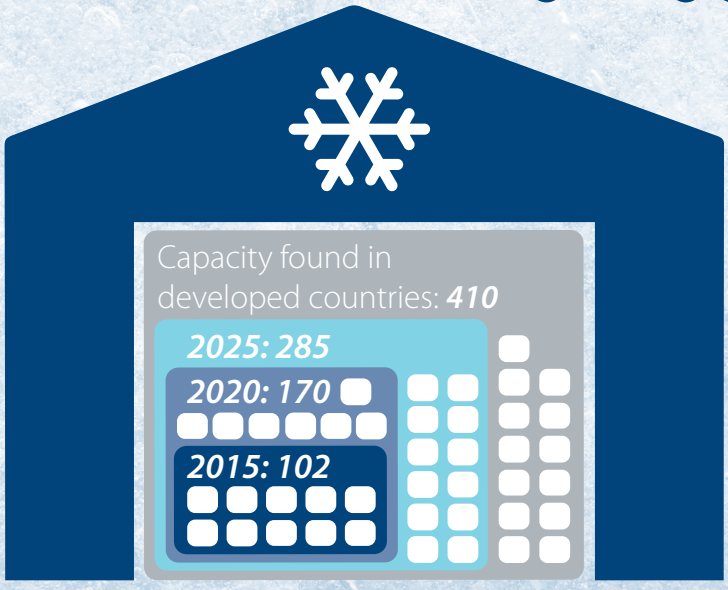
In addition to growth, China's future cold chain capacity also needs to accommodate more product types. Currently, fruit and seafood are dominant in terms of capacity utilisation, but in the coming years, more meat, dairy and even rice will need access to cold chains. Also, there is a trend towards logistics of processed at the expense of bulk logistics. For these reasons, new, multi-purpose and multi-temperature facilities will need to be built.

Rabobank

Number of refrigerated trucks in China

thousands





Cold storage capacity in China

million m^3

Source: Rabobank, 2015

China needs to build higher-quality and higher-service cold chains

Rabobank

China's cold chain challenge goes beyond the current capacity gap. It needs a major improvement of current cold chain assets and operations. An estimated 75% to 80% of cold chain infrastructure in China is of insufficient quality. Although cold chain companies have benefited from government support, they neglected the needs of their potential client base. As a result, cold chain providers focused on volume and standard service and a very competitive low-cost market emerged, preventing companies from investing in quality and value-added services.

From volume to value strategy

Growing reputational risks mean food companies are demanding better cold chain practices and protocols. And the growing diversity of products and distribution channels, means food companies require a higher level of customisation and flexibility from their cold chain provider. In addition, they are asked to provide multi-temperature rooms and different options for handling. To increase overall supply chain efficiency for clients, cold chain providers are expected to offer a higher degree of automatisation, warehouse management systems and enhanced traceability of products.

The needs of China's cold chain customers are growing

Quality	• *Improved food safety protocols* • *Refurbishment of inferior cold chain assets*
Customisation	• *Greater flexibility and bespoke services*
Value-added services	• *Warehouse management services* • *IT solutions* • *Services such as packing, processing and inspection*

Changing business models will lead to better quality

The current Chinese cold chain market has too many companies offering similar services (e.g. bulk, single-temperature, short-distance) and high-volume/low-cost strategies. To improve overall margins in the sector, companies will need to change their business models. Opportunities to do so are handed to them by developments at the customers' end. Chinese food manufacturers, processors and retailers see the complexity, requirements and diversity of their supply chains grow and the cost of their logistics rise. As operating and owning a cold chain becomes an increasing cost and distraction from their core business, companies are looking for efficiency and outsourcing—a trend previously seen in developed markets like the US and EU.

To meet client needs, cold chain companies can change their business models in three ways:

Integration Servicing food companies with integrated solutions rather than a number of distinct logistical services. Part of the move towards 3PL (third-party logistics) business models. As logistical needs grow beyond coastal cities, regional integration is also required.

Specialisation Chinese companies will need more expertise on the best logistics solutions for their food products. A focus on specific activities or products will help companies to enter less-competitive environments.

Management services Clients will be looking for new and diverse operation and ownership models to reduce risk. Margins on managed services can be 25% to 50% higher than on standard services.

Cold chain companies should pursue integration, specialisation and customisation

Integration

will improve the quality of cold chains as knowledge and best practices are shared much faster

- Increase efficiency and lower costs
- Offer one-stop shop solutions
- Expand in the customer supply chain by taking over activities such as packing, inspection and certification
- Improve regional integration

Specialisation

improves quality of cold chains as knowledge is the differentiating factor for businesses

- Focus on specific parts of the supply chain; B2C, express, rail, air
- Focus on specific product expertise: frozen, fresh, meat, fruit

Management services

can improve quality of cold chains, as risk and responsibilities are distributed in new ways

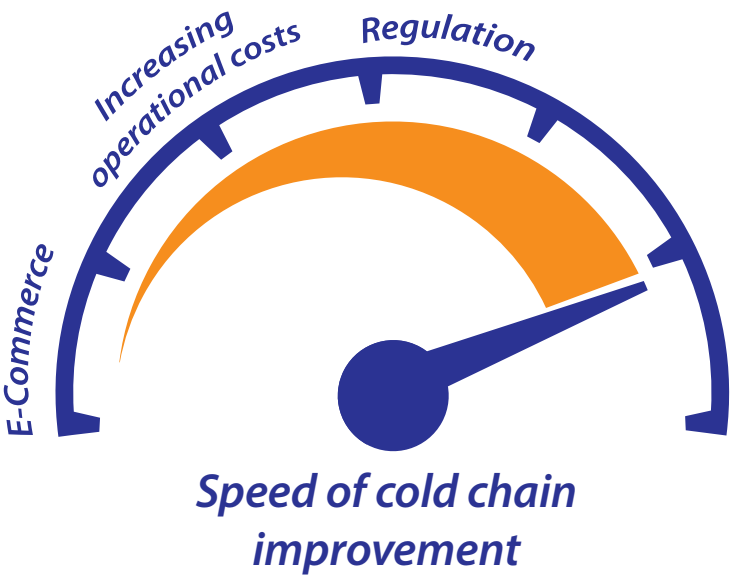
- Move into cost + contracts
- Create new ownership models

Clients determine the speed of improvement

Business models will not change, and quality will not improve unless clients pay higher prices for better quality, or expand their cold chain demands in terms of services.

It is difficult to predict when this will happen, but one trend that provides us with clues as to the speed of improvement is e-commerce. E-commerce accelerates the pace of matching domestic cold chain services and international high-level standards. In addition, the expectation that more than half of all perishables will be distributed through modern retail channels in 2025 can be a tipping point for cold chain providers. The need for high-level cold chains will overtake demand from clients with lower standards.

Additional drivers will be regulation—which should push customers to best-in-class cold chain providers—and macro-economic trends such as labour and energy costs. Increasing labour and energy costs might drive efficiency improvements and quality, as investments in automated inventory management and automated handling will provide a better return on investment.



Investments will depend on the appetite of three types of businesses

Rabobank

Rabobank estimates that USD 85 billion is needed between 2015 and 2025 to improve China's cold chain infrastructure. Three types of companies can be expected to consider investments:

- Internationally-funded enterprises or JVs
- Domestic logistics providers
- Cold chain companies owned by retailers and/or branded food manufacturers

Estimated investments in China's cold chain: ***USD 85 billion***

Internationally-funded cold chain companies

- Know how to operate high-level cold chains efficiently

- Experienced in attracting the most prominent clients

- Have high standards, making acquisitions and partnerships challenging

- Returns on greenfield investments may be lower than elsewhere in the world

Cold chain providers owned by retailers or manufacturers

- Can grow business by increasing share of revenues from other food companies

- Driven mainly by expansion plans of the owner, cold chain business can have low priority

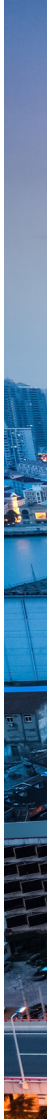
- Must build trust to acquire new customers

Domestic cold chain logistics providers

- Can reduce competition by moving into higher-margin business models.

- Ownership model and local background can make consolidation easier

- May have the biggest improvement to make in terms of quality and knowledge



3 A leap into the future

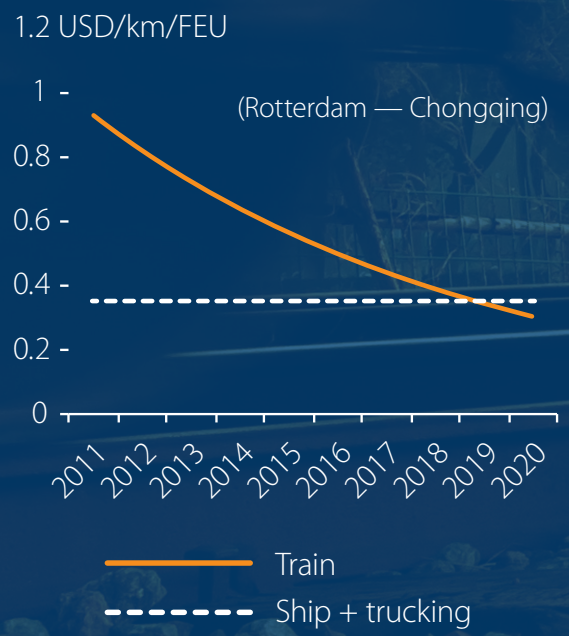
The potential impact of the New Silk Road and high-level cold chains on China

The New Silk Road will lower costs and increase capacity...

Lower costs

If current cost reductions are continued, the New Silk Road has the potential to become cost competitive with shipping. First on inland destinations and later on coastal destinations. Key drivers of cost reduction will be the growing number of trains, their increasing size and the further reduction of travelling days.

The New Silk Road becomes competitive



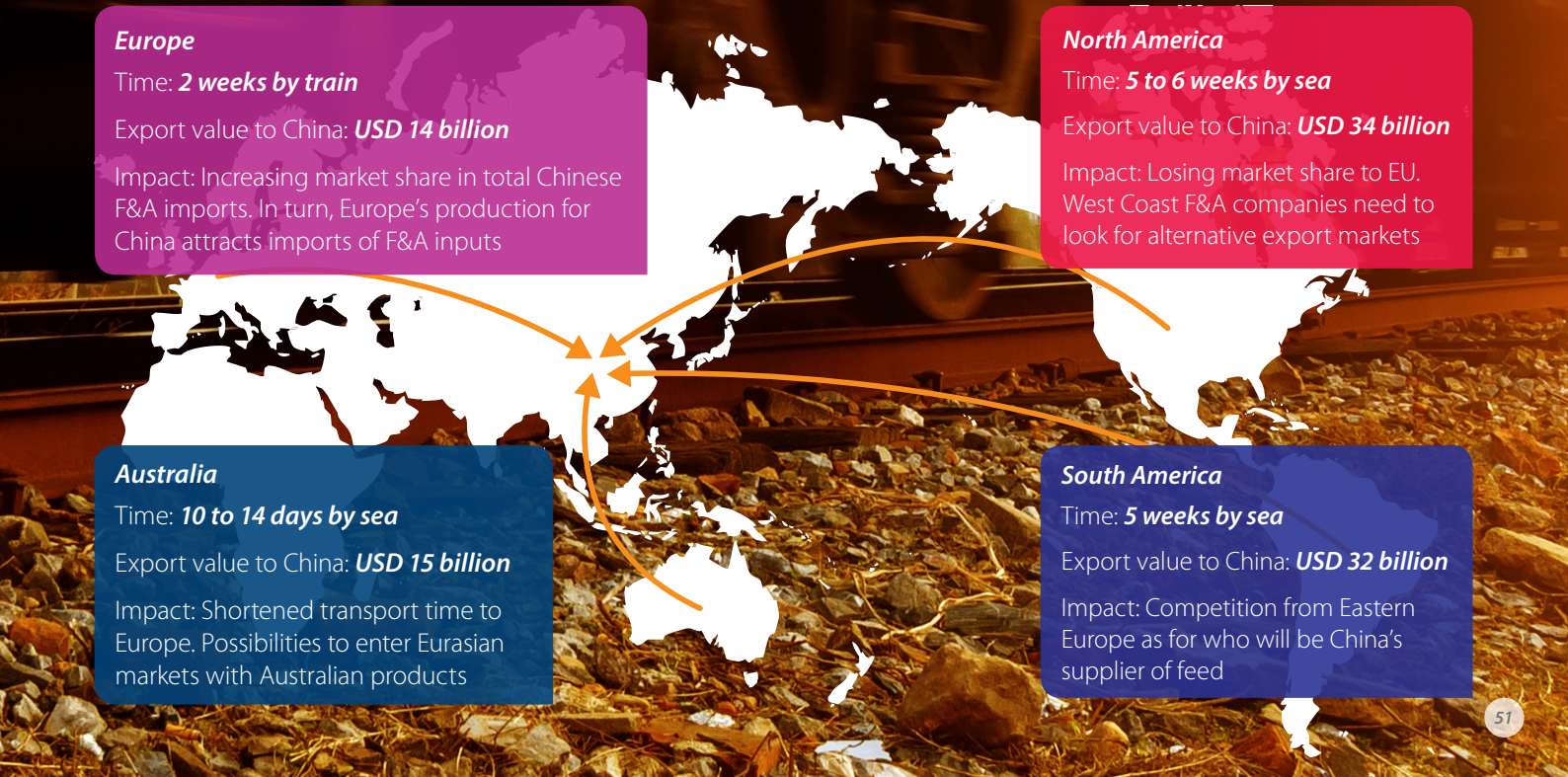
Increased capacity

Globally, freight trains are growing in capacity. Single track railway corridors can typically grow to accommodate 100 containers per train and 10 trains per day. This would result in an annual transport capacity of 365,000 containers, or 10 million tonnes. For comparison, China's current import of perishables by ocean is also approximately 10 million tonnes.

...to change global food & agri trade

Changing global F&A trade

Fresh food will be the first adopter of the New Silk Road as its strongest point is to reduce transport time.
If the New Silk Road reaches cost parity with shipping however, all food and agri products will be impacted.



Europe

Time: ***2 weeks by train***

Export value to China: ***USD 14 billion***

Impact: Increasing market share in total Chinese F&A imports. In turn, Europe's production for China attracts imports of F&A inputs

North America

Time: ***5 to 6 weeks by sea***

Export value to China: ***USD 34 billion***

Impact: Losing market share to EU. West Coast F&A companies need to look for alternative export markets

Australia

Time: ***10 to 14 days by sea***

Export value to China: ***USD 15 billion***

Impact: Shortened transport time to Europe. Possibilities to enter Eurasian markets with Australian products

South America

Time: ***5 weeks by sea***

Export value to China: ***USD 32 billion***

Impact: Competition from Eastern Europe as for who will be China's supplier of feed

High-level cold chains create multiple benefits for China

Cold chains are a pivotal part of any country's food distribution infrastructure and have a huge impact on people's access to food. A transition to high-level cold chains could also benefit China in areas such as farmer income, sustainability, balanced nutrition and healthcare costs.

14% reduction in waste of fresh food

Cold chains in developed countries generate 14% less waste of perishables compared to developing countries—a USD 7,5 billion saving in China annually.

This also reduces farm inputs, positively impacting availability of water, land and ultimately productivity in China.

10% reduction in food prices and hunger

Investments in China's food distribution infrastructure can reduce food prices and risk of hunger by 10%. Rural income will increase as farmers transport their crops in refrigerated trucks, leading to higher quality.

Reduction of healthcare costs

Improved cold chains help to reduce the over 90 million recorded cases of food borne diseases in China annually, as they allow people to buy better-preserved foods.

10-20% reduction of emissions

Conventional cold chain technologies cause significant greenhouse gas emissions and pollution by leakage. Modern, energy efficient, technologies and new refrigerants can reduce emissions of both vehicles and warehouses by 10-20%.

Improvement of diets and balanced nutrition

Improved cold chains can stimulate balanced nutrition as cooling has the unique ability to extend product shelf-life, while maintaining the initial physical, nutritional and chemical properties desired by consumers.

How the New Silk Road and cold chains can improve the stability and competitiveness of China's food system

Development of logistical infrastructure such as the New Silk Road and cold chain networks have the potential to connect the Chinese consumer with an increasing number of food producers. The enhanced connections between (international) food producers and Chinese consumers reduce vulnerability to regional events—such as diseases and extreme weather—enhance competition and improve price stability of the food system.

Speed of trade to improve food price stability

Improved logistics that reduce transportation time and reduce waste, lower the volatility of food prices. Importers can respond to shortfalls in local availability more quickly and price volatility is reduced. The potential impact of faster transport will depend on China's developing position as a net importer of food.

Nationwide networks would improve availability and competition

The New Silk Road and improved cold chain networks will be an important part of the Chinese governments' efforts to improve food security and accessibility. This creates opportunities for nationwide and all-season supply of fresh food, for instance from China's southernmost tropical provinces in winter, or from its northern provinces in summer. Internal quality and competition can also be enhanced, benefiting China's competitive position for global trade.

From Freight Trains to Cold Chains
Building China's New Supply Chains for Fresh Food

Lead authors:
Paul Bosch
Food & Agribusiness Research and Advisory, Rabobank
Xiaoyong Zhang
Wageningen UR

Contributors:
Ping Chew
Chenjun Pan
Will Sawyer
Lief Chiang
Food & Agribusiness Research and Advisory, Rabobank

Ning Fan
Wageningen UR

Acknowledgements:

Bright Food Group
Care International
Chongqing Customs District People's Republic of China
Chongqing Entry Exit Inspection and Quarantine Bureau
Chongqing Municipal People's Government Logistic Council
Chongqing University
COFCO
FloraHolland
FrieslandCampina
GroentenFruitHuis B.V.
Hewlett-Packard Development Company, L.P.
Hoogwegt International B.V.
Jaguar, the Fresh Company B.V.
Jinguoyuan
Kingdom of the Netherlands
KTZ Express
Minsheng Logistics Co., Ltd.
Pacific Dairy Ingredients Co., Ltd.
Royal Wagenborg
Rotterdam Partners
Rotterdam Commercial Representative Office
SinoTrans PFS
Unit45 B.V.
Vion Food Group
YuXinOu Logistics Co., Ltd.

WAGENINGEN UR
For quality of life

Rabobank

Banking for Food is Rabobank's vision on global food security and the role of the bank. As a consequence of a growing and wealthier global population, the demand for food is expected to rise considerably. The food and agri value chains have to produce more with fewer natural resources. As a leading international food and agri bank, Rabobank aims to support and facilitate in meeting this challenge—by providing access to finance, knowledge, and networks to clients and their communities.

This report has been published in line with Rabobank's long-term commitment to international food and agribusiness. It is one of a series of publications undertaken by the global department of Food & Agribusiness Research and Advisory.