

Investment and export opportunities in a sustainable pig supply chain in China



Investment and export opportunities in a sustainable pig supply chain in China

Robert Hoste

Dinghuan Hu

Jochem Tolkamp

LEI report 2013-018

January 2013

Project code 2273000373

LEI Wageningen UR, The Hague

LEI is active in the following research areas:



Agriculture & Entrepreneurship



Regional Economy & Land Use



Markets & Chains



International Policy



Natural Resources



Consumer & Behaviour

**Investment and export opportunities in a sustainable pig supply chain
in China**

Hoste, R., D. Hu and J. Tolkamp

LEI report 2013-018

ISBN/EAN: 978-90-8615-619-1

85 p., fig., tab., app.

Project BO-08-018.04-001-LEI, 'Kansen eco-efficiënte veehouderijsystemen naar opkomende markten'

Dit onderzoek is uitgevoerd binnen het kader van het EZ-programma Beleids-ondersteunend Onderzoek; Thema: Voedselsystemen; Cluster: Voedsel, dier en consument.

Photo cover: Shutterstock

Orders

+31 70 3358330

publicatie.lei@wur.nl

This publication is available at www.wageningenUR.nl/en/lei

© LEI, part of Stichting Landbouwkundig Onderzoek (DLO foundation), 2013
Reproduction of contents, either whole or in part, is permitted with due reference to the source.

Contents

Preface	8
Summary	9
S.1 Key findings	9
S.2 Complementary findings	9
S.3 Methodology	10
Samenvatting	11
S.1 Belangrijkste uitkomsten	11
S.2 Overige uitkomsten	11
S.3 Methode	12
摘要 (Summary in Chinese)	13
S.1 关键结论	13
S.2 补充结论	13
S.3 方法	14
1 Introduction	15
1.1 Background information	15
1.2 Scope of research	15
1.3 Objective	16
1.4 Method and structure	16
2 China, the country	17
2.1 Brief introduction to China	17
2.2 Policy & Legal framework	17
2.3 Economy	19
2.3.1 General economy	19
2.3.2 Tax system	22
2.3.3 Employment	22

2.4	Socio-Demographics	23
2.5	Technology	25
3	Pork supply chain	27
4	Retail and consumers	29
4.1	Consumption	29
4.1.1	Meat consumption	29
4.1.2	Meat price	32
4.1.3	Food safety	33
4.2	Retail	35
5	Meat industry	38
5.1	Meat production	38
5.2	Trade of meat and meat products	43
6	Primary Sector	45
6.1	Production	45
6.2	Economy of the production	49
7	Supplying industries	56
7.1	Feed industry	56
7.1.1	Production and consumption of feedstuffs	56
7.1.2	Feed processing	59
7.2	Other supply	61
7.2.1	Housing and farming systems	61
7.2.2	Breeding	62
8	Trade	63
8.1	Rules and regulations	63
8.2	Doing business	65
9	Export and investment opportunities from the Netherlands	67
9.1	PEST analysis	67
9.2	SWOT analysis	70

10	Conclusions and recommendations	73
	Literature, websites and personal communications	76
	Appendices	
1	Abbreviations	84
2	Pig production per province	85

Preface

Historically, pig farming is very important for Chinese families. The Chinese symbol for a household consists of the signs for roof and for pig. Pigs are said to bring fortune and happiness. Although many things have changed in the People's Republic of China, pigs are still important. For instance, half the pigs in the world are held in China, but pigs also play a role in the economic indicator Consumer Price Index.



With an expected growth of pig meat consumption in China of 15% in ten years, there are challenges towards sustainability issues. Is there an opportunity for Dutch companies to contribute to a sustainable Chinese pig production system, either by exporting products or investments? This is the research question in this report. The research was commissioned by the Netherlands' Ministry of Economic Affairs, Agriculture and Innovation. This report shows that there is a lot of opportunity in sharing knowledge and innovative products, not only since China is a very big and growing market, but also since there is ample room for sustainable intensification.

We like to thank Marinus Overheul and Emar Gemmeke of the Netherlands' Embassy in Beijing for their support in the practical organisation of the visit and for sharing their knowledge of the local situation in the pig supply chain. We also like to thank Jie Yan of the Wageningen UR China Office for organising the trip to several interesting companies and farms in and around Beijing. Thanks too to all the company representatives in Beijing (among them Jan Cortenbach of De Heus) and in the Netherlands as well, for their time and valuable information.

We wish the Dutch companies in the pig supply chain a good business in this country with vast opportunities.

L.C. van Staalduinen MSc
Managing Director LEI Wageningen UR

Summary

S.1 Key findings

Given the increasing average income of the Chinese consumer, increasing awareness of food safety and giant performance arrears there is a large need for investments in the entire pig supply chain. The Netherlands can contribute to a more sustainable Chinese pig production system, both by exporting products and investments. [See Chapter 10.](#)

The Chinese government stimulates the development of large production and processing facilities, resulting in a great demand for machinery in the entire supply chain and the required knowledge for its optimal use, such as for housing techniques, animal identification systems, feed composition, meat processing techniques, logistics chain management, traceability and benchmark systems and efficiency-oriented training for managers. [See Chapter 10.](#)

S.2 Complementary findings

Increasing labour costs and scale of production lead to industrialisation and need of labour saving techniques in all stages of the pig production chain in China. [See subsection 2.3.3.](#)

The biggest challenges in the development of pig farming in China are disease control, production efficiency and feed efficiency. To this end, not only techniques are needed (housing, breeding, feed etc.), but also awareness and improved management skills. [See Chapter 6.](#)

It is recommended to develop a high quality meat brand for sales to the middle and upper class Chinese urban consumers ([see Section 4.1](#)).

Table S.1 SWOT analysis of the Dutch pig supply chain for the Chinese pork market and industry ([See Section 9.2](#))

Dutch pig supply chain	
Strengths	Weaknesses
<ul style="list-style-type: none"> - History of International trade - Innovative, high-tech, quality focus - Integral approach - Wageningen is famous 	<ul style="list-style-type: none"> - Lacking reputation - Business mentality - Production cost (compared to competitors)
China's pork market and industry	
Opportunities	Threats
<ul style="list-style-type: none"> - Increasing income and consumption - Demand for large-scale industrial production - Growing attention to food safety - Growing attention to sustainability - Giant performance arrears - Demand for knowledge and innovation - Demand for efficiency - Strengthening Chinese currency 	<ul style="list-style-type: none"> - Domestic companies are treated preferentially - High indirect costs - Legislation interpretation and implementation - Risk of border closures - Lacking awareness of efficiency opportunities - Quality fading - Copying behaviour

S.3 Methodology

The research question behind this report was: Is there an opportunity for Dutch companies to contribute to a sustainable Chinese pig production system, either by exporting products or investments? This study was commissioned by the Netherlands' Ministry of Economic Affairs and based on an extensive literature review, as well as a visit to companies in the entire pig supply chain in and around Beijing, China. The country visit was organised in cooperation with the Wageningen UR China Office in Beijing.

Samenvatting

Investerings- en exportkansen in duurzame varkens(vlees)productie in China

S.1 Belangrijkste uitkomsten

Gegeven het toenemende gemiddelde inkomen van de Chinese consument, een toenemende aandacht voor voedselveiligheid en een enorme productiviteitsachterstand is er een grote behoefte aan investeringen in de gehele varkensketen. Nederland kan bijdragen aan een duurzamer varkensvleesproductiesysteem in China, zowel door export van producten als door investeringen.

De Chinese overheid stimuleert de ontwikkeling van grootschalige productie- en verwerkingsbedrijven in de gehele keten. Dit resulteert in een grote behoefte aan technieken en machines in de keten en de kennis voor optimaal gebruik ervan, zoals huisvesting, dieridentificatiesystemen, kennis van veevoersamenstelling, vleesbewerkingstechnieken, management van ketenlogistiek, traceerbaarheids- en benchmarksystemen en opleidingen voor efficiëntie-georiënteerde managers.

S.2 Overige uitkomsten

Toenemende arbeidskosten en schaalgrootte leiden tot industrialisatie en een behoefte aan arbeidsbesparende technieken in alle fasen van de varkensproductieketen in China.

De grootste uitdagingen in de ontwikkeling van varkenshouderij in China zijn ziektebeheersing, productie-efficiëntie en voerefficiëntie. Om hieraan tegemoet te komen zijn niet alleen technieken nodig (huisvesting, fokkerij, voer, enzovoort), maar ook bewustwording en hulpmiddelen voor managementondersteuning.

Het wordt aanbevolen om een concept te ontwikkelen voor kwaliteitsvlees dat onder merknaam verkocht kan worden aan de midden- en hogere klasse stedelijke Chinese consumenten.

Tabel S.1		SWOT-analyse van de Nederlandse varkensketen voor de Chinese varkensmarkt en -industrie	
Nederlandse varkensketen			
Sterkten		Zwakten	
<ul style="list-style-type: none"> - Historie van internationale handel - Innovatief, hightech, kwaliteitsfocus - Integrale benadering - Wageningen is beroemd 		<ul style="list-style-type: none"> - Ontbrekende reputatie - Businessmentaliteit - Productiekosten (vs. concurrenten) 	
China's varkensmarkt en industrie			
Kansen		Bedreigingen	
<ul style="list-style-type: none"> - Toenemend inkomen en consumptie - Behoeftte aan grootschalige industriële productie - Meer aandacht voor voedselveiligheid - Meer aandacht voor duurzaamheid - Grote productiviteitsachterstand - Behoeftte aan kennis en innovatie - Behoeftte aan efficiëntie - Sterkere Chinese munt 		<ul style="list-style-type: none"> - Voorkeursbehandeling Chinese bedrijven - Hoge indirecte kosten - Interpretatie en implementatie van wetgeving - Risico van grenssluiting - Onvoldoend besef van mogelijkheden om efficiëntie te verbeteren - Kwaliteitsverlies binnen contracten - Kopieergedrag 	

S.3 Methode

De onderzoeksvraag van dit rapport was: Is er een mogelijkheid voor Nederlandse bedrijven om bij te dragen aan een duurzaam Chinees varkensproductiesysteem, hetzij door export van producten, hetzij door investeringen? Het onderzoek is uitgevoerd in opdracht van het ministerie van Economische Zaken. Hiervoor is een uitgebreid literatuuronderzoek uitgevoerd en zijn bedrijven in de varkenskolom in en rond Beijing, China, bezocht. Het landenbezoek werd mede georganiseerd door het Wageningen UR kantoor in Beijing.

摘要 (Summary in Chinese)

伴随中国生猪供应链可持续进程的 投资与出口机遇

S.1 关键结论

中国消费者人均收入不断增长，人们的食品安全意识愈见增强，行业表现却大幅滞后，鉴于以上因素，整个生猪供应链有巨大的投资需求。通过出产品和投资，荷兰可以为中国生猪产业体系的可持续发展做出贡献，

中国政府对大型产业和工艺设备的刺激，使得整个供应链对机械及先进管理知识有很大的需求，例如猪舍建设工艺、动物识别体系、饲料成分、肉类加工工艺、物流链管理、可追溯和标杆体系，以及对目标管理者的培训。

S.2 补充结论

增加的劳动力成本和产业规模，导致中国生猪产业链的各个环节都有对工业化和节省劳动成本需要。

中国生猪养殖场发展面临的巨大挑战包括疫病控制、生产效率和饲料转化率。为此，不仅猪舍、育种、饲料方面的技术有待提高，管理能力和管理意识也需要增强。

针对中国城市中高产阶级消费者创建高端的猪肉品牌。

表 对荷兰生猪供应链与中国生猪市场和产业的SWOT分析	
荷兰生猪供应链	
优势	劣势
<ul style="list-style-type: none"> - 国际贸易历史由来已久 - 创新、高科技、注重质量 - 抱团合作 - 瓦赫宁根大学的高知名度 	<ul style="list-style-type: none"> - 声望仍有所欠缺 - 经营思想（欠灵活） - 生产成本（与竞争者相比有待下降）
中国猪肉市场和产业	
机遇	挑战
<ul style="list-style-type: none"> - 收入和消费的增长 - 对大规模工业生产的需求 - 对食品安全的日渐关注 - 对可持续性（生产）的日益关注 - 行业表现的大幅滞后 - 对知识创新的需求 - 对高效率的需求 - 人民币的走强 	<ul style="list-style-type: none"> - 优先对待本国企业 - 间接成本过高 - 法规解释与执行 - 边境关闭的风险 - 缺乏效率意识 - 质量减退 - 仿造行为 -

S.3 方法

在中国生猪产业可持续发展进程中荷兰企业有没有机会参与投资或出口？这是本报告的研究问题。本课题由荷兰经济事务、农业与创新部指定研究，通过文献回顾、公司访问的形式对中国北京周边的生猪供应链进行了调查。其中乡村调查访问部分在瓦赫宁根大学中国办公室的组织下合作完成。

1 Introduction

1.1 Background information

Worldwide there are several countries with a strong demographic and economic growth. Well known are the BRIC countries: Brazil, Russia, India and China. Other upcoming countries are e.g. Mexico, Argentina, Indonesia and Turkey.

A growing population, increasing prosperity and urbanisation in these countries will go together with a demand for a diet with more animal proteins. Given the pressure of this increasing demand on the limited available and renewable natural resources, the world has challenges to meet regarding food security, environment (land, water) and climate conservation. The most important challenge is to meet this increasing demand with a sustainable growth: higher production with less environmental pressure and a more efficient use of natural resources. This could be called sustainable intensification.

The Netherlands can support this need through the export of knowledge, experience and innovative systems. This fits seamlessly with the ambitions of the Dutch government as formulated in the top sector Agro & Food. Sustainable and economic ambitions go hand in hand.

The primary target group is the Dutch industry. The results of this research are directly available for the companies considering exporting production systems to the upcoming countries. The ministry of Economic affairs, agriculture and innovation gains insight into sustainability and bottlenecks regarding export of sustainable agricultural systems. This is relevant for the Agricultural Council of the Netherlands Embassy in those upcoming countries. It is imaginable that this study also leads to new opportunities in the field of knowledge development and application and innovation.

1.2 Scope of research

Commissioned by the Netherlands Ministry of Economic Affairs, LEI Wageningen UR carried out a research in two parts. A first part of the study consisted of a series of interviews among about 20 companies in the fields of dairy, pig and poultry supply chains in the Netherlands. These interviews were held in February and March 2012. Companies were asked about their company's products and markets, market perspectives, bottlenecks, ways of cooperation, sustainability

and future expectations regarding 10 upcoming markets: Argentina, Brazil, China, India, Mexico, Russia, South Korea, South Africa, Turkey and Ukraine.

Based on the outcomes of these interviews, for further research the ministry decided to focus on opportunities in the pig supply chain, as well as in the dairy supply chain in China. The current report gives the research on opportunities in the Chinese pig supply chain. The research on the dairy sector was carried out by student Jochem Tolkamp (Tolkamp, 2012).

1.3 Objective

The objective of this research is to map investment and export opportunities of sustainable agricultural systems in the pig supply chain in China for Dutch companies.

1.4 Method and structure

For this research information has been collected through web searches and face to face interviews. The information was used in this report for a description of the Chinese situation. The Beijing region was visited at the end of September 2012. Several interviews were held at the agricultural exhibition VIV China and with representatives from several companies within the supply chain who were visited (feed, farms, meat processors, banks etcetera). The trip was organised in cooperation with the Netherlands Embassy and the Wageningen UR China office. The visit aimed to check and broaden insights collected from the literature.

In this report, a description is given of the country (Chapter 2), and of the supply chain: its organisation (Chapter 3), retail and consumers (Chapter 4), processing (Chapter 5), primary production (Chapter 6) and supplying industries (Chapter 7). Chapter 8 is dedicated to trade and international competition. In Chapter 9 the analysis of export and investment opportunities was carried out. The first step of the analysis was the so-called PEST analysis, focusing on Political, Economic, Social and Technological developments. Outcomes were used in the SWOT analyses (Strengths, Weaknesses, Opportunities and Threats). Chapter 10 finalises the report with general remarks and conclusions. A few abbreviations are given in Appendix 1.

2 China, the country

2.1 Brief introduction to China

The People's Republic of China (in short: China) has over 1.3bn inhabitants (CIA, 2012), exceeding every other country. It has become the second largest economy in the world, after the USA. But China is going for more. After 30 years of autocratic socialist rule, President Deng Xiaoping opened up the country and the economy to the outside world and focused more on a market-oriented economic development. Consequently, import and export have improved, and so has the living standard. Political controls remain tight.

China has 23 provinces, 5 autonomous regions, 4 province-level municipalities (Beijing, Chongqing, Shanghai, and Tianjin) and two special administrative regions (Hong Kong and Macau). Beijing is the capital city, whereas Shanghai is the financial and business centre of China.

2.2 Policy & Legal framework

The People's Republic of China is a communist state with eight political parties. The government system is divided into three bodies: (1) the political arm with the leading party CPC (Communist Party of China), (2) the administrative arm, known as the State Council, and (3) the People's Liberation Army (PLA). The CPC has the majority in parliament. At the moment Hu Jintao is president and Wen Jiabao is the premier of China, both since 2003. They are elected by the National Congress for a 5-year term.

China is undergoing a transition from a centrally-controlled economic system to a competitive environment driven by the private sector. After three decades of liberalisation, product markets have become increasingly competitive and market forces are now generally the main determinant of price formation and economic behaviour (Conway et al., 2010). Conway et al. however conclude that, even if the transition has achieved a fundamental shift, and the market is increasingly becoming well-established, the transition still is far from complete and that product market regulations substantially restrict competition. State control and barriers to international trade and investment are the main components here. Especially the 'foreign ownership barriers' indicator is relatively high. However, according to UNCTAD (website), China is the second largest recipient

of foreign direct investments, after the USA, amounting to USD207bn in 2011 (China including Hong Kong). Up to 2011 the Netherlands invested EUR11.5bn in China, making the Netherlands the third European investor. The Netherlands Embassy is aware of about 800 offices of Dutch companies in China.

The government works with strategic five-year plans. The 12th five-year plan (FYP) runs from 2011 till 2015. The aim of the current plan is to rebalance the economy on multiple fronts to achieve economic, environmental and social sustainability (MOA, 2012a). With this 12th FYP, the Chinese government made a major policy shift and moved from focusing on 'growth at any cost' towards a more balanced and sustainable growth pattern with a long-term focus. There is more emphasis on a harmonious society and scientific development. This shift was influenced by the global financial crises, which led to an increased risk of social instability because of rising costs. The 12th FYP would also improve income and social benefits for the Chinese people.

According to Gale et al. (2009), market reforms in agriculture are lagging behind other industries. Agricultural land is still under a collective ownership system with vaguely defined property ownership rights. This system discourages long-term investments and using land to secure mortgage loans for investments. It seems, however, that the 12th FYP is putting more focus on improving agriculture.

Food security is a key element for the Chinese government. To gain a maximum level of self-sufficiency, the government heavily invests in productivity improvements. Increasing the amount of irrigated land (now about 50% of the cultivated land), water management (EUR495bn investment in 10 years' time for water conservancy) and investments in technology and rural infrastructure are key elements to achieve this (Beek, 2012).

The Ministry of Agriculture in China (MOA) has increased the amount of subsidies in 2010 up to EUR107 trillion, which is about 15% higher than in 2009. Additionally to the several types of subsidies from the central government, local authorities are allowed to add some subsidies if necessary (China Agricultural Development Report, 2011).

Food price changes are watched closely by the government. For China's decision-makers, the Consumer Price Index (CPI) is one of the most watched indicators (Chow et al., 2012). CPI fluctuations can impact consumers' standards of living seriously. CPI movements are rather much influenced by pork price fluctuations, due to the large share of pork in the CPI basket (3.6%, which is very high for one out of thousands of products) as well as the large price volatility of pork (Chow et al., 2012). Sometimes the CPI is therefore jokingly referred to as the China Pork Index.

In the previous FYP (2006-2010), the Chinese government already planned to modernise and stabilise the pig production and pork price volatility. Modernisation included industrialisation, standardisation and increased scale of production. In 2009, Chinese policymakers introduced a 'hog price alert' market intervention programme, aimed at reducing the cyclical variation in hog prices. Demand and supply were artificially smoothed by the government, by purchasing pork in times of low prices and selling it when prices are high. Decision on intervention was based on the so-called hog-corn ratio, i.e. the ratio between the pig price (hog) and the price for feedstuffs (corn) (see Section 6.2). A more detailed description is given in Gale et al. (2012). Still there is a lot of volatility, only partly induced by disease outbreaks. More in-depth market insight and a quicker reaction to market developments might help increase the effectiveness of the stabilisation programme. The governmental programme could not prevent price fluctuations after the outbreak of diseases such as PRRS, FMD, CSF, et-cetera.

2.3 Economy

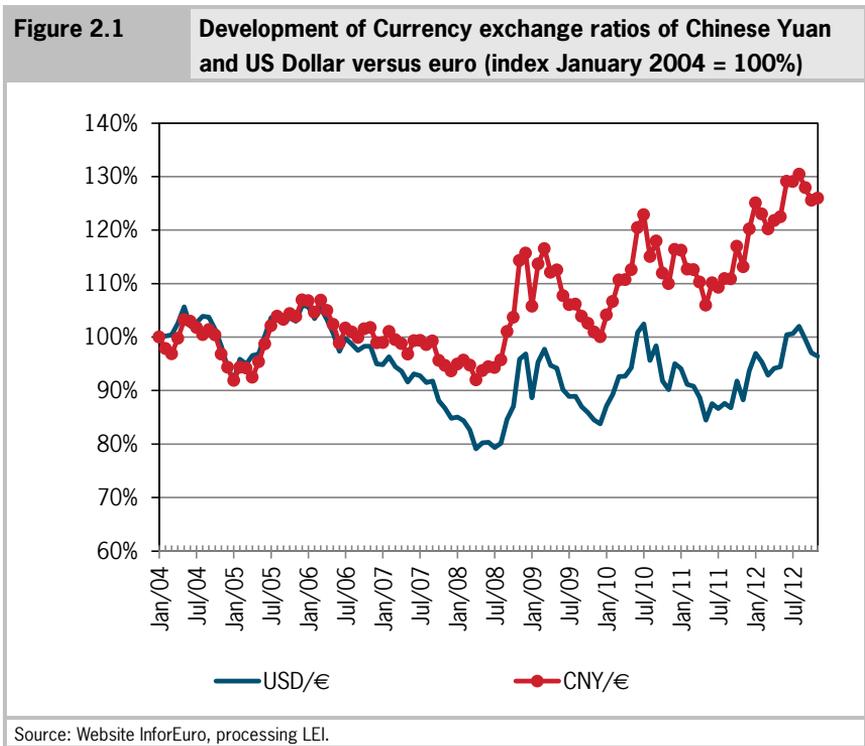
2.3.1 General economy

After the reforms since 1978, the structure of the Chinese economy has changed fundamentally. Consequently, more than a quarter of a billion people have been taken out of poverty (Atherton, 2008). The Chinese government re-focused, after the Mao era, on developing legislation, the institutional framework and broader macro-economic conditions to enable growth of the private sector. Local governments sometimes had difficulties following this upheaval.

The economy of China has grown rapidly the past 10 years, with an average GDP growth of 10.2% (OECD/FAO, 2012). This high GDP growth, combined with a low population growth, explains the improvements regarding the poverty combat. The GDP increase is expected to slow down, with 2011 showing a much lower 5.2%, but is still very high compared with other countries. OECD/FAO (2012) expects a recovery to 8.2% in the years to come (2012-2021).

In 2010 China became the world's largest exporter with a value of EUR1.3 trillion and surpassed the US. The trade balance has been rather stable and positive from 2006; both import and export show a steady growth (in value terms). The main export partners are the US, Hong Kong, Japan and South Korea and main import partners are the US, Japan, South Korea and Taiwan.

The Chinese currency is the Yuan or Renminbi (abbreviated to CNY). The value was pegged to the US dollar until the end of 2001 and, with some fluctuations, continued to be pegged until 2005. Nowadays, the currency is pegged to a composite of currencies, of which the composition is not publicly known. They probably include the US dollar, Japanese yen and the euro (Pan, personal communication). Since 2005, the CNY has been revalued by about 30%, compared to both the US dollar and the euro (Figure 2.1). This means an advantage in export to China, but a disadvantage for Chinese exporters. It also helps to soften the high inflation.



In the 12th FYP, many investment programmes are defined, to ensure economic growth, such as the development of seven 'Strategic Emerging Industries'. The seven industries are: 'biotechnology, new energy, high-end equipment manufacturing, energy conservation and environmental protection, clean-energy vehicles, new materials, and next-generation IT'. Around CNY4 trillion (EUR500bn)

has been spent for these strategic emerging industries during the 12th FYP period (MOA, 2012).

The Chinese government is working on reducing the level of corruption within the government and also for private companies. However, Ho (2007, p. 45) mentions 'the battle against corruption still causes a lot of political and societal turmoil in China'. Distant from the mainly bigger cities, the degree of corruption is increasing (Fongers, personal communication, 2012). China ranks quite poorly on the so-called Corruption Perception Index. Measured on a 1-10 scale, where 1 stands for high corruption and 10 is very good, the index is 3.6 for China. This can be compared to 8.4 for Hong Kong, or 8.9 for the Netherlands (Transparency International, 2012). This score indicates that when trading (dealing or working) with Chinese companies, companies should keep in mind that the system is susceptible to corruption.

The World Economic Forum Competitive Report (Schwab, 2011) shows the Global Competitiveness Index. China ranks 26th on the list of most competitive countries, where the Netherlands has position 7. China is said to be an efficiency driven economy, whereas the Netherlands is characterised as innovation driven economy. According to Schwab (2011), agriculture has a 10% share in the GDP of China, and the manufacturing and nonmanufacturing industry have a 46% share. This is much higher than the 2% share of agriculture and the 24% share of the manufacturing and nonmanufacturing industry in the Netherlands. Consequently, the Netherlands has a 74% of GDP in services, which is much higher than the 43% in China. This pattern is typical for the stage of economic development, where developing countries are more focused on primary and secondary activities and developed countries (such as the Netherlands) are more focused on services.

Chinese households typically have a high saving rate, with 39% of their disposable income (Euromonitor, 2012), mainly for health costs, study and old age provisions (Gemmeke, personal communication). This may be a consequence of the break-down of the former socialist protective system.

Chinese business men tend to search for saving options after having made sales agreements. Cost reduction however, might lead to quality fading. This partly explains the occurrence of food scandals (Gemmeke, personal communication). According to AWT (2012) innovation in China currently is mainly a search for cost efficiency by inventing cheaper alternatives, rather than the development of new concepts or products.

2.3.2 Tax system

After the tax system reform in 1994, China built up a tax system which supported the socialist market economy. It has been playing an important role in assuring China's fiscal revenue, increasing the opening up to the outside world and promoting the sustained, fast and healthy development of China's national economy.

In 2008, the Chinese government changed the VAT system from a production-based VAT regime to a consumption-based regime. The Chinese tax system is perceived as complex, with many different categories that all have several exceptions. According to the Beijing Local Taxation Bureau (2012), there are now 25 types of national taxes. One type concerns the turnover taxes, such as VAT (currently 0%, 13% or 17%, depending on the kind of goods), Consumption Tax (with 11 different taxable items) and Business Tax (varying from 5% to 8%). The levies of these taxes are based on the volume of turnover or sales of the taxpayers in the manufacturing, circulation or service sectors. Another kind of tax is the Income Tax for individuals and domestic and foreign investment companies. Property taxes include house and urban real estate taxes. Then there are agricultural taxes, slaughter taxes, resource taxes, car taxes and custom duties and several other types. From 1 October 2012 wholesale of fresh meat is exempted from VAT, as a means to control price fluctuations (Anbound, personal communication).

Comparable to the agricultural VAT system in the Netherlands, there is a special VAT regime for small-scale enterprises (annual sales less than CNY1.8m). They pay 3% on sales and cannot recover input VAT (Cao, 2008).

2.3.3 Employment

China's work force amount to 795.5m people and unemployment rate in 2011 in China amounted to 6.5% (CIA, 2012). Unemployment may be underestimated due to unregistered unemployment in rural areas. Figures for China are higher than 5.4% unemployment in the Netherlands in 2011 (Website CBS). However, as Cai and Wang (2012) argue, China has reached the beginning stage of the Lewis Turning Point - the shift from a labour surplus economy to one of labour shortages.

The amount of people working in the agricultural sector is about 499m (Website FAOStat; year 2011). Due to higher wages in urban areas and to political support towards more professional agricultural production, the number of

agricultural workers is decreasing. Wages have been growing rapidly both in agricultural and non-agricultural sectors (Cai and Wang, 2012).

Due to an ongoing shift from primary and secondary (production) to tertiary (service) work, workers' demands are growing. Employers are under increasing pressure to respect workers' rights (Euromonitor, 2012), especially after 2008, when several Chinese labour laws were issued or updated (Cai and Wang, 2012). New environmental, corporate responsibility, anti-discrimination and worker safety standards are coming up. New national healthcare provisions have been introduced and social security contributions are obligatory for all contracted employees.

The Labour Law sets 40 hours per week as standard, and overtime should be paid additionally. Minimum wages have been introduced since 2008, varying per province. Still there is a 'job for life' mentality (Euromonitor, 2012).

Collective contracts are becoming standard, as the coverage rate of collective contract systems was planned to cover 80% of enterprises in 2011 (Cai and Wang, 2012). They also describe the related goal that 92% of staff and workers should become members of trade unions in 2012.

2.4 Socio-Demographics

China is the biggest country of the world, in terms of population size. Almost one out of five people in the world live in this country. Although the government issued the one-child policy, the population is still growing, however at a slower pace. Over the period 2002-2011 the population number grew 0.52% per year and OECD/FAO assume a further 0.3% annual growth in the years 2012-2021 (OECD/FAO, 2012).

The majority of the Chinese people are Han Chinese (91.5%), but there are several other ethnic groups. China has several dialects (languages) but only one written language (Mandarin). This might give communication problems when doing business. Almost half of the Chinese people live in urban areas (47% in 2010), and this is still increasing.

China has a one-child policy for the largest ethnic groups. Chinese people are also more focused on their careers and have less time to raise a child. Everywhere in China, cities are building new living facilities to provide housing for new people who come to work in the city. China has over 160 cities with more than 1m inhabitants and 13 metropolises with more than 10m inhabitants. This creates opportunities because the needs in the urban area are different from the rural area. People are slowly taking over a western diet (McCluskey et al.,

2012). Due to economic growth, people are moving to the cities to get a job to earn a living. With more money to spend, people are also more aware of their health. The expenditure on health care amounts to 5.1% of GDP, still much lower than 11.9% in the Netherlands (year 2010; website World Bank), but it is increasing. The average annual disposable household income in 2010 amounted to CNY19,109 for urban households and CNY5,919 for rural households (Chinese statistical year book, 2011).

At the moment the income disparity between wealthy and poor is large and also geographically different. Generally spoken, the lowest income is found in the inland and western provinces, whereas the coastal areas are more prosperous. The GINI coefficient, showing the income dispersion within a country, for China is 48.0 (CIA, year 2009), much higher than the European Union's level of 30.4 (year 2010). Euromonitor (2012) estimates that due to the persistent economic growth nearly 100m households will come into the middle- and affluent classes. The 12th FYP has a main priority in developing a 'harmonious society' (MOA, 2012a). It focuses on spreading economic growth to a wider community. The government is determined to decrease this gap by focusing on urbanisation. Other policy tools include the expansion of the government-funded social welfare and health care system and promoting labour-intensive service industries. To let the consumption grow, plans are made to increase household disposable income by an increase of the minimal wages and better social welfare payments. The current legal minimum wage is CNY1,000 (about EUR125) per month; however, in practice there are big regional differences. Labour costs have increased rapidly on the East coast of China, making the West more attractive for manufacturers and foreign investors who seek to build a local manufacturing factory. According to Enting (personal communication) additional costs for employers are about 80% of the net salary.

The government will continue to invest in the West of China through preferential policies such as land credit, lower taxes and subsidies for manufacturers looking to locate inland (MOA, 2012a).

The standard of living in China can be derived from the so-called 'Human Development Index' (HDI). The HDI is composed of three elements: long and healthy life, access to knowledge and a decent standard of living. The United Nations Development Program (UNDP, 2011) shows that China has a medium position, ranking 101 on the list of 187 nations, whereas the Netherlands takes up third position.

In 2011, 51% of the Chinese inhabitants were living in urban areas, up from 45% in 2007 (website World Bank). Chinese people have right of education. Education however, shows regionally different quality (lower quality espe-

cially in poorer areas) and is related to the registered residence of inhabitants. For the many migrant workers in particular, it is hardly possible to get access to education. Migrant workers cannot reregister, unless they have lived in the new region some years and they must be employed (Gemmeke, personal communication).

2.5 Technology

A key priority of the 12th FYP is the transition from 'Made in China' to 'Designed in China' (MOA, 2012a). To achieve this goal, the government plans to invest heavily in science, technology education and R&D. China wants to improve the domestic innovation capabilities in technology through the use of several tools, including:

- *Research & Development*
The government will invest heavily in science and technology R&D to bring about key breakthroughs in targeted technology subsectors, such as core electronic devices, integrated circuits, life sciences, space, marine, earth sciences and nanotechnology.
- *Intellectual Property Rights (IPR)*
China plans to continue its efforts to strengthen creation, use, protection and management of intellectual property rights, particularly through support for companies that provide those services. China wants to create an official patent right where investors can register their products to prevent copying. However, this IPR system is not coordinated with the European system, which means that IPR acknowledgements must be done separately for the Chinese market. Copying is a deep-rooted habit, stemming from the Confucian idea of 'copying the master' (Enting, personal communication).
- *Administration*
The 12th FYP plans to strengthen fiscal and financial policies that support high-tech industry, including updating research funding management and venture capital investment systems.
- *Commercialisation*
A key goal - and challenge - for China will be to get the research undertaken at government-sponsored universities and research institutions to the marketplace. The government hopes that both large and small enterprises will increase their R&D investments as well.

China is the 4th largest country in surface after Canada, Russia and the US. Not all the land is suitable for agriculture. Living in the western provinces is harder than in the eastern provinces. The land is dryer, has more mountains and is therefore harder to use for agriculture or industry. China has many natural resources, such as coal, iron ore, petroleum, natural gas, and several rare earth elements.

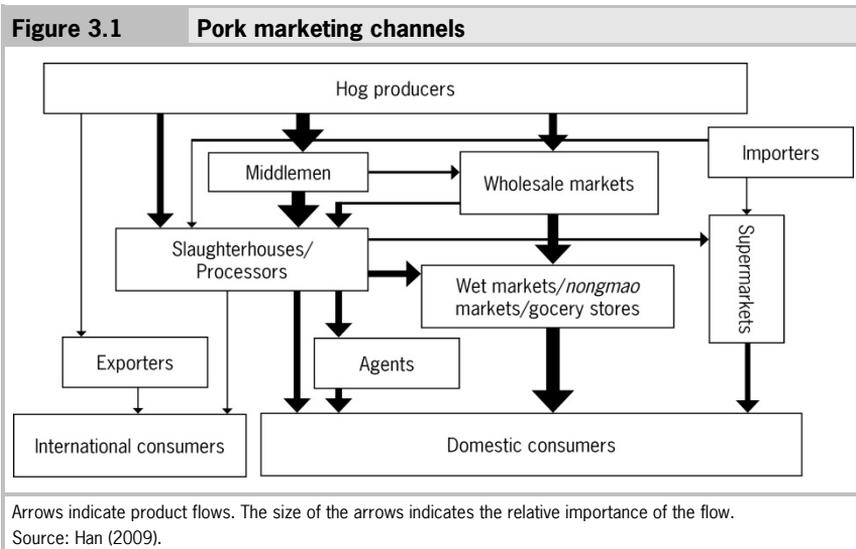
According to the CIA (2012), there are several environmental issues, such as air pollution (greenhouse gases, sulphur dioxide) from black coal, water shortages (particularly in the north); water pollution from untreated wastes; deforestation; estimated loss of one-fifth of agricultural land since 1949 to soil erosion and economic development; desertification and trade in endangered species. In the near future, China faces severe environmental threats due to the ongoing industrialisation, reliance on coal (70% of energy consumption), a relative large and energy-intensive manufacturing industry and lack of environmental protection policy. In the 12th FYP the government states that the Chinese industry must reduce its carbon foot print and ensure sustainable methods of energy use which will be more efficient, reliable and cleaner (MOA, 2012a). China is investing in research and methods of using new energy sources. In the 12th FYP, China's objectives on energy use include a reduction of energy intensity by 16%, of carbon intensity by 17%, and of new energy as a percentage of primary energy by 11.4% until 2015 (Schwab, 2011). China is very active in developing renewable energy sources and leads the world in wind power capacity and biomass power (UNDP, 2011).

Outdoor air pollution is associated with some 300,000 deaths and 20m cases of respiratory illness in China each year, with estimated health costs of about 3% of GDP annually (UNDP, 2011).

3 Pork supply chain

The current production of pigs and pig meat is very fragmented. There are millions of pig producers, of which the majority are backyard producers, mainly for home consumption. The share of industrial production however is increasing very fast, supported by the government. The meat industry is quickly reducing the number of plants, while industrial slaughter and processing is subsidised. One of the drivers behind this quick development is the governments' will to improve food safety. This is much more secure in professionally organised large-scale companies than in the many small production plants.

Sales of pig feed are usually done from producers, via dealers, to the farmers (Fen, personal communication). Also in the sales of slaughter pigs, trade is very often done via middlemen. According to Wang (2012), 60% of the slaughter pigs are sold via dealers (Figure 3.1). Sales of meat are shifting away from wet markets to retailers, especially in urban areas.



Ortega and Wang (2009) say:

'Local backyard producers are key players in the Chinese pork-processing sector, often cutting, processing, and selling their own pork. Because of

a lack of refrigeration and poor transportation and distribution systems, however, many manufacturers and distributors supply solely to regional markets.'

Wang and Xiao (2008) give some options for cooperation in a supply chain, based on experiences of current supply chains, such as the Shuanghui group and the Yurun group. They describe that current vertical integration models do not function well. Pan and Nelson (2012) and Pan (personal communication), however, argue that a full vertical integration is not likely to be the common future model of the pig supply chain. Full vertical integration has high requirements concerning professional experience, but also concerning capital, land access and environmental protection. Vertical integration is believed to be attainable for a few players only. However, there is need for improvement of the coordination between farming and slaughtering.

Retailers have increasing bargaining power over processors. They force suppliers to improve quality, product specification and traceability and also impact the pricing. Pan and Nelson (2012) expect that retailers will have a rising influence on the upstream along with the development of chain stores.

4 Retail and consumers

4.1 Consumption

4.1.1 Meat consumption

Within the country, there are regional differences regarding food preferences. Wheat as staple food is popular in the north of China and rice in the south. Pork and chicken, however, are popular across the entire country (Euromonitor, 2012).

Pig meat is the most important meat type, amounting to 37.6 kg per capita (average 2009-11). Although this is expected to further increase by about 15% in the coming ten years, the share of poultry meat will increase (Table 4.1). Beef/veal and sheep meat are only a small portion of the average Chinese meat plate. The domestic price for beef and lamb is almost double that of pork and chicken and consumers are unfamiliar with beef and lamb as a main menu item (Redfern, 2010).

Year	2009/11		2021	
	Consumption	Share	Consumption	Share
Beef/veal	4.2	7.3%	4.7	6.8%
Pig meat	37.6	65.5%	43.3	63.2%
Poultry meat	12.7	22.0%	17.4	25.5%
Sheep	3.0	5.2%	3.1	4.6%
Total	57.4		68.5	

Meat consumption in carcass weight.
Based on OECD/FAO (2012), calculation LEI.

The total consumption of pig meat amounts to 50m tonnes per year (Table 4.2), which is about half of the total world pig meat consumption. The self-sufficiency in pig meat is about 100%. OECD/FAO (2012) expect consumption will increase the coming years by about 20% or 10m tonnes. For each type of meat, import has been projected. China both imports and exports pig meat (see Section 5.2).

Table 4.2 Meat consumption (million tonnes/year) in China (mainland) and import share (%), average in 2009/11 and projected for 2021

Year	2009/11		2021	
	Consumption	Import share	Consumption	Import share
Beef/veal	5.6	-0.6%	6.5	0.3%
Pig meat	50.4	0.0%	60.1	0.3%
Poultry meat	17.0	0.8%	24.2	1.8%
Sheep	4.0	1.3%	4.3	1.4%
Total	77.0		95.1	

Based on OECD/FAO (2012), calculation LEI.

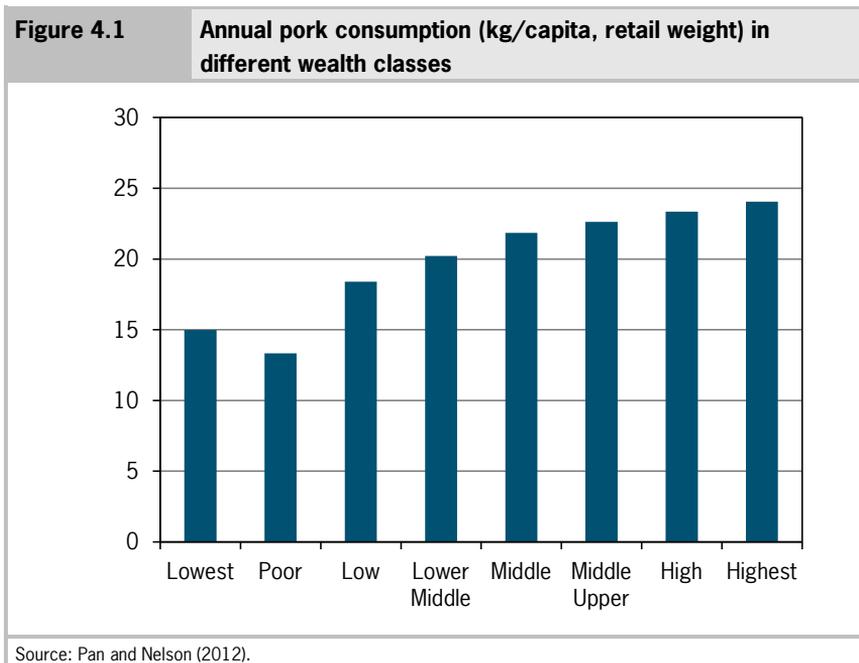
Pig meat is typically sold as fresh meat to the consumers. Liu and Sun (2010; cited in Gale et al., 2012) estimated that all sales of chilled, frozen and processed pork together account for less than 10% of China's pork market. This is supported by results from a survey (Wang et al., 2008) showing that 84% of the turnover of meat companies came from slaughtering and fresh meat. Twelve per cent came from frozen meat and only 2% from processed meat. According to Hu (personal communication) meat is usually eaten without spices, preserving the real meat taste. This means it is important to take the intrinsic meat taste into account during breeding and farming. Meat is mostly sold unpacked, although it is said that pre-packing will be developed (Fu, 2007).

According to Garnier (2012) the production of processed pork products is increasing fast and now accounts for 13% of the pork usage. Of these processed products less than half is Chinese-style products and the rest is Western-style products, mainly frankfurters and ham. He also expects a continuing rapid growth of sales of processed meat products. Pan (2012) also expects a growth from 20% small cuts and processed pork in 2010 to 40% in 2020. Especially prosperous consumers are demanding leaner meat, as they are increasingly influenced by Western fashions (GIRA, 2012).

Fu (2007), supported by Hu (personal communication), says that there is a trend towards branded meat, focusing on the middle and upper class consumers. During a store-check at a Carrefour hypermarket in Beijing, branded meat was found; the meat was from black hill pigs and sold pre-packed and with traceability coding, at about double the price of mainstream pork. This is especially interesting, since US exporters mainly focus on commodity meat sales. Branded meat for the middle and upper class consumers might be an export opportunity for Western European suppliers, provided that attention is paid

to high product quality, guaranteed food safety, good taste and trust. Taste will be very important for imported pork, as distinct from local pork. The higher production cost in Europe compared to the US will then be less relevant (Hu, personal communication), and likewise the rather low retail price for commodity pork.

Pan and Nelson (2012) show increasing expenditure for pork with increasing wealth (Figure 4.1). Increasing meat consumption is related to the increasing middle and upper wealth classes.



Pork is consumed all year round, but the Chinese New Year is the typical occasion for pork feasts. Garnier (2012) says that although Chinese are open to Western goods, they are conservative in their eating habits. A development towards more muscle meat is found, alongside a historical and cultural focus on legs, tails, etcetera.

At a store check in a Carrefour hypermarket in Beijing, it was found that fresh meat was only sold on the day of slaughtering. This means that it was slaughtered early in the day and then transported to the store and butchered on the spot for immediate sales. According to the meat department manager unsold meat at the end of the day was destroyed.

Ortega et al. (2009) estimated an income elasticity for food expenditure for pork of 0.86, indicating that pork is a necessity for Chinese consumers within their meat budget allocation. This value is higher for poultry (1.01) and much higher for aggregated beef, mutton, and fish (1.33). They conclude that apart from pork and poultry, most other animal proteins (i.e. poultry, beef, mutton, and fish) are considered luxury goods within the meat budget allocation for Chinese households.

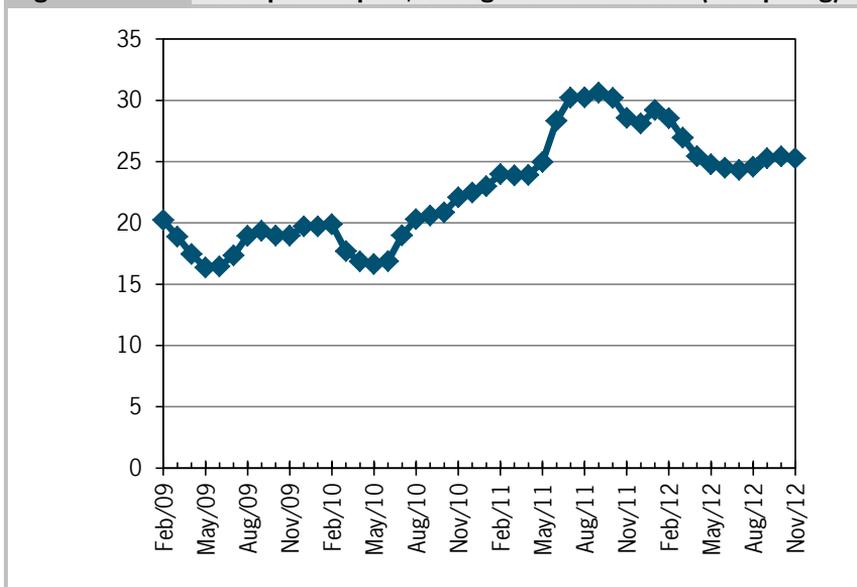
4.1.2 Meat price

The average sales price of pig meat in the supermarkets in the period from February 2009 to November 2012 was CNY22.7 per kg (about EUR2.90 per kg) (Website FAOStat). This is less than half of the average sales price in the Netherlands (EUR6.26 per kg, without VAT in 2011; PVE, 2012).

During a store check at a Carrefour hypermarket in Beijing, the retail manager said that pig meat is a traffic generator, resulting in low margins. Sales of products on offer have a share of about 30% of the total turnover of pig meat. Price reduction of offers is about CNY1 or 2 per half a kg.

The retail price of pig meat has fluctuated sharply over the last few years. The average price in 2011 was about 40% higher than in 2010 and on a monthly basis the price difference was even 80% (May 2010 and September 2011 (Figure 4.2).

Figure 4.2 Retail price of pork, average of 50 main cities (CNY per kg)



Source: Website FAOStat.

Food expenditures make up 36.3% of the urban household total disposable income in 2011 and in rural households this is even 40.4% (Chinese Statistical Year Book 2011). Since pig meat is an important food product, price fluctuations of pig meat have a big influence on the average shopping cart. It is even argued that price volatility of pig meat is mainly responsible for the inflation development in China (Chow et al., 2012).

4.1.3 Food safety

With increasing wealth comes increasing attention to food safety. Several scandals have plagued the domestic food industry (such as melamine, ractopamine, clenbuterol or boric acid). Food safety policy is embedded in over 2,000 national standards, more than 2,900 industry standards and more than 1,200 regional food safety standards (Keefe, 2012a).

The Chinese Government attaches great importance to food safety. In 2009 the Food Safety Committee was installed, which reports directly to the State Council. China is currently the only country in the world where a Food Safety Committee reports directly to the State Council, not via a ministry such as the Ministry of Health. The performance on food safety is also part of the promotion

criteria. This has created many implementing rules and a large control system that requires extensive testing of all food products on all ingredients.

In 2012 the Decision on strengthening food safety by the State Council was issued. This plan improves the effectiveness of food safety control, by improving food inspection and risk detection technology, containment of illegal activities, a de-listing, recall and destruction system and a public black list data base regarding food business persons and companies (Ch-agri, 2012a). The government has set up education programmes seeking to promote healthy eating habits, aiming to reduce health costs and to improve work productivity (Euromonitor, 2012).

Chinese consumers are particularly concerned about food safety, more than in the EU or in Brazil (Krystallis et al., 2012). They compared consumer attitudes between these three regions and asked, among others, 'It's always best to purchase <country's> products' (where 'country' stands for either China, Brazil or EU). Brazilian and European consumers rated this question with 5.74 and 4.28 respectively, on a scale of 1 (strongly disagree) to 7 (strongly agree), whereas Chinese consumers just rated 3.62, showing less confidence in Chinese food companies. For example, Chinese consumers regard baby milk from outside China as safer and of higher quality than inland produced baby milk, and it is sold for higher prices. Chinese consumers increasingly buy organic products, as a reaction to the food scandals. Chinese policy makers characterise food safety as a social sustainability issue component. Krystallis et al. (2012) suggest three clusters of citizens, reflecting different stages in food safety awareness. The first group is not concerned about social sustainability issues such as food safety. A second group is becoming concerned because of a safety issue and a third group sees the solution to the issue, by transforming the value chain into a large-scale industrial production.

The Chinese government has a positive approach towards genetically modified (GM) organisms, which supports the supply of the country's food needs. GM maize and soy beans have already been approved and are used, with or without consumers' knowledge (Euromonitor, 2012). Ractopamine, a growth-promoter commonly used in the America's (US, Canada and Brazil), is not allowed in China.

Zheng et al. (2012) analysed consumers' willingness to pay for traceable pork in Beijing. They concluded that consumers are willing to pay an average of CNY4.5 per kg (about USD0.7 per kg) for traceable pork, which is a 22.5% premium on the average market price for non-traceable pork of CNY20 per kg (USD3 per kg). Especially female buyers and those who perceive themselves to be in poor health tend to buy traceable pork.

4.2 Retail

Chinese people like to eat out, instead of cooking at home. Kitchens are often quite small and sparsely furnished. Eating out is convenient and affordable, and takes place in restaurants and at mobile street food vendors. When Chinese do cook at home, they routinely seek fresh products (Euromonitor, 2012). Local markets are convenient and popular and they tend to offer cheap and fresh produce daily. Typically affluent Chinese consumers in urban areas and younger people, either with or without young families, are attracted by supermarkets, offering a wide range of products. Local fast food restaurants have become increasingly popular. According to Fu (2007) only 20% of the pork is sold via supermarkets.

AT Kearny (2012) regularly compares countries' attractiveness for retailers' investments. In their Global Retail Development Index (GRDI) China has come to a 3rd place (from 6th place in 2011) and it is said that the country's future retail growth remains positive, with a double-digit rise in annual sales expected. Rising rent costs (+30%) and labour costs (+15% annually) however, are bringing pressure. Domestic players still dominate the market, but international retailers, such as Metro Group, Wal-Mart, Tesco, Auchan and Carrefour are on the market too. The biggest five retailers (Table 4.3) however, have less than 10% of the total retail market.

Enterprise	Turnover	Stores
Vanguard	82,700	3,977
Lianhua Supermarket	68,076	5,221
RT-Mart	61,567	185
Carrefour	45,196	203
Wal-Mart	43,000	271
Wu-Mart	33,031	409
Nonggongshang Supermarket (Group)	30,246	3,374
Yonghui Supermarket	20,380	204
TESCO	18,000	121
A-Best Supermarket	17,534	116
Shandong Jiajiayue Group	16,245	573
Lotte Mart	15,411	75
Wuhan Zhongbai Chained Business Group	14,690	203
Renrenle Chained Business Group	13,842	126
Jinjiang Metro	13,800	54

Source: China Chain Store & Franchise Association.

DDMA (2012) carried out market research into online shopping in China among 9,000 consumers. Online shopping in 2011 was 66% higher than the year before, amounting to an equivalent of USD125bn. This is much higher than a 16% increase in traditional sales. In 2011, 195m consumers shopped online. Leading online shopping sites are building consumer confidence. As a result, many Chinese consumers now have more confidence in the authenticity of products sold through an established online platform, such as 360Buy, Yihaodian or DangDang, than if they purchased the equivalent product from an independent retailer either in an offline or online setting (DDMA, 2012). Other reasons for the rapid growth of online shopping is flexibility in the assortment and the speed with which new products are offered, but also the fixed pricing, which is, surprisingly, pleasing consumers. Also, a wider assortment and convenience, as well as a lower price are advantages of online shopping.

The rapid price increase for real estate in urban areas lead to high rental costs. In combination with a labour shortage and consequently increasing labour costs, conventional stores face economic difficulties to compete with online shopping.

From the information above it is clear that pig meat consumption is expected to increase about 15% in ten years' time. The main driver is the increasing disposable income. Consumers are frightened by the food scandals over the last few years, demanding more safety guarantees and information.

It is also expected that the trend towards eating out will continue, since urbanisation is continuing and consumers have little time to cook for themselves. The Chinese are no heavy snack consumers, but demand is growing (Euro-monitor, 2012).

5 Meat industry

5.1 Meat production

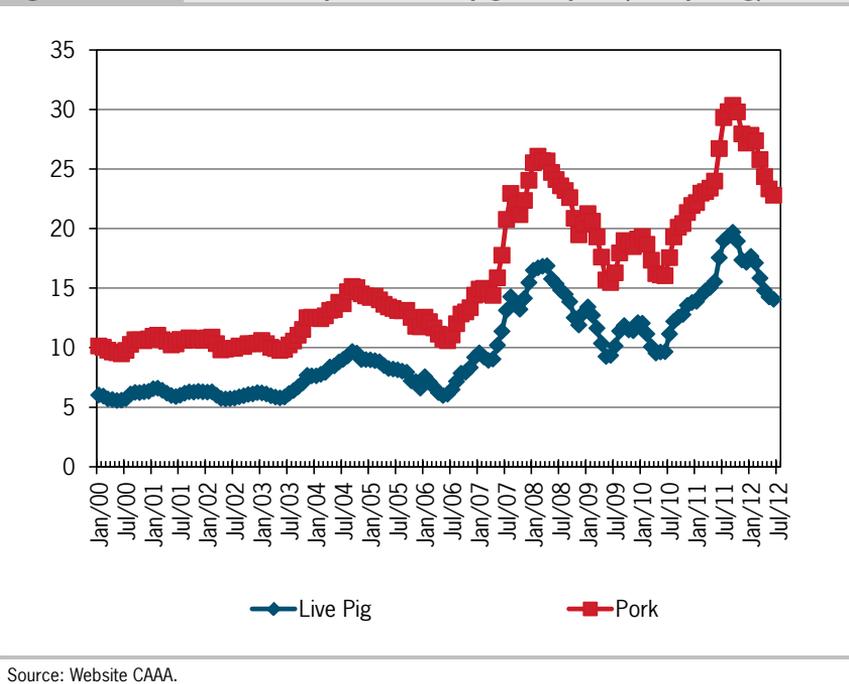
The total number of slaughter pigs amounts to 662m in 2011. This corresponds to 50.53m tonnes (BPEX, 2012). From this an average slaughter weight of 76 kg per slaughter pig is calculated. Xiao et al. (2012) show that the production of pork has increased strongly, from 8m tonnes in 1978 to 49m tonnes in 2009. The annual growth rate, however, has slowed down from 7.2% annually between 1980 and 1990 and 5.9% between 1990 and 2000, to just 2.2% in the years between 2000 and 2009. This has also to do with the shrinking production after the severe PRRS epidemic in 2006/07.

According to Han (2009), the driving forces in China's meat industry are first, food safety and quality management, including consumer concerns and food safety management system; second, rationalisation of production and processing; and third, innovation.

Profitability

Figure 5.1 shows the price development of live pigs and pork (consumer price). Although these prices could not directly be compared (live pig is per kg of live pig and the pork price is per kg of meat), the increasing gap between both prices is evident, showing an increasing margin for the meat industry.

Figure 5.1 Price development of live pigs and pork (CNY per kg)



Source: Website CAAA.

Regional division

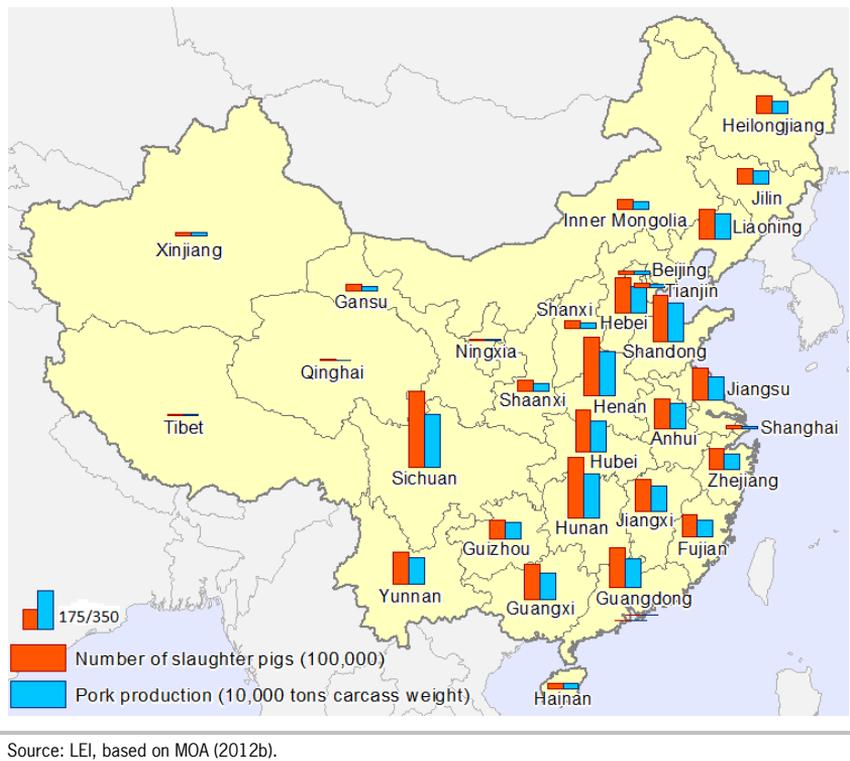
The largest pig producing provinces are Sichuan, Henan and Hunan, see Table 5.1 and Figure 5.2. An overview of the production in all provinces is given in Appendix 2.

Table 5.1 **Number of slaughter pigs (million) and pork production (1,000 tonnes of carcass weight) in the main pork producing provinces in China in 2011**

Province	Slaughter pigs	Production
Sichuan	70,0	4848
Henan	53,6	4064
Hunan	55,8	4061
Shandong	42,3	3469
Hubei	38,7	2905
Guangdong	36,6	2710
Hebei	32,4	2466
Yunnan	29,6	2439
Guangxi	32,0	2398
Anhui	27,2	2331
Liaoning	26,5	2259
Jiangxi	28,8	2241
Jiangsu	28,8	2159

Source: China Statistical Yearbook.

Figure 5.2 Regional division of pig and pork production in China in 2011



Processors

Currently there are 21,000 registered slaughter plants. The biggest 10 companies are shown in Table 5.2. These companies have a very low total market share.

Table 5.2	Top 10 pig meat processors in China in 2011
	Henan Shineway
	Jiangsu Yurun Food
	Linyi Xincheng Jinluo Meat Products
	Sichuan Gaojin
	Henan Zhongpin
	Hunan Tangrenshen
	Jiangxi Zhengbang
	Tianjin Baodi
	Shandong Delisi
	Beijing Shunxinpengcheng
Source: China Meat Association (2012).	

According to China's 12th five-year plan (2011-2015) more focus should be put on chilled and frozen meat instead of fresh sales. Distribution should take place as fresh (50%), chilled fresh meat (30%) and frozen meat (20%) respectively. The quantity of processed meat would reach 15m tonnes (on a total of 77m tonnes, see Table 4.2). Western-style processed meat is targeted to account for half of the total processed meat volume.

Another goal is that a food safety traceability system should be in place in all meat enterprises located in all cities above 100,000 inhabitants. The number of slaughtering houses is expected to decrease from 21,000 to 3,000 by 2015 through a combination of various measures including consolidation, or financial/administrative measures. Pan and Nelson (2012) even expect only 2,000 abattoirs to be in business in 2020.

Ninety per cent are small businesses and they are only partially mechanised (Claxton, 2012). A major development in the meat industry is industrialisation and increase of scale. Small-scale processors quit production. The 12th 5 year plan (2011-2015) aims to improve processing, with consequently a higher degree of mechanisation.

Currently (2010) 35% of the processors slaughter pigs by hand, 45% are half mechanised and only 20% are fully mechanised (Pan and Nelson, 2012). Half of the manual or semi-mechanised processors are expected to be eliminated at the national level and 80% for developing regions. The year 2020 would see 70% mechanised slaughtering and 25% half mechanised (Pan and Nelson, 2012).

Logistics will also improve towards a modern cold chain. This means considerable and ongoing investments in the industry in the years to come. The central government grants cash subsidies of CNY50 per pig to newly established and advanced slaughtering facilities. Local governments usually give additional support (Pan and Nelson, 2012). New slaughterhouses should have a minimum of 200,000 pigs slaughtered, to assure quality standards (Asian Agribusiness, 2012).

Overcapacity in the meat industry is significant, since industry investments increase at a higher rate than pig production. Also, the industry is moving towards expansion across provinces.

Pigs are paid for per kg of live weight. Quality parameters hardly play a role in the sales. The most important factor determining the price is the breed: special Chinese breeds are sold at a higher price level than western-type modern breeds. Weight, age or leanness do not play a substantial role in the price-setting (Wang, 2012).

The increasing focus on product safety, including e.g. industrial processing and traceability, in combination with a growing production leads to a large need of supplying machineries in slaughtering and meat processing.

5.2 Trade of meat and meat products

China (mainland) sends about 1.7m pigs annually to Hong Kong and Macau for local fresh meat. A further 210 thousand tonnes of pig meat are exported (FAS, 2012a). In 2011 China imported 468 thousand tonnes of pig meat and almost 900 thousand tonnes of edible offal. The US is by far the most important supplier of pig meat and edible offal to China. From the EU, Denmark and Spain are the biggest suppliers to China, both in pork and in edible offal (Table 5.3).

Table 5.3		China's pork imports of pork and edible offal (year 2011, volumes in thousand tonnes)	
Country		Pork	Edible offal
World		468	882
United States		252	548
Denmark		60	149
Canada		50	76
Spain		45	31
France		26	42
Germany		25	26
Ireland		7	9
Other		3	1
Of which the Netherlands		0.1	0.1

Note: Pork is HS code 0203; Edible offal is HS Codes 020641+020649.
Source: Comtrade.

The Netherlands has been allowed to export pig meat to China (from dedicated abattoirs) since October 2008. Since November 2012, pig trotters may be exported to China. However, from Table 5.3 it can be seen that no significant amount of pig meat or edible offal was traded between the Netherlands and China in 2011.

6 Primary Sector

6.1 Production

Pig farming generates 48% of the total production value of livestock industry (Zhang, 2008). According to FAOStat (website), China had in total 476m pigs in 2010. This is about 40 times the number of pigs in the Netherlands. At the end of 2011, there were 49m sows in China. The total number of slaughter pigs amounts to 662m in 2011 (MOA, 2012b). Based on these figures, sows produced 13.6 slaughter pigs per year on average. Wang (2012) gives figures, based on a sample of pig producers (excluding back yard), that are clearly higher. His figures result in almost 19 slaughter pigs produced per sow and year (Table 6.1). Both a low farrowing index and a low number of live-born piglets per litter cause quite a low performance level, rather than caused by mortality. According to Cortenbach (personal communication) some high performing farms in China produce 23 or 24 reared piglets per sow annually. As far as known, there is no representative sample of professional pig production. Dead pigs are usually buried deep in the ground (Wang, 2012). This could become a safety issue in future.

Parameter	Value
Farrowing index	2.09
Live-born per litter	10.53
Weaned per litter	9.39
Weaned per sow and year	19.62
Mortality until weaning	10.8%
Sold for slaughter per litter	8.97
Slaughter pigs per sow and year	18.75
Mortality of finishing pigs	4.5%

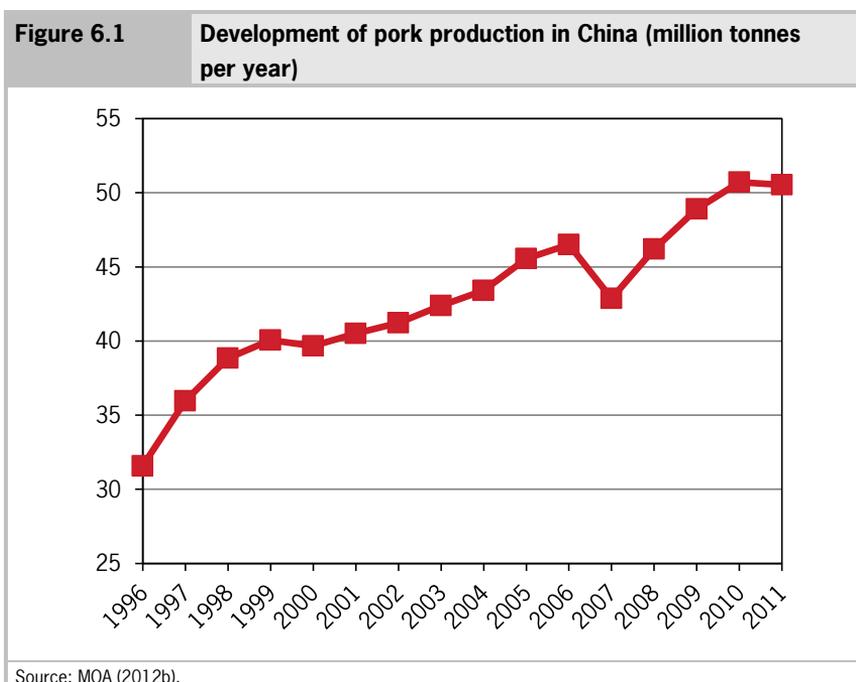
Source: Based on Wang (2012).

Pig production efficiency is still lagging behind European levels. Based on OECD/FAO (2012), meat production efficiency can be expressed in off-take ratios, calculated as production of slaughter weight per average present pig. In China this amounts to 108 kg, as opposed to 144 kg in the EU-27. This figure is

estimated (own calculation) at 173 kg for the Netherlands, which means a 60% higher efficiency in meat production in the Netherlands than in China.

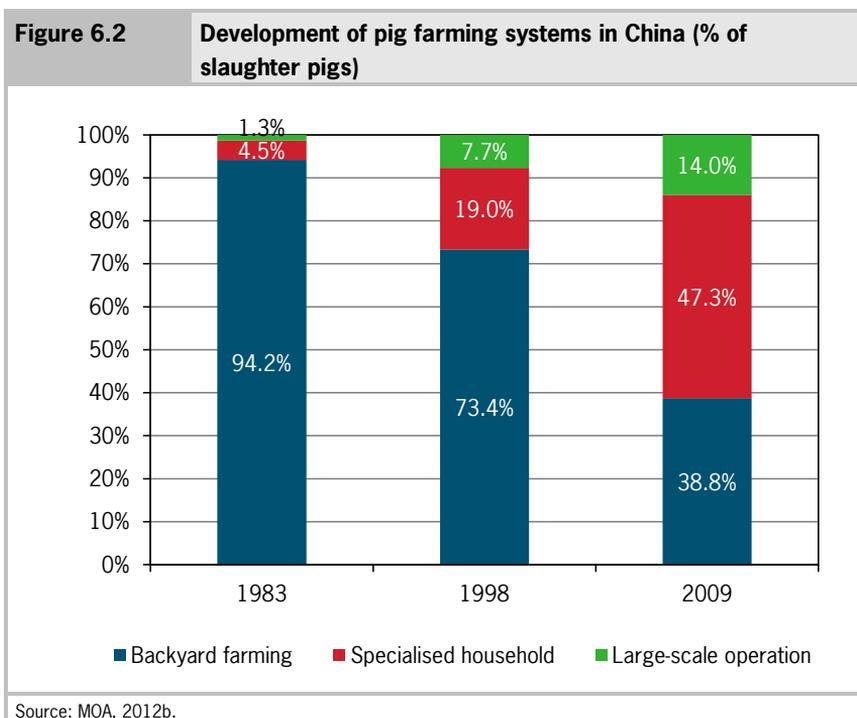
The average slaughter weight amounts to 76.4 kg. This slaughter weight is rather low, compared to Western standards, due to the fact that slaughter houses prefer lean meat.

Main challenges for the Chinese pig producers are to improve production efficiency, feed efficiency and disease control (Zhang, 2008). Production volumes are increasing over time (Figure 6.1). Provincial production numbers and volumes are given in Appendix 2.



The number of backyard pig producers declined rapidly over the last three decades (Figure 6.2). The contribution of backyards to the national production of slaughter pigs diminished from 94% in 1983 to less than 40% in 2009. However, in 2007 there were still 80.1m backyard pig producers, representing about 97% of all the pig producers in China. The share of specialised household production expanded to almost half of the total production. Large-scale commercial farms, including state-owned, collectively owned enterprises and private

enterprises are expanding rapidly as well and in 2009 accounted for 14% of the pig production.



According to BPEX (2012) the large-scale farms typically have an own feed mill or purchase compound feed and are making use of imported breeds. These farms usually have good management and disease control measures. The medium-scale producers need external technical support. Small-scale farmers usually have low performance, inadequate housing, a weak breeding infrastructure and poor veterinary services. Due to a lack of market information they cannot easily adapt to changing market situations (Wang and Xiao, 2008). The cyclical fluctuations in supply and profitability of pig production in China have led to consolidations and many smaller farmers leaving the industry (McOrist et al., 2011).

According to Wang and Xiao (2008) animal husbandry land belongs to the rural collective land and cannot be used as mortgage for loans. Wang (2012) made a representative survey among pig farmers in China and found that about 60% of the farmers have taken loans. Seventy-one per cent said that particularly bank loans are very difficult to get, with rigorous conditions and complicated

procedures. Loans are often first used for the purchase of feed and piglets, and then for farm expansion. The government has issued a regulation, effective from January 2013, aiming to improve farmers' access to financial services. The interest rate for a one year unsecured loan is 6%, according to People's Bank of China (Pan, personal communication).

Ortega and Wang (2009) write:

'Although the Chinese government is trying hard to encourage more investments in hog production, it remains a challenge in the long run for domestic pork supply to meet the rapidly increasing demand. This is due to the current high world feed costs and limited Chinese arable land, which restrict domestic feed production. In the past, China has been cautious about importing food and feed grain (except for oilseeds), and it seems unlikely that China will import a lot of feed grain to support large-scale hog production.'

According to Enting et al. (2010) the pig sector is less progressive in size of production and the use of compound feed than the poultry sector. There is still a lot of backyard production.

Major companies

The Wens Food group is by far the biggest pig producing company (Table 6.2). They slaughter over 5m pigs per year, in addition to poultry and cattle breeding (Lyja Media, 2011).

The farms in this table have about 700,000 sows, which is about 1.5% of the total of sows in China. COFCO, a state-run agency trading in farm products, has bought almost 5% of the shares in Smithfield Foods of the US, aiming to learn how to produce pigs on a large scale. Smithfield in return has taken shares in COFCO in November 2012 for an equal sum (Keefe, 2012b). The meat industry has a more or less equal regional division to the pig production (Chapter 5).

Producer	Location	Number of sows
Wens Family Farms	Guangdong	350,000
LuoNiuShan	Hainan	60,000
Muyuan	Henan	50,000
Charoen Pokphand	Nationwide	50,000
Zhengbang	Jiangxi	45,000
Long River	Guangdong	16,000
New Wellfull	Hunan	30,000
COFCO	Jiangsu	30,000
New Hope Farms	Sichuan	20,000
Agfeed	Guangxi	18,000
Shuanghui Group	Henan	16,000
Longda Foods	Shandong	13,000

Source: McOrist et al. (2011).

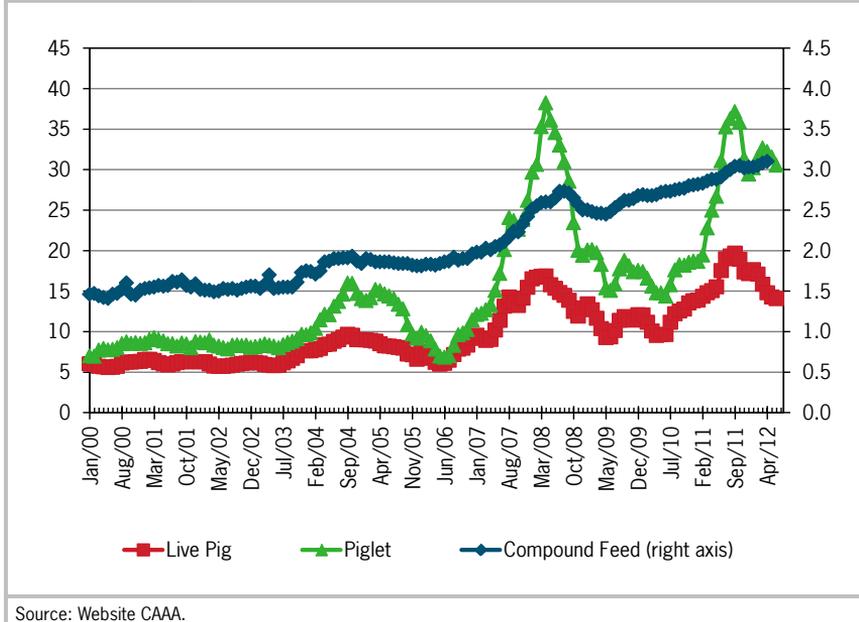
6.2 Economy of the production

Gale et al. (2012) compared production costs in China and the US and found a cost of production for a Chinese commercial-scale pig producer in 2009 of 19% higher than a US producer. The US cost advantage was mostly due to lower feed expenses and may be a reflection of a more efficient conversion of feed to meat as well as lower feed prices (Gale et al., 2012) (see Section 7.1 for more details on feed prices differences). This confirms findings of Hoste and Backus (2003), who calculated a 17% higher cost of production in China than in the US, and about 4% higher than in the Netherlands. Given the rather low feed efficiency, rising feed prices such as in the last few years, are hitting the cost of production harder in China than in efficient countries such as the Netherlands. According to Zhang (2008) these large-size producers attain a feed-conversion ratio of 2.8 (between 20 and 100 live weight), where the national average would sooner be 3.0 to 3.5 (Wang, personal communication).

The price for piglets, pigs, pork and feed has risen clearly since 2000 (Figure 6.3). From this figure it is also visible that the piglet price increase was substantially higher than the price for slaughter pigs (live pigs). This is a consequence of the cull of many sows after PRRS outbreaks in 2007. Between June 2006 and April 2008 the piglet price changed from less than CNY7 to CNY38 per kg of piglet.

Due to the undersupply of the Chinese market however, it seems that pig farmers were compensated more than sufficiently for risen feed costs. It is estimated that the rising feed prices led to an increase in production costs of about CNY8 per kg of live pig, whereas the market price rose CNY12 per kg.

Figure 6.3 Price development of pigs, piglets and pig compound feed (CNY per kg)



Source: Website CAAA.

The market price for slaughter pigs in China is much more volatile than in the Netherlands (Figure 6.4).

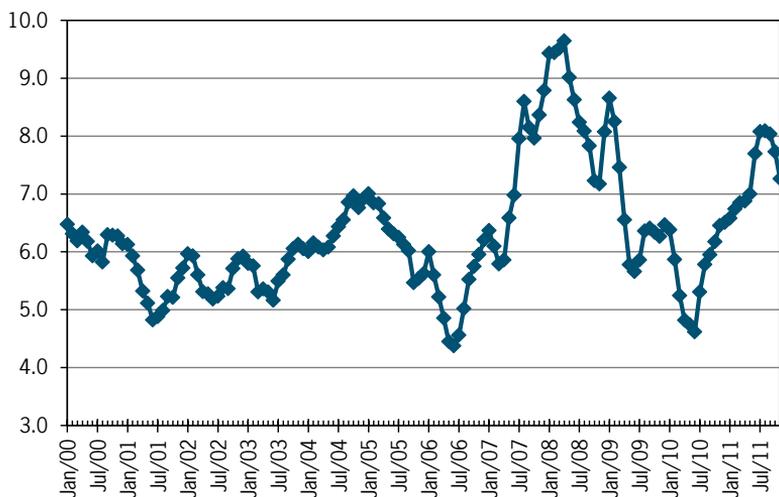


The hog-corn price ratio is the ratio between the price of slaughter pigs (hogs) and corn (Figure 6.5). Historically, this ratio was a valuable indicator of profitability of pig production in the US. In China, this indicator is used for decisions on pork interventions. Ratios between 6 and 9 are seen as normal market circumstances. If the ratio falls below 6, authorities may take measures, depending on the actual ratio. They may purchase frozen pork to hold in reserve, give subsidies to commercial companies for holding pork in stock or to farmers not to sell sows for slaughter and encourage pork export and discourage imports. If the ratio comes above 9, the government can sell frozen pork reserves and may subsidise low-income consumers. This programme has been issued at the end of 2008 and the first intervention was in May 2009, when the ratio fell below 6. Several interventions have followed since then.

The governmental programme could not prevent a steep rise in pig prices, which was not expressed in the hog-corn ratio because feed prices were rising simultaneously.

Figure 6.5

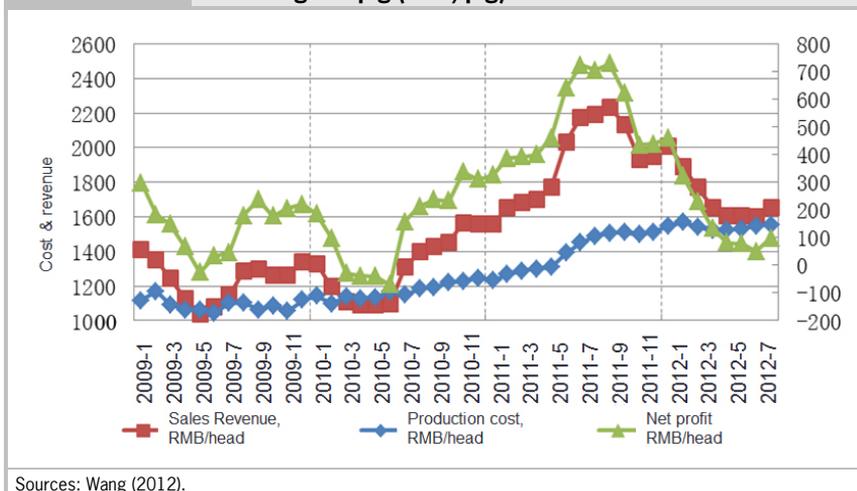
Hog to corn ratio in China (ratio between market price of slaughter pigs and market price of corn)



Source: Website CAAA.

Figure 6.6 shows the fluctuating prices and the margin of pig production. It can be seen that the net profit in 2011 was much higher than in the time before and in 2012, where the profit even went down to almost zero.

Figure 6.6 Development of revenue, production cost and net profit per sold slaughter pig (CNY/pig)



Sources: Wang (2012).

Health situation

A reason for the sharp pig price increase in 2007 and 2008 was the occurrence of pig diseases, such as PRRS (Porcine reproductive and respiratory syndrome), and FMD (Foot-and-Mouth Disease) and CSF (Classical Swine Fever), which had a big impact on the pig market. In particular, the outbreak of highly pathogenic PRRS in 2006 and 2007 had a severe impact on the pig sector. Substantial numbers of pigs died, resulting in supply shortage and rising prices.

In 2012 PRRS reappeared, which was the same virus strain as in 2007. The outbreak again led to widespread losses on farm. Since however, the pig price is quite high, farmers are able to afford more vaccine, which in turn limits the impact. The Chinese government tried to improve production by resuming subsidies for productive sows (CNY100, about EUR12 per sow). Farmers offering culled or dead (sick) animals are given a remuneration of CNY800 (about EUR100) per animal (Claxton, 2012).

He et al. (2011) mention PRRS as one of the most important diseases in the intensive pig farms. Also PCV2, TGEV, PEDV, *Streptococcus suis*, APP and *Hemophilus parasuis* are often detected in China. According to OIE's website, China showed 2 cases of FMD so far in 2012, 27 outbreaks in 2010 and 17 in 2009. Other contagious pig related diseases are not reported, except PRRS.

A risk factor for spreading diseases is the use of food scraps from restaurants. The majority of kitchen waste is not sent to a food waste treatment factory, but sold as pig feed (PigProgress, 2012).

Wang (2012) set up a representative survey among 450 farmers in several provinces of China. Figure 6.7 shows the development of the number of epidemics on these farms, clearly showing an increase over the last 10 years and with a peak in 2007 and 2011. Wang does not mention which diseases were found, but PRRS and Circo are probably included.

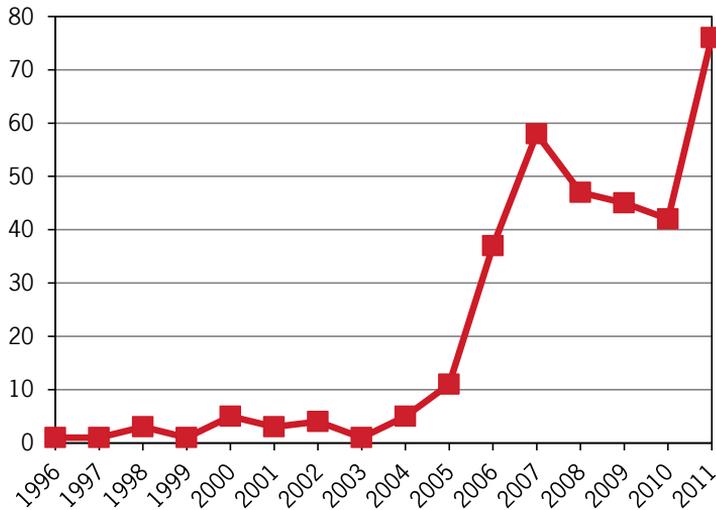
Given the major importance of pig meat for the countries' economy, the Chinese government understood the risk of such diseases and took them very serious. After the outbreak of highly pathogenic PRRS in 2006 and 2007, a disease reporting system was set up from township level to the central government. A compulsory vaccination scheme, with vaccines provided by the government for free, has been implemented nationwide (Zhang, 2008). According to the 'Immunity Plan on Animal Epidemic Diseases in China in 2011' farmers had to vaccinate pigs against PRRS, FMD and CSF. However, only 46% of the farmers in a sample judged that available vaccines have a good quality (Wang, 2012).

Wang and Xiao (2008) and Gale et al. (2012) describe that veterinary management systems were established on a regional basis, which however resulted in ineffective supervision, inspection and testing equipment; relevant state regulations are not effectively implemented, leading to poor vaccination and veterinary drug abuse. OIE (website) gives a number of almost 700 thousand veterinarians and paraveterinarians, or 7.1 per 100 km². In the Netherlands this figure is twice as high, with 14.3 vets and paravets per km². The independent private vets play a much larger role in the Netherlands (8.3) than in China (1.0 per km²).

Wang and Xiao (2008) say that 'Disease epidemics have been seen to seriously undermine the long-term, healthy development of live pig production'. According to Wang (personal communication) and Hu (personal communication) antibiotics are probably used abundantly, but no data are available.

The legislation system for environmental protection includes the following laws, regulations and Standards (BPEX, 2012): Environmental protection law, Cleaner production promotion law, Law of animal husbandry, Discharge standard of pollutants for livestock and poultry breeding, Circular economic promotion and Policy for pollution prevention and disposal technology on livestock farming.

Figure 6.7 Occurrence of epidemics on a representative sample of pig farms (number per year)



Source: Wang (2012).

Energy saving and emission reduction are important points of interest for modern pig production. Technical solutions for manure management include volume reduction, manure separation, conversion of polluting waste into useful resources, by biogas production and manure composting for fertiliser production. Manure is partly used for biogas production, especially in southern regions, where the average ambient temperature is higher than in the north of China.

Societal pressure on pig farming is increasing. In DongYuan (a county in Guangdong province) for example, no pig farming is allowed due to environmental problems. Also, in the vicinity of the city of Beijing a number of farms had to be moved to reduce environmental pressure on the city (Wang, personal communication). Another reason for farmers to move away from expanding cities is land demand for new housing development.

China is said to issue its first voluntary animal welfare general rule (Ch-agri, 2012b), aiming to prevent unnecessary pain or stress of farm animals. Improving animal welfare is thought to protect human lives.

7 Supplying industries

7.1 Feed industry

7.1.1 Production and consumption of feedstuffs

China produces 17% of the global wheat production and 16% of the coarse grains. The country is almost self-sufficient in these grains. However, for oil seeds, almost half the domestic consumption needs to be imported. Much of the oil seeds are processed in the country itself. The domestic crush capacity amounts to 90m tonnes and is expected to increase to 110m tonnes. Self-sufficiency of cereals and oil seeds or protein meal is likely to diminish (Table 7.1). GM maize and soy beans have already been approved; it is unclear to which extent these are used already.

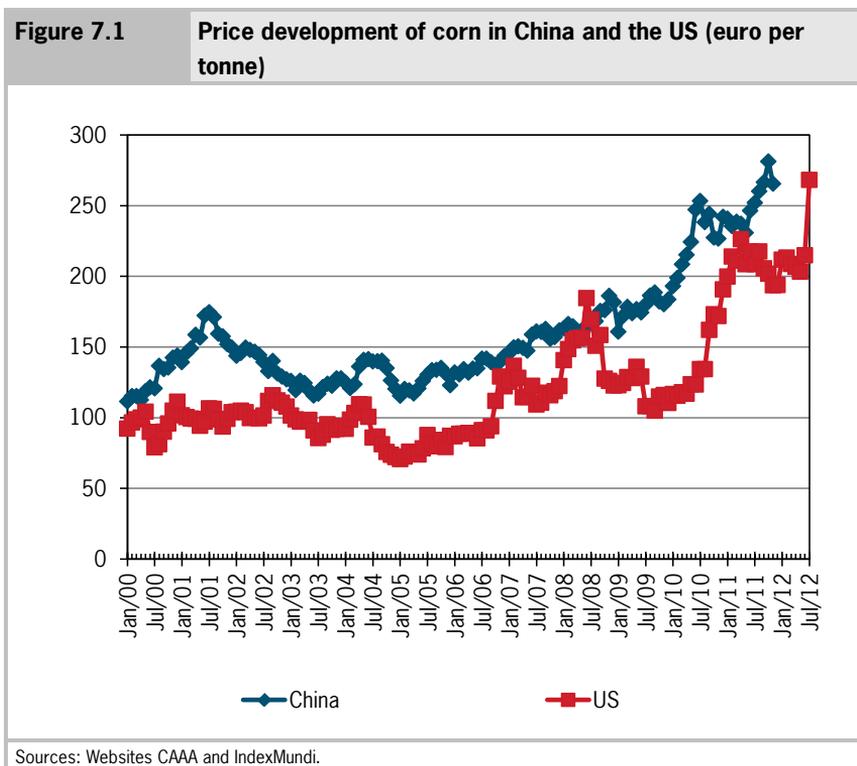
Year	2009/11		2021	
	Consumption	Import share	Consumption	Import share
Wheat	116	1%	125	5%
Coarse grains	186	4%	238	11%
Oil seeds	112	48%	137	53%
Protein meal	63	2%	82	7%

Based on OECD/FAO (2012).

Feed ingredients are more expensive than in the US and in the Netherlands. As shown in Figure 7.1, the price level of corn in China is clearly higher than in the US and in the EU. This holds also for soy bean meal. The average gap since January 2000 is over EUR40 per tonne for corn and almost EUR80 per tonne for soy bean meal. Prices however, are not always fully comparable, due to different specifications of the product per location. Soy bean meal has typically 45-46% crude protein in China, which is lower than about 48% in the US. The price difference however, was described by Gale et al. (2012) as well and is recognised by Chinese feed companies too (personal communications). Liu (2009) explains this price gap from the higher cost of production, caused by lower productivity and a less organised infrastructure. At the same time the

production increase does not hold pace with the increasing demand of feed materials. With higher ingredient prices, it is plausible that pig feed is more expensive in China than elsewhere (see Section 6.1).

DDGS is used in China, mainly as an import product from the US. The product quality is rather low and more susceptible to mycotoxins, due to higher moisture content (Cortenbach, personal communication).



The increasing production of feedstuffs leads to an increasing nitrogen surplus. OECD/FAO (2012) showed that this N surplus increased from 14 kg/ha of agricultural land in 1970 to 49 kg in 2000. This level of 49 kg/ha is roughly equal to the EU level in that year (50 kg/ha) and will increase further to an expected 57 kg/ha in 2030. UNDP (2011) refers to China as a country showing severe land degradation through loss of fertile top soil. The cereal production per hectare in China amounts to 5,521 kg/ha, higher than the world average of 3,564, but lower than 8,574 kg/ha in the Netherlands (website World Bank; year 2010).

Given the expected growth in meat production, feed consumption is expected to rise. However, efficiency improvements seem to give ample room to reduce the feed consumption. Calculations have been made to estimate the pig feed consumption in 2021. As was shown in Table 4.2, the pig meat consumption is expected to rise, from 50.4m tonnes in 2010 to 60.1m tonnes in 2021. After correction for increasing imports, the domestic production is estimated to rise 9.4m tonnes. In the current situation, an overall feed conversion ratio (feed use for all pigs on a closed cycle farm, divided by the live weight of produced slaughter pigs) of 3.5 is estimated. Table 7.2 shows some scenarios. Scenarios A to D are related to the year 2021.

In Scenario A an autonomous development towards a higher sow performance (+ 2.5 slaughter pigs produced per sow and year) and 10% better feed efficiency is assumed. Although the meat production has risen by about 19%, the nationwide pig feed consumption rises by only 7%. In the next scenario (B), the slaughter weight of the pigs increases from 76.3 to 85.0 kg per pig, resulting in a slightly better feed conversion ratio (3.1) and consequently lower feed use of 4m tonnes. Scenario C calculates which feed efficiency improvement would be needed to come to the same feed use as in 2010, resulting in a nationwide average overall feed conversion ratio of 2.95, which is a 16% feed efficiency improvement compared to 2010. The last scenario (D) shows a further increasing performance in sow production (19.0 slaughter pigs produced per sow and year) with a consequently lowered overall feed conversion ratio to 2.90. This results in an even lower feed consumption than in 2010, in spite of a 19% higher meat production in China.

Depending on the efficiency-improvement efforts, these scenarios seem realisable. Given this assumption and based on the calculations it can be concluded that feed supply must not limit further expansion of the pig meat production in China. A strong development towards professional pig production with good management, appropriate feed and breeding material is necessary.

Scenario	Sows (million)	Slaughter pigs (million)	Sow performance (pigs/sow,yr)	Slaughter weight (million tonnes)	Slaughter weight (kg/pig)	Live weight (kg/pig)	Overall FCR	Feed use (million tonnes)
2010	49	662	13.5	50.5	76.3	100.0	3.50	232
A	49	785	16.0	59.9	76.3	100.0	3.15	247
B	44	705	16.0	59.9	85.0	111.4	3.10	243
C	44	705	16.0	59.9	85.0	111.4	2.95	232
D	37	705	19.0	59.9	85.0	111.4	2.90	228

7.1.2 Feed processing

The feed processing industry has been described in detail by Enting et al. (2010).

According to the Statistical Yearbook, the total output of commercial feed in China in 2011 was 169m tonnes, of which about 138m tonnes was compound feed (80%). Of the total feed output, 37% was pig feed (Table 7.3). Since 1998, feed production has more than doubled its output and production might increase to 200m tonnes by 2015 (Best, 2010).

Feed type	Volume	Change
Pig	62.1	+4%
Poultry meat	49.8	+5%
Poultry eggs	31.0	+3%
Ruminant	7.6	+4%
Aquatic	15.4	+3%
Total	169.0	+4%
Compounds	138.0	+6%
Concentrates	25.0	-6%
Premixes	5.85	+1%

Source: Ministry of Agriculture.

Figures from the China Feed Industry Association illustrate a shift within the livestock industry through the higher use of compound feed substituting concentrate and premix. This trend is expected to continue (FAS, 2012b). Premixes are often less concentrated than in the Netherlands; up to a share of 5% of the feed composition is called 'premix' in China (Cortenbach, personal communication).

The feed industry consists of over 13,000 feed companies. However, just 16 of them have a production capacity of over 1m tonnes per year (Table 7.4). These large companies produce about 45m tonnes, which is one third of the total feed production in China. In total 187 companies produced over 100,000 tonnes per year. Feed factories are mainly located in the coastal areas, with Guangdong and Shandong as main producing provinces. The largest companies and those in the coastal areas are typically focused on aqua feed, rather than animal feed (Enting et al., 2010). A clear reduction in the number of feed companies is expected, as a consequence of the increased attention to feed and food safety. Dutch companies in the Chinese feed chain are DSM, Nutreco, Provimi, Sonac, Wellhope De Heus and Nuscience.

Feed is typically sold in bags, rather than in bulk. The typical sales structure is via dealers and feed shops between feed company and farmer, due to fragmented retail sales and transport distances (Fen, personal communication). According to Gale et al. (2012), a typical Chinese pig feed diet contains 60% corn and 15% soy meal. This, however, can vary widely across farms. Pan (2012) mentions a composition of 50% corn, 15% soybean meal, 15% wheat or rice bran, 18% other meals and 2% premixes, which is confirmed by Cortenbach (personal communication). Contents of energy, crude protein and amino acids are comparable to those in the Netherlands. Crude protein contents in piglet feed however, are higher, since Chinese farmers generally prefer this as a sign of feed quality (Cortenbach, personal communication).

Name	Province	Estimated production capacity (million tonnes)
New Hope (Liuhe) Group	Sichuan	15.4
Charoen Pokphand Group	Beijing	7
East Hope Group	Shandong	6.1
Hunan Tangrenshen Group	Hunan	4.3
Guangdong Wen's Group	Guangdong	3.7
Dachian/East Asia Group	Beijing	2.9
Tongwei Group	Guangdong	3.4
Tieqilishi Group	Sichuan	3
Yuetai Group	Shandong	3
Haid Group	Guangdong	3.4
Hunan Zhenghong	Hunan	2
Wellhope De Heus	Liaoning	1.9
Guangdong Hengxing	Guangdong	1.5
Jiangxi Shuangbaotai	Jiangxi	1.5
Jiangxi Zhengbai	Jiangxi	1.2
Sanwang Group	Sichuan	1

Source: Composed of Enting et al. (2010); Lin (2012).

7.2 Other supply

7.2.1 Housing and farming systems

There is a clear need for modern housing systems in China. Zootechnical performance levels are low and availability of qualified staff is diminishing. This leads to a demand for equipment, especially for large-size farms, with hired labour. Needed systems include animal identification, monitoring software and separation techniques, climate control, biogas, manure and waste water processing, floors (slats) etc. These systems, however, must sometimes be adapted to Chinese circumstances, such as for low educated staff or ambient temperature (such as biogas or climate control systems) and after sales services must be included. Incorporating the need of after sales services can also prevent unwanted copying behaviour.

Housing and farming systems can be used to increase the general performance and profitability. However, as Hoste (2012) argues, awareness of the

need of efficiency improvement must precede investments in farming systems, or high tech feed and breeding material. To this end, farm comparison and benchmarking can support farmers. Software systems for animal management at farm level are needed and other benchmarks, such as a sustainability benchmark (Hoste and Van Iperen, 2012) can be helpful. According to Yeung (personal communication), however, Chinese pig farmers are not interested in farm comparisons.

7.2.2 Breeding

All the global players in pig breeding are represented in China, such as PIC, Topigs, JSR, Hypor and Danbred. Given the number of 49m sows in China and an assumed replacement of 45%, about 22m gilts would be necessary for replacement annually. No figures are known about the market share of the global commercial pig breeders, but it is expected that they only have a small part of this potential market. If only sow replacement of larger farms is taken into account, this would mean a need of some 3m gilts per year.

There are still 48 extant native Chinese pig breeds, differing from very fertile breeds (such as Meishan), breeds with hardiness outdoors, such as smaller hill pigs (e.g. Xiang roaster pigs), breeds with flavoured meat (China two-end black pig, e.g. Jinhua) or fatty pork breeds (such as Northern Min, or Neijiang from Sichuan) (McOrist and Walters, 2009). The importance of the local native or fatty pork market should not be underestimated and is typical for backyard farms, which produce fatty local-breed pigs, sell the meat to local markets, especially in more rural areas. Such pigs often have low growth rates. It may be expected that such breeds do not play an important role in the expansion and commercialisation of pig production in China.

8 Trade

8.1 Rules and regulations

The Chinese government is using a Catalogue of Industries for Guiding Foreign Investment, which gives a framework for investments from abroad. The country still welcomes foreign direct investments, but more selectively, focusing on the transfer of interesting technologies and knowledge. Three categories of investments can be distinguished: Encouraged, Restricted and Prohibited. Investments in the Encouraged category are usually allowed to set up so-called wholly foreign owned enterprises (WFOEs), whereas in the Restricted category usually a joint venture is necessary, sometimes with an obligatory Chinese controlling interest. Strategic industries, such as innovative technologies and materials and sustainable applications in environment and energy are encouraged. According to the Netherlands Embassy in China, it is important for companies to consider thoroughly the balance between short term market entrance advantages and possibly giving away a technology head start in the longer term. Additional to the Catalogue there are several sector specific rules limiting the investment opportunities, even from the Encouraged category. Additionally for exported pig meat is the requirement that slaughter pigs must be born and bred in the same country where they are slaughtered. Also for some feedstuffs there are additional requirements. Generally, companies from abroad have considerable arrears regarding market entrance, compared to Chinese companies. Dutch companies have to fulfil certification demands and a complex of licenses of the (local) government. There are also requirements to companies from abroad regarding capital, volume and location. Companies from abroad cannot apply for subsidies for technology research and development. See for more details HIL (2012).

On country level, the sanitary and phytosanitary system of the Netherlands (and European Union) is recognised by China's government, as well as the OIE's guidelines concerning disease-free status, imposing and lifting of bans due to disease outbreaks or other incidences (Rau et al., 2012). Additional to the country level requirements, establishments are to be approved individually.

The EU applies the principle of pre-listing to China and to all other trading partners (i.e. the EU relies on the official control systems applied by the Competent Authorities (CAs) of exporting countries), rather than having to carry out inspections of the individual establishments. However, China does not apply this

principle, except for aquaculture. China insists on inspecting all establishments prior to export. The Chinese procedure of inspecting individual EU establishments causes enormous delays and obstacles to market access for EU exporters of, in particular, fresh meat and meat products (EC, 2012). The country does not accept a list of approved companies from the exporting country itself. The legal basis for this is the Regulation on Registration for Foreign Establishments Intended to export Foods to China (Order No. 16, 2002, issued by the General Administration of Quality Supervision, Inspection and Quarantine of the People's Republic of China, AQSIQ). Companies that want to apply can be designated by the Dutch government, for inspection by the Chinese authority. Opposite to this, Hong Kong as a special administrative region relies on such a list from the exporting countries' government. The application process is quite complex and a lot of paper work and the decision making process is not very clear. The establishment approval for meat establishments to export to China is valid for four years (Rau et al., 2012).

Based on reports of the European Commission, Rau (2012) names administrative burden, lack of transparency and the fact that standards are not consistent with international standards as main barriers to export to China. She interviewed exporters of animal products, who name the following main issues: strict requirements, a different concept that seems to be complex and difficult to understand from a EU perspective, labelling in national languages.

Gort and Wang (2012) show that feed and feed additives cannot be sold and used in China without obtaining an import registration certificate (IRC) of the General Administration of Quality Supervision, Inspection and Quarantine of the People's Republic of China (AQSIQ). AQSIQ is the responsible authority when it comes to 3rd country products entering China and products leaving China. The IRC issued by AQSIQ gives an approval of the entity exporting to China. Additionally, most products require a registration (product license) by the Chinese Ministry of Agriculture (MOA). Certificates and licenses are valid for 5 years. It is important to be aware of the recently renewed Catalogues of Feed Materials, Single Feed and Feed Additives. As long as products to be exported to China are listed in these catalogues, they can be registered by MOA in a normal procedure. Products that are not yet in one of the catalogues (provided they are allowed in the country of origin) must go through extended registration procedures before they can be imported into China. This registration process can include several testing procedures to be executed within China. Products not allowed in the land of origin cannot be exported to China.

Live pigs may be exported from the Netherlands to China. Pig meat is exported, but only from two Vion plants (Boxtel and Groenlo) and from the Van Rooi

Meat plant in Helmond. Pig semen export to China is expected to be allowed from 2013; the Chinese pig sector has a need for genetic material from high performing breeds. Regarding steel and technical products there is no hindrance to export.

In general, import allowance processes are dynamic, time restricted, not fully predictable, partly intransparent, time consuming and complex. To tackle these, companies need to invest in detailed knowledge or the Chinese regulatory procedures (Gemmeke, personal communication).

The Netherlands Ministry of Economic Affairs has set up an export supporting facility 'Finance for International Business'. Companies willing to invest in transition countries, including China, can apply for a loan as part (up to 35%) of external funding (ELI, 2012).

The Chinese Ministry of Agriculture and the Netherlands Ministry of Economic Affairs have agreed on cooperation in agricultural business. Although Orange Pig will terminate in 2014, both countries wish to prolong the cooperation on governmental, institutional and business level in the fields of Breeding; Design & technology for sustainable production, storage, processing & supply chains; Disease control and animal welfare; Rural energy and water use, waste handling (environmental issues); Good Agricultural Practices, product quality and food safety, tracking and tracing systems; Knowhow transfer (training of farm and industry staff at several levels); Feed innovation (sustainable technology, availability and application of high quality, safe raw materials and high value additives to meet rising demand) (ELI and MOA, 2012).

It is nearly impossible to fulfil the procedures needed to export agricultural products to China of animal origin or for animal purpose without the use of local Chinese experts (Gemmeke; Enting, personal communication).

8.2 Doing business

The Global Competitiveness Report (Schwab, 2011) scores factors which form problems for companies when doing business with China. Inflation, access to financing and the inefficient government bureaucracy are perceived most problematic. Other high ranking factors are policy instability, corruption, inadequate supply of infrastructure and tax rates. The factors perceived as least problematic are crime and theft, poor public health and government instability. This does not conclude that these factors can be problematic in the Chinese society, but they are not perceived as a problem during doing business.

The Chinese culture is different from the Netherlands' culture. The Chinese culture is a ritual culture, rather than rules-based such as in the Netherlands (Gemmeke, personal communication). To give an example: according to Hofstede et al. (2010) China is a highly collectivist culture (score 20, on a scale of 0 for strongly collectivistic to 100 for strongly individualistic countries). Opposite to this is the Netherlands, with a score of 80, indicating an individualistic society. Such culture differences influence the way of doing business.

The Chinese term 'guanxi' describes a delicate way of networking where favours are exchanged such as gifts or inside information. It has to do with building mutual trust and is essential for doing business in China. Eating and drinking together is important to build-up guanxi. Enting and Wang (2012) mention the need for foreign companies to have a local Chinese manager. Good guanxi can open doors and minimise obstacles in doing business in China. Practically speaking, patience and understanding of this culture is necessary.

9 Export and investment opportunities from the Netherlands

9.1 PEST analysis

A PEST analysis describes a framework of macro-environmental factors influencing the Chinese production environment. The mnemonic PEST stands for Political, Economic, Social and Technological analysis.

The method has been further elaborated to include e.g. Ethical, Legal, Educational and Demographical aspects, leading to abbreviations such as PESTLE or STEEPLED analysis. This approach is used as a stepping stone for analysing export and investment opportunities for the entire supply chain of pig production. Outcome of this analysis will be used as input for the consequent SWOT analysis. Indicators are filled in either qualitatively or quantitatively and sometimes comparatively to the Netherlands.

Table 9.1 **PEST analysis**

As- pect	Indicator	Comment
Political (incl. legal)	General political situation and Governmental structure	Stable for many years; planned economy. Five year plan gives predictable guidance towards expected policy developments
	Tax policy	Taxation is complex
	Employment laws	In favour of employer. Limited employee protection but improving
	Environmental & Animal welfare regulations	Environmental problems are recognised in current FYP, but less strict than in EU. Animal welfare does not play a role
	Trade restrictions	Complex to enter, but possible. Negotiations are running
	Import tariffs	Rather low, up to 10%
	Ownership rights	Land is owned by government; long term lease
	Intellectual ownership rights	State actively implements a patent system. Nevertheless copying is still commonplace
	Reliability of governments' decisions	Policy is reliable but implementation has a strong political angle
	Corruption	High; CPI is 3.6
	Speed of permission allowance	Low. Very bureaucratic. Connections to government may speed up the process
	Attitude towards foreign investments and sourcing	Government is open for foreign investments, however with limitations
Economic	Economic growth	High economic growth; currently a bit under pressure
	Interest rates	Relatively low (6% for 1 year unsecured loan)
	Credit availability	Hardly possible for investors from abroad
	Monetary policy	Devaluation policy for strong export position
	Inflation rate	High, related to high economic growth; partly related to the feed and food price fluctuations
	(Minimum-) Wage rate	Minimum wages CNY1,000 (about EUR125) per month but increasing firmly
	(Effective) working hours	Over 40 hours per week
	Social taxes	Pension system is implemented; no other social security
	Attitude to work	People are willing to work hard
	Availability of workers	Skilled workforce increasingly limited. Position of employee becoming stronger

Table 9.1 **PEST analysis**

As- pect	Indicator	Comment
	Unemployment	Rather low (4%) and stable over last 5 years
	Cost of living	Increasing (urban areas)
	Production costs	Costs are increasing due to feed supply. Labour costs low
Social (including demographic and ethical)	Population growth rate	Rather low, growth rate 0.48%. Ageing people
	Live expectancy	Good; 75 years on average
	Urbanisation	51% (2011) and increasing
	Income dispersion	Still very high: GINI 48.0. Harmonisation is focus point in 12th Five year plan
	Education	Major regional quality differences. Right of education linked to registered residence
	Age distribution	Ageing population due to one-child policy
	Cultural norms and expectations	Chinese culture is a ritual culture, rather than rules-based such as in the Netherlands. Human relations determining factor in trade & investments
	Health consciousness	Health awareness is low, but growing; expenditures still low. Food safety has become very relevant. Due to domestic food scandals products from abroad might be trusted as safe
Technological	Career attitudes	High respect for higher ranked people. People work hard to achieve the highest
	Attitude towards technology	Very high interest in technology. High tech can be tricky
	Economic force towards automation	Labour is still cheap. Search for simple technical solutions and automation is growing
	Focus on development of new technology	High. Special focus for safety and process improvement.
	Support for innovation and R&D	High. Government invests a lot through subsidies for domestic companies.
	Intellectual property rights/copy behaviour	Problematic. Independent official patent right system being set up. Copying is a deep-rooted Chinese habit

9.2 SWOT analysis

This SWOT analysis deals with the opportunity of investment or export to a sustainable pig supply chain in China. The results of the PEST analysis are used in the SWOT. The letters SWOT stand for Strengths, Weaknesses, Opportunities and Threats. The first two factors relate to strengths and weaknesses of Dutch companies regarding entering the Chinese market, whereas the latter factors, opportunities and threats are external factors that play a role in the investment and export opportunities. The analysis covers both investment and export opportunities and all parts of the pig supply chain and does not go into detail for the separate parts of the supply chain.

Strengths

Strengths are characteristics of Dutch companies that give an advantage over companies from other countries willing to enter the Chinese market:

- Dutch people are used to trade internationally historically and are (to some extent) able and willing to adapt to other cultures.
- Dutch companies are innovative, high-tech focused, internationally oriented and show a high performance in production (effective and efficient). Compared to China, materials and knowledge is already available and applicable in Chinese circumstances without major adaptations. Agreed quality is trustworthy. A distinguishing characteristic is the integral approach. All these aspects however, are not really different from competing companies from other countries.
- Wageningen is a famous brand.

Weaknesses

Weaknesses are characteristics of Dutch companies that place them at a disadvantage relative to companies from other countries willing to enter the Chinese pig production chain:

- Lacking reputation. For relevant Chinese stakeholders the Netherlands and Dutch companies are not well-known as a knowledge and innovation country (AWT, 2012). This is supported by several companies' representatives, telling that other countries (such as Denmark, Germany, or the US) are better known in China. This might also be due to a rather late entrance into the Chinese market of Dutch companies, and to some negative experiences. Although Wageningen brand is positively known, the golden triangle (government, business and knowledge institutes) isn't.

- The straightforward and goal-oriented mentality of Dutch businessmen sometimes conflicts with the Chinese rituals-based business culture.
- Production costs in the Dutch pork industry are higher than in the Americas, giving a disadvantage to Dutch producers.

Opportunities

Opportunities are external factors that offer chances for the companies in the Netherlands to export or invest:

- Given the increasing average income of the Chinese consumer and giant performance arrears there is a need for housing techniques, animal identification systems, feed composition knowledge, meat processing techniques, logistic chain management, traceability and benchmark systems and education of efficiency oriented managers.
- Increasing consumption and a very big market lead to firmly growing production needs in the pig supply chain. The Chinese government stimulates the development of large production and processing facilities, resulting in a large need of machineries in slaughtering and meat processing and the knowledge for optimal use of the machineries.
- The high focus on food safety results in a large need of knowledge and equipment to effectively control food safety.
- Increasing labour costs and scale of production lead to industrialisation and the need of labour saving techniques in all stages of the pig production chain in China.
- Limited resources (feedstuffs, water) and increasing environmental pressure, in combination with more attention towards public health leads to increasing attention towards sustainable production and efficiency in all stages of the production chain. Especially in farming a lot of efficiency gain can be attained. Lacking awareness of efficiency opportunities and management skills lead to a demand for sharing knowledge and application of benchmark tools.
- Strengthening Chinese currency means an advantage for exporters to China.

Threats

Threats are external factors that could make entrance for Dutch companies into the Chinese pig market more difficult:

- Domestic companies are treated preferentially in terms of loans, subsidies and licensing. These companies also have advantages in terms of equal culture and a short distance to deciding policy makers.
- High indirect costs through corruption and bureaucracy and the need of guanxi.

- Although legislation is trustworthy, implementation can change and is subject to interpretation differences. For organic materials (feedstuffs, animals and animal products) borders can be closed quickly within the so-called sanitary and phytosanitary (SPS) agreements, for example if diseases occur or unwanted residues are found.
- Quality fading. Due to a search for saving options after having made sales agreements, the product quality of domestically made materials may decline. This is a threat for investors into Chinese companies.
- Copying behaviour is common.

Table 9.2 SWOT analysis of the Dutch pig supply chain for the Chinese pork market and industry	
Dutch pork supply chain	
Strengths	Weaknesses
<ul style="list-style-type: none"> - History of International trade - Innovative, high-tech, quality focus - Integral approach - Wageningen is famous 	<ul style="list-style-type: none"> - Lacking reputation - Business mentality - Production cost (compared to competitors)
China's pork market and industry	
Opportunities	Threats
<ul style="list-style-type: none"> - Increasing income and consumption - Demand for large-scale industrial production - Growing attention to food safety - Growing attention to sustainability - Giant performance arrears - Demand for knowledge and innovation - Demand for efficiency - Strengthening Chinese currency 	<ul style="list-style-type: none"> - Domestic companies are treated preferentially - High indirect costs - Legislation interpretation and implementation - Risk of border closures - Lacking awareness of efficiency opportunities - Quality fading - Copying behaviour

10 Conclusions and recommendations

Conclusions

The big and growing Chinese market is demanding products, systems and knowledge throughout the entire pig supply chain and market. Given the giant performance arrears there is a need for housing techniques, animal identification systems, feed composition knowledge, meat processing techniques, packaging, logistic chain management, traceability and benchmark systems and schooling of efficiency oriented managers.

Fluctuating volumes and consequently fluctuating prices will support the desire for cooperation or even partial integration in the pig meat supply chains. It is however uncertain whether fully integrated production will become the typical business model.

Given the big Chinese market and enormous developments in the food supply chain, there is abundant room for suppliers from abroad. It is however, questionable whether Dutch companies are able to be a preferred supplier, given the lacking reputation of the Netherlands in the agro-industry compared to competitors. To improve the Dutch competitive position, further Holland branding is needed.

The disadvantage of relatively high production costs in for example pig production and meat processing might lead to competition in exporting pig meat to China. Rather than getting involved in a price competition, it is recommendable to develop a meat brand for the middle and upper class urban consumers, with a focus on high product quality, guaranteed food safety, good taste and trust. The higher production cost in the Netherlands compared to the US will then be less relevant. The typical Chinese trade partners are the retailers.

The Chinese government stimulates mechanisation and automation of meat processing, aiming to improve food safety. This resulted in a big demand for slaughter and processing lines.

The biggest challenges in development of pig farming in China are disease control, production efficiency and feed efficiency. To this end, not only techniques are needed (housing, breeding, feed etc.), but also awareness and improved management skills. Software systems for on farm animal management and other bench marks are needed. It is questionable, however, whether Chinese pig farmers are willing to make use of such tools.

The feedstuff supply in China is insufficient for animal feed; especially protein sources are imported. Moreover, the self-sufficiency is expected to diminish the

coming years. The raw material price of feed components is higher than in the US or the EU. There is a need for feed efficiency improvement, both in farming and in feed composition. Increasing farm size and professionalisation are ingredients towards improved demand for complete feed and for knowledge to support farm managers in their feed management.

Given the low performance level throughout the pig supply chain in China, it is defensible that efforts from Dutch companies to either invest into the Chinese pig supply chain, or to export products to China do improve the sustainability of pig meat production.

The question whether to invest in Chinese production, or to export products cannot be answered simply. This choice is related to several factors, such as local advantages (wages, product freshness) or disadvantages (food safety image, funding), purchase frequency and the need of after sales, cross-border disadvantages (risk of border closure due to SPS measures, export hindrances, currency exchange fluctuations), speed of market entrance, IPR or the speed to adapt product specifications to customers' demands. Given the Chinese human relations based business culture, it is highly necessary to be locally present, both for investors and for exporters. For investors it is important to thoroughly consider the balance between the short term market entrance advantages and possibly giving away a technology head start in the longer term. The Chinese have a hunger for innovative solutions: as soon as they are able to offer them themselves, they will no longer need western support and products.

Entering the Chinese market can be quite complex. For companies it is recommended to jointly approach the market with other supply chain players, such as the Orange Pig network. The Netherlands can offer an integral approach for supply chain solutions to Chinese business partners, but also can the Dutch companies exchange experiences, lowering start-up costs and finding marketing opportunities.

Recommendations to the Dutch government

- To improve awareness of the Netherlands as supplier to China it is recommended to improve Holland branding in China.
- Ongoing effort is recommended to reduce export and investment hindrances.
- It is further recommended to continue efforts in setting up company consortia and matchmaking.
- Further research is recommended towards development of consumption and consumer patterns and consequently to carry out a feasibility study for a high quality branded meat supply chain

- Finally, the government is recommended to set up a demonstration farm, showing techniques and management practices, both as a show-case and for schooling of Chinese people.

Recommendations to companies

- For companies it is recommended to jointly approach the market with other supply chain players.
- For investors it is recommended to thoroughly consider the balance between short term market entrance advantages and possibly giving away a technology head start in the longer term.
- It is recommended to make use of the services of the Netherlands' embassy in China, being an independent foothold in this country.
- It is also advised to make use of the positive image of Wageningen in China, both by adhering to cooperative projects (for example between Wageningen UR and Beijing Municipal Bureau of Agriculture) and by involving the Wageningen knowledge in product development.
- It is recommended to develop a high quality meat brand for sales to the middle and upper class Chinese urban consumers.

Literature, websites and personal communications

Literature

Asian Agribusiness, February 2012. *China launches campaign to improve abattoir standards.*

Atherton, A., 2008. 'From 'fat pigs' and 'red hat' to a 'new social stratum'; The changing face of enterprise development policy in China.' In: *JSBED* 15 (4), pp. 640-655.

ATKearny, 2012. *Global retail expansion: keeps on moving.*

AWT, 2012. *De Chinese handschoen; Hoe Chinese en Nederlandse kennis elkaar kunnen versterken.* Adviesraad voor het Wetenschaps- en Technologiebeleid (AWT).

Beek, V. ter, 2012. 'China - heading for food self-sufficiency and more.' In: *Pig Progress* 28.5.

Best, P., 2010. 'World feed panorama: China leads a late recovery.' In: *Feed International*, January/February, pp. 12-13.

BPEX, 2012. *Pigs and the environment; How the global pork business is reducing its impact.* BPEX, division of Agriculture and Horticulture Development Board (AHDB), UK.

Cai, Fang and Meiyang Wang, 2012. *Labour market changes, labour disputes and social cohesion in China.* OECD Development Centre, Working paper 307.

Cao, Fuli, 2008. *Impact of China's VAT Reform on foreign-invested enterprises.* Jones Day Commentary.

China Agricultural Development Report, 2011. *Ministry of Agriculture of the People's Republic of China*. China Agriculture Press, Beijing.

China Chain Store and Franchise Association, 2012. *China Top 100 Chain Retailers*. <http://www.chinaretail.org/reports.asp>

Ch-agri, 2012a. *China set to solve the critical food safety problem in three years*. www.guojixumo.com/en/news/newshow.aspx?id=19454. Published 11 July 2012.

Ch-agri, 2012b. *China to Publish its First Animal Welfare General Rule*. <http://www.guojixumu.com/en/news/newshow.aspx?id=20746>. Published 16 October 2012.

Chow, J.Y., I. Choi and C. Pan, 2012. *Is the CPI the 'China Pork Index'?* Rabobank Industry Note 311-2012. Rabobank International.

CIA, 2012. *The World Factbook*. Accessed 28 August 2012. <https://www.cia.gov/library/publications/the-world-factbook/geos/ch.html>

Claxton, R., 2012. *Far East Economy 2011*. GIRA.

Conway, P. R. Herd, T. Chaloux, P. He and J. Yu, 2010. *Product market regulation and competition in China*. OECD Economics department working papers, No. 823. OECD Publishing.

DDMA, 23 March 2012. *Online shopping in China*.

EL&I, 2012. *Staatssecretaris Bleker steunt bedrijven die willen investeren in opkomende markten*. Den Haag, Ministerie van Economische Zaken, Landbouw en Innovatie. Nieuwsbericht 16 juli 2012.

EL&I en MOA, 2012. *Agreed Minutes of the Fifteenth Agricultural High Level Meeting Between. The Ministry of Economic Affairs, Agriculture and Innovation of the Kingdom of the Netherlands and The Ministry of Agriculture of the People's Republic of China*. Fifteenth Sino-Dutch High Level Meeting on Agriculture. Beijing, September 27.

Enting, I., B. Wang, X. Zhang and G. van Duinkerken, 2010. *The animal feed chain in China; Opportunities to enhance quality and safety arrangements*. The Hague, Ministry of Agriculture, Nature and Food Quality.

Enting, I. and B. Wang, 2012. *Doing business in China*.

Euromonitor, February 2012. *Consumer lifestyles in China*. Euromonitor International: Passport.

FAS, 2011. *China - Livestock and Products Annual 2011*. GAIN (USDA) report CH 11042.

FAS, 2012a. *China - Livestock and Products Semi-annual Report 2011*. GAIN (USDA) report 12017.

FAS, 2012b. *Grain and Feed Annual 2012*. GAIN (USDA) report CH 12022.

Fu, Fu Qiang, 2007. *Pork consumption - from the prospective of China market*. Presentation at World Pork Congress, China.

Gale, F., B. Lohmar and F. Tuan, 2009. 'How tightly has China embraced market reforms in agriculture.' In: *Amber Waves* 7 (2), pp. 30-35.

Gale, F., D. Marti and D. Hu, February 2012. *China's volatile pork industry*. ERS (USDA), LDP-M-2011-01.

Garnier, J.P., 2012. 'Chinese pork consumption continues to grow.' In: *Pig International*, January/February, pp. 22-23.

GIRA, 2012. *Asia*. Gira Meat Club 2011.

Gort, F. and B. Wang, 2012. *China & EU Feed law; Approval & Registration, Inspection & Control in relation to Import & Export*. Presentation at the International China Summit, 22 September 2012, Beijing, China.

Han, Jiqin, April 2009. *Developments and concerns of the meat industry in China*. Presentation at the IMS Economics Workshop, Wageningen, The Netherlands.

He, Qigai, Aizhen Guo, Pin Chen and Huanchun Chen, 2011. *Current Pig Industry in China*. Proceedings of the 5th Asian Pig Veterinary Society Congress, 7-9 March 2011, Pattaya, Thailand.

HIL, 2012. *A summary of China's foreign investment law & practice. HIL International lawyers and advisers*, July 2012.

Ho, P., 2007. *Dat is Chinees voor mij; Zin en onzin over China*. Uitgeverij De Geus.

Hofstede, G., G.J. Hofstede and M. Minkov, 2010. *Cultures and Organizations: Software of the Mind. Revised and Expanded 3rd Edition*. McGraw-Hill. New York, USA.

Hoste, R. and G.B.C. Backus, 2003. *Global pig production costs. Costs of pig production in Brazil, Canada, China, Poland and the USA compared with those in the Netherlands*. Wageningen: LEI.

Hoste, R., 2012. *Efficient and sustainable solutions for pork production*. Beijing, China. 22 September.

Hoste, R. and P. van Iperen, 2012. *Sustainability bench mark for pig farms; Methodology development*. LEI Memorandum 12-120. LEI Wageningen UR, The Hague.

Keefe, L., 2012a. *China introduces five-year food safety plan*. Meatingplace.com. 20 June.

Keefe, L., 2012b. *Smithfield buys back COFCO's shares*. Meatingplace.com. 19 November.

Krystallis, A., K. Grunert, M. de Barcellos, T. Perrea and W. Verbeke, 2012. 'Consumer attitudes towards sustainability aspects of food production: insights from three continents.' In: *Journal of Marketing Management* 28: 3-4, pp. 334-372.

Lin, D., 2012. *China's feed sector consolidation*. FEED Business Worldwide. August 2012.

- Liu, C., 2009. 'China robust export market for soya beans.' In: *Feed International*, November, pp. 10-12.
- Lyja Media, 2011. *Guide to China market 2010-2011; Chinese suppliers' directory*. Shanghai Lyja Cultural Media Co., Ltd.
- McCluskey, J. et al., 2012. *Westernization of Chinese Breakfast*. USDA GAIN report. Foreign Agricultural Service.
- McOrist, S. and R. Walters, 2009. 'Native pig breeds of China.' In: *Pig Progress* 25 (3), pp. 6-7.
- McOrist, S., K. Khampee and A. Guo, 2011. 'Modern pig farming in the People's Republic of China: growth and veterinary challenges.' In: *Rev. sci. tech. Off. int. Epiz.* 30 (3), pp. 961-968.
- MOA, 2012a. *Excerpt of China's 12th Five-Year Plan - Agricultural Part (April 2012)*. Ministry of Agriculture, <http://english.agri.gov.cn/> Retrieved May/June/July.
- MOA, 2012b. *China Animal Husbandry Yearbook*. Ministry of Agriculture.
- OECD/FAO, 2012. *OECD-FAO Agricultural Outlook 2012-2021*, OECD Publishing and FAO. http://dx.doi.org/10.1787/agr_outlook-2012-en
- Ortega, D.L., H. Holly Wang and J.S. Eales, 2009. 'Meat demand in China.' In: *China Agricultural Economic Review* Vol. 1, Iss. 4, pp. 410-419.
- Ortega, D.L. and H. Holly Wang, 2009. *Opportunities for U.S. Pork in China and Implications for U.S. Hog Producers*. Report EC-758-W. Purdue Extension.
- Pan, Chenjun, 2012b. *China's Pork Supply Chain Dynamics*. Presentation at International China Summit, Beijing, China, 22 September.
- PigProgress, 2012. *China: Restaurant scraps being used as pig feed*. Pig Progress, 23 May 2012.

PVE, 2012. *Statistisch Jaarrapport 2011, Voorlopig; Varkenssector*. PVE, Zoetermeer.

Rau, M.L., 2012. *Exploring non-tariff measures in agri-food trade; incidences and issues from the Dutch perspective*. LEI report 2011-070. The Hague.

Rau, M.L., L. Ge, N. Valeeva and C.P.A. van Wagenberg, 2012. *Establishment approval in international trade of animal products*. LEI Memorandum 12-026. The Hague.

Redfern, 2010. *The China meat market sector overview 2010*. RedFern Associates.

Schwab, K., 2011. *The Global Competitiveness Report 2011-2012*. World Economic Forum, Geneva, Switzerland.

Tolkamp, J.W., 2012. *China's Dairy Chain*. Embassy of the Kingdom of the Netherlands, Beijing.

Transparency International, 2012. *The Corruption Perception Index 2011*. http://cpi.transparency.org/cpi2011/in_detail/

UNDP, 2011. *Human Development Report 2011; Sustainability and Equity: A Better Future for All*. United Nations Development Programme.

Wang, Jimin and Hongbo Xiao, 2008. *Development of the Hog industry and its integration in China*. In: Wang, Jimin and Mariko Watanabe, 2008. *Pork production in China; A survey and analysis of the industry at a Lewis turning point*. Institute of Developing Economies, Japan External Trade Organization (IDE-JETRO)

Wang, Jimin, 2012. *Survey on China's hog production and circulation*, 22 September 2012.

Xiao, Hongbo, Jimin Wang, Les Oxley and Hengyun Ma, 2012. *The evolution of hog production and potential sources for future growth in China*. In: *Food Policy* 37: pp. 366-377.

Zhang, Baowen, 2008. *China's pig farming industry: the status quo, opportunities, challenges and development strategy*. Presentation at the Chinese-European pig summit, November 2008, Hannover, Germany.

Zheng, Shi, Pei Xu, Zhigang Wang and Shunfeng Song, 2012. 'Willingness to pay for traceable pork: evidence from Beijing, China.' In: *China Agricultural Economic Review* Vol. 4 Iss 2: pp. 200-215.

Websites

CAAA. <http://www.caaa.org.cn/en/media%20center/market/Market.php>;
Accession date 21 August 2012.

CBS Statline. <http://statline.cbs.nl/statweb/>; Accession date: 3 September 2012.

Comtrade. Accessed 6 November 2012.

FAOSTAT, 2012. <http://faostat.fao.org/site/550/default.aspx#ancor>; Accessed July 2012.

IndexMundi. <http://www.indexmundi.com/commodities/?commodity=soybeans&months=360>; Accession date 21 August 2012.

InforEuro. <http://ec.europa.eu/budget/inforeuro/index.cfm?Language=en>;
Accession date: 20 August 2012.

LEI. Agricultural Prices. http://www3.lei.wur.nl/bin_asp/frm_start_binternet.aspx?database=Prijzen&language=0; Accession August 2012.

OIE. World Health Organization. http://www.oie.int/wahis_2/public/wahid.php/Countryinformation/Veterinarians; Accession date 20 September 2012.

UNCTAD. Inward and outward foreign direct investment flows, annual, 1970-2011; <http://unctadstat.unctad.org/TableViewer/tableView.aspx>;
Accessed 28 August 2012.

World Bank. Cereal yield (kg per hectare). <http://data.worldbank.org/indicator/AG.YLD.CREL.KG>; Urban population (% of total). <http://data.worldbank.org/indicator/SP.URB.TOTL.IN.ZS>; Accessed 2 November 2012.

Personal communication

Mr. Marinus Overheul	Agricultural counsellor, Embassy of the Netherlands, Beijing, China
Mr. Emar Gemmeke	Veterinary and Phytosanitary counsellor, Embassy of the Netherlands, Beijing, China
Mr. Jan Cortenbach	Chief Technical Officer China, Koudijs-De Heus International
Mrs. Chenjun Pan	Senior industry analyst, Rabobank Beijing
Mr. Paul Vriesekoop	Director Livestock Research Wageningen UR
Mrs. Dr. Ina Enting	Manager, Dutch Meat & Feed Centre and Orange Pig, China
Mr. Jan Fongers	Asia Desk, Wageningen International, Wageningen UR
Mr. John Yeung	General manager, Nedap Agri China
Mr. Yu Chen	Vice director, Beijing Animal husbandry and veterinary technology services centre
Mr. GuoWei Feng	Vice manager Beijing Resource Group, DaXing, Beijing
Mrs. YaoQiao Fan	Regional technical director, Wellhope De Heus
Mrs. Wang Jun,	Technical director, Wellhope De Heus
Prof. Dr. Jimin Wang	Research Fellow, Institute of Agricultural Economics and Rural Development, China Academy of Agricultural Sciences, Beijing
	Manager of a Ping pig farm, XiBaiTaCun
Mr. Frank Gort	Trust Feed Manager of meat department in Carrefour store, Beijing
Mr. Gerben Nooyen	Nooyen Pig Flooring
Mr. Glen Illing	Regional director Asia & Pacific, Topigs
Mr. Henk Janssen	Area manager, Topigs
Mr. Peter van 't Veld	DVM, Denkavit
Mr. Jan Merks	C-Pig, Shanghai

Appendix 1

Abbreviations

CSF	Classical Swine Fever
FMD	Foot-and-Mouth Disease
FYP	Five Year Plan
GDP	Gross Domestic Product
IPR	Intellectual Property Rights
MOA	Ministry of Agriculture
PRRS	Porcine Reproductive and Respiratory Syndrome
SPS	Sanitary and Phytosanitary
VAT	Value Added Tax

Appendix 2

Pig production per province

Ranked according to pork production volume, year 2011		
Province	Number of slaughter pigs (million)	Pork production (1,000 tonnes carcass weight)
Sichuan	70.0	4,848
Henan	53.6	4,064
Hunan	55.8	4,061
Shandong	42.3	3,469
Hubei	38.7	2,905
Guangdong	36.6	2,710
Hebei	32.4	2,466
Yunnan	29.6	2,439
Guangxi	32.0	2,398
Anhui	27.2	2,331
Liaoning	26.5	2,259
Jiangxi	28.8	2,241
Jiangsu	28.8	2,159
Chongqing	20.2	1,486
Guizhou	16.9	1,483
Fujian	19.5	1,466
Zhejiang	19.3	1,358
Jilin	14.8	1,220
Heilongjiang	16.4	1,169
Shaanxi	10.6	773
Inner Mongolia	9.1	713
Shanxi	6.7	522
Gansu	6.3	458
Hainan	5.1	422
Tianjin	3.5	276
Beijing	3.1	242
Xinjiang	2.6	225
Shanghai	2.7	191
Qinghai	1.3	92
Ningxia	1.0	73
Tibet	0.2	14
China mainland (total)	661.7	50,533

Source: MOA (2012b).

LEI Wageningen UR develops economic expertise for government bodies and industry in the field of food, agriculture and the natural environment. By means of independent research, LEI offers its customers a solid basis for socially and strategically justifiable policy choices.

Together with the Department of Social Sciences and the Wageningen UR, Centre for Development Innovation, LEI Wageningen UR forms the Social Sciences Group.

More information: www.wageningenUR.nl/en/lei

