

Global Meat Complex: The China Series

China's Pork Miracle?

Agribusiness and Development in China's Pork Industry

By: Mindi Schneider with Shefali Sharma
Institute for Agriculture and Trade Policy
February 2014

Global Meat Complex: The China Series
China's Pork Miracle? Agribusiness and Development in China's Pork Industry

By Mindi Schneider with Shefali Sharma

Published February 2014

The author is an Assistant Professor of Agrarian, Food and Environmental Studies at the International Institute of Social Studies (ISS) in The Hague, Netherlands.

Shefali Sharma is based in Washington DC as the Institute for Agriculture and Trade Policy's (IATP) Director of Agricultural Commodities and Globalization Program.

Some of the research presented in this report was supported by Oxfam Hong Kong.

The Institute for Agriculture and Trade Policy works locally and globally at the intersection of policy and practice to ensure fair and sustainable food, farm and trade systems.

More at iatp.org

ACKNOWLEDGEMENTS

When we embarked on this project to examine China's role in the Global Industrial Meat Complex, we had intended to produce only one report. Fairly quickly into the research, we realized—given the complexity of China, the scale and scope of production and the rapid rate at which different meat segments in China are evolving—individual sectors such as feed, pork, dairy and poultry merited their own stories. This large endeavor could not have been achieved without the help of numerous people that were involved from the conception, research, drafting, translation and editing phases of the project.

First, we'd like to thank Jim Harkness, IATP's president for 7 years (2006–2013) as the person who conceived this project as a critical contribution to the debate on the expansion of industrial meat production, its increasing concentration and its implications for social and environmental justice. Our interviews, conducted in May 2013, in China would not have been as rich without Jim's excellent contacts, his Chinese language skills and his 16 years of experience living and working in China. His editorial input, suggestions and revisions throughout the process have been invaluable.

IATP is also grateful to Mindi Schneider for being the lead author of our report: *China's Pork Miracle? Agribusiness and Development in China's Pork Industry*. We are indebted to her for being generous with her knowledge, in-depth research and analysis on China's "pork miracle," the role of government policies and the emergence of Chinese corporations in the meat and feed industries.

Several other people contributed with hours of research and writing that helped shape these reports. We thank Sophia Murphy, Sarah Martin and Sarah Horowitz who contributed heavily in the early stages of the project and whose research contributed to the content of the final reports. Assistance with translations of documents and interviews was adeptly provided by Jiang Tuo and Yuan Miao Zhu.

Lastly, but definitely not least in the writing process, Zhang Rou and Chendong Pi spent numerous hours researching, writing and revising various drafts of the dairy and poultry reports, respectively. We are grateful for their hard work and efforts. Ben Lilliston also provided important editorial input throughout the process and IATP's communications team worked around the clock to deliver a beautiful final product.

In addition, we thank experts like Fred Gale, Mia MacDonald (Brighter Green), Susanne Gura, Kees Kodde (Greenpeace China) and Third World Network who generously shared their research and analysis of China's meat revolution with us. We also thank the researchers, academics, representatives of the industry and Chinese policymakers who were interviewed anonymously in China as part of this research. Any factual errors are our own responsibility and not of these individuals. We especially thank the Grace Foundation for supporting this project and understanding the importance of researching the global dimensions of the industrial meat complex and why China was a good place to start.

A final caveat: The project has been an enormously enriching process of learning about how China is grappling with its choices to consume and produce more meat and what this means for social and environmental issues within and outside China. It is by no means intended to be a definitive account—an impossible task for a country as complex and vast as China. We hope however, that it will be an important contribution to an evolving debate and process.

—Shefali Sharma

TABLE OF CONTENTS

The global industrial meat complex: Understanding China's meat revolution.....	7
Executive summary	9
I. Introduction: China's pork miracle?	11
II. Developing China's pork industry	12
All the pork in China: a brief historical overview	12
Industrializing pork	13
Pork industry production, consumption and imports	14
Imports	15
Import prospects.....	16
Pork industry restructuring: Who raises China's pigs?	18
Consolidation and overcapacity of slaughterhouses	20
III. China's pork and livestock development strategy: more meat, modern meat, safe meat.....	21
Why more pork?	21
"Let them eat pork"	21
Food safety as a demand driver	22
IV. Dragon Heads, vertical integration and contract farming	23
Dragon Head Enterprises: Agribusiness firms take the lead	24
DHEs link to farmers.....	25
Dragon Heads and the pork industry	26
Vertical integration and contract farming: The "company and farm" model.....	28
Impacts of this system on small livestock producers	29
V. Foreign firms and global consolidation in China's pork industry	29
VI. Impacts of the industrial livestock production model.....	32
Conclusion.....	33
Endnotes	34

THE GLOBAL INDUSTRIAL MEAT COMPLEX: UNDERSTANDING CHINA'S MEAT REVOLUTION

When the Chinese company Shuanghui International Holdings announced its intention to purchase Smithfield Foods, it got the attention of the U.S. Congress and the media. The idea of a foreign firm owning a giant U.S. pork producer, and an influential player in the U.S. food system, raised a government debate about the links between food security and national security.¹ The purchase was just the latest in the growing consolidation in the global industrial meat complex—where long supply chains include feed production, genetics and breeding span the globe and blur national identity. Shuanghui's recent name change to WH Group Limited exemplifies this global branding and reach.²

Aside from operating in the U.S., the global meat industry is increasingly interlinked with emerging economies. China and Brazil are now not only big agricultural producers and consumers, they have spawned a new set of agribusinesses, shaping the global meat complex. Their governments have embraced the factory-style meat production promoted by U.S. agribusiness companies. They are also adopting Western diets, including rising meat consumption.

In 2013, the U.S. was the top global importer of beef, and top exporter of pork; Brazil was the top exporter of beef and poultry. China is the world's largest producer and consumer of pork, the second largest producer of poultry and the world's largest soybean (for animal feed) importer. Brazil is increasingly filling the global need for meat, while the U.S. and Brazil compete for China's soy market. With the purchase of Smithfield, Shuanghui/WH Group becomes the largest pork enterprise in the world. Brazilian based JBS is now the world's largest meat company. U.S.-based Tyson remains one of the world's largest poultry companies, competing with JBS's acquisitions in the poultry industry. In short, industrialized meat production, processing and consumption has truly become a global phenomenon with global implications.

U.S.-based corporations, and their model of industrial animal production, have certainly been a major catalyst in the growth of industrial meat production around the world. Over the last 50 years, the rise of industrial meat production in the U.S. has been nothing short of astounding.

Animal production has shifted from a decentralized family farm system to a more concentrated system with fewer companies producing and large numbers of animals in confined spaces. These operations standardized feed for weight gain, genetic selection and the mechanization of feeding and watering.

Six years ago, a commission sponsored by the Pew Foundation examined the industrial meat production in the United States. The Pew Commission issued a series of recommendations, including the phase out of non-therapeutic use of antibiotics in animal production, stronger regulations to manage waste, the shift away from intensive confinement toward more humane treatment, vigorous enforcement of antitrust laws and increased funding for public research on alternative approaches for animal production. "Failure to address these issues will only result in a further lack of confidence in the animal agriculture industry, increased environmental damage, worsening public health, dismal animal welfare, and a grave outlook for rural communities," concluded the commission.³

For the U.S. farm economy, the industrial meat system has pushed out nearly all independent poultry and pork producers, while independent beef producers continue to hang on against all odds. Over 13 years ago, IATP documented the transformation of U.S. hog production in *The Price We Pay for Corporate Hogs*. In a period of 30 years (1950–1980), the number of U.S. hog farms declined by nearly 80 percent, while the average farm size increased six-fold. By 1999, 50 percent or more of the farmers were under some sort of contractual arrangement and four companies (including Smithfield) controlled 20 percent of the production. In the last decade, this process has only further intensified. By 2007, four companies controlled 66 percent of the production—at a great cost to U.S. farmers, consumers, the environment and public health. Further, working conditions at industrial meat processing facilities are considered some of the most dangerous in the U.S.⁴

In response to the numerous problems associated with industrial meat production in the U.S., rural communities, farm groups, environmental and public health organizations around the country have opposed the industrial meat system on a number of different fronts, in many cases winning important battles. But while U.S. meat consumption per capita has declined over the last four years,⁵ U.S. meat production continues to rise, linked to increasing U.S. meat exports. There are clear lessons to be learned from the U.S. experience.

Like most agricultural commodities, the meat industry is not local, regional or national—it is global. And the multinational companies that dominate this industry, from production to feed to processing and distribution, are set on exporting this industrial model of production around the globe. The industry is aided by trade agreements that threaten to lower worker safety, health and environmental standards while further empowering the legal standing of corporations to challenge national regulations.

It is becoming increasingly clear that addressing the economic, environmental and health downsides of the global industrial meat system will have to include an international dimension. Certainly, the health threats associated with industrial meat production—avian influenza, Mad Cow disease, H1N1 (swine flu), antibiotic-resistant bacteria, melamine poisoning—do not recognize national boundaries.

Will countries such as China, Brazil and India continue down the same path of the U.S. on industrializing their meat production? Or, is a different path possible?

In this first phase of our research on the global industrial meat complex, we examine the role of China. We look in depth at four sectors within China associated with animal production: feed, pork, dairy and poultry. It is an endeavor to understand and share how China's transformation towards a U.S. agribusiness model is both a common story of industrial meat production anywhere but is also specific to China. Further, it is an attempt to show how China's story, like the U.S.'s, is a global one, with global links and global impacts.

Understanding how Chinese companies are “going out” to develop their supply chains and how major U.S. and other international livestock and dairy companies are “going in” to China better prepares us to address the global nature of this industrial complex and its impacts—domestic and global. It can help us to get beyond big headlines in the paper about China's growing meat consumption and dig deeper into how and why it is taking place and imagine a different pathway towards fairness, nutrition, public health, environmental protection in food production—lessons that are readily available from the U.S. experience.

The global trend points to ever greater consolidation of fewer and more powerful corporations controlling scarcer water and land resources to feed millions of animals in confined spaces to produce more cheap meat. How citizens and governments deal with the externalities of this sector

and its endemic global ramifications merit careful thought. China—as the largest producer of pork, the second largest producer of poultry, the largest feed importer in the world and the fourth largest dairy producer—is a critical piece of this global puzzle.

Endnotes

1. IATP, Food and national security: The Shuanghui-Smithfield merger revisited, September 12, 2013, <http://www.iatp.org/blog/201309/food-and-national-security-the-shuanghui-smithfield-merger-revisited>.
2. Wattagnet, 2014. Shuanghui International changes name to WH Group: New corporate name manifests company's emerging global reach and aspirations as a world-leading brand, <http://www.wattagnet.com/166126.html> (accessed January 24, 2014).
3. Pew Commission on Industrial Farm Animal Production, <http://www.ncifap.org>.
4. Human Rights Watch “Abuses Against Workers Taint U.S. Meat and Poultry,” January 25, 2005, <http://www.hrw.org/news/2005/01/24/abuses-against-workers-taint-us-meat-and-poultry>.
5. Elaine Watson, “Is the decline in US meat consumption terminal?,” April 12, 2013, FoodNavigator-USA, <http://www.foodnavigator-usa.com/Markets/Is-the-decline-in-US-meat-consumption-terminal>.

EXECUTIVE SUMMARY

Agriculture has helped fuel the “China miracle.” Since 1978, agricultural and food output has soared, Chinese agribusiness firms have become key players in domestic and international markets, and by all accounts, China has been highly successful in overcoming land and resource constraints to feed its population of 1.3 billion people. The country is celebrated for its successes in reducing poverty and hunger over the last 30 years, and more recently, for creating an agrifood system that makes eating “high on the hog” a possibility and reality for many Chinese people.

Pork is at the heart of this miracle. A hallmark of the post-1978 agricultural development model is ramping up the production, sale, and consumption of meat. Processed and packaged meats are the fastest growing market segments, reflecting the increasing influence and operation of pork processors, and the more general trend towards processed foods that can be shipped, stored, and sold with a longer shelf-life in super- and hyper-markets. These trends are also reflected in the Shuanghui (now called the WH Group to take on a more international identity) buyout of Smithfield Foods, a move that will increase China’s pork supplies, strengthen Shuanghui’s brand within China as “safer” meat with higher consumer status because of its US origin, and further generate and shape consumer demand for industrial pork. The Shuanghui-Smithfield deal is a matter of political and economic interest, but also signals a much more basic insight: pork, and the systems and actors that produce it, are central in China’s agrifood system with increasingly global inter-linkages and implications.

Government officials support increased pork production and consumption through subsidies, investments, and favorable policies for medium- to large-scale industrial operations. Agribusiness firms control much of the production and sale of meat (and agricultural products more generally), often through production arrangements with commercial farmers, and with financial support from public and private investment. Smallholder farmers either opt out of pig production in the context of increasing consolidation of the industry, become specialized hog producers, or are transformed into waged, typically migrant, laborers. And consumers eat more pork than ever before, with wealthier eaters preferring industrially produced meat, which is viewed as more strictly regulated, and therefore, safer.

Yet, food safety, public health problems and environmental pollution associated with the sector are also increasingly becoming bottlenecks--evident in the starkly vivid images of dead pigs floating in a river near Shanghai earlier in 2013. This dialectic between pork’s socio-political importance in China and its mounting externalities will shape Chinese policy towards pork production, trade and consumer choices in the coming decade.

This report builds on Mindi Schneider’s 2011 IATP report, *Feeding China’s Pigs: Implications for the Environment, China’s Smallholder Farmers and Food Security*. It addresses the question of how and why China’s animal husbandry sector has shifted towards increasingly industrialized meat production, which in many ways replicates the dominant and unsustainable U.S. model, but at an even larger scale. The analysis reveals and describes an interrelated set of drivers, both state-led and otherwise, that have increased industrial meat production and consumption in China throughout the reform era.

Section II provides a synopsis of pork industry development in China, including a historical overview of pork production, a summary of reform era policies, production and consumption trends, and an analysis of current and continuing restructuring, including some Chinese perspectives on the Shuanghui-Smithfield deal. Section III examines some of the motivations that underlie swine sector industrialization, including the politics of government production goals and food safety, and how these drivers play a role in the construction of consumer demand. Section IV examines some of the key actors, ideas, and mechanisms of pork development. It details leading agribusiness firms called Dragon Head Enterprises, and the Chinese versions of vertical integration and contract farming. Analysis in this section reveals that ownership and operation in China’s pork industry is largely domestic, but based on logics and practices common to agribusiness-led industrial production everywhere. Section V discusses the presence of foreign firms in China’s pork industry, serving as a trace on global consolidation as it touches down in China, and as China simultaneously begins to change the dynamics of consolidation. The last section addresses some of the impacts of this industrial mode of livestock production, which Chinese officials and agribusiness seem to have embraced whole-heartedly. It describes some of the challenges the U.S.—as the originator of the model—is facing in public health and environmental pollution today, relating them to development in China with the hope that these issues can be faced and effectively confronted.

This report has shown that in a system that was decentralized in the late 1970s and early 1980s, state support has made Dragon Head Enterprises (a government status bestowed upon private or public companies that meet a set of criteria for agriculture development) the leaders in producing, selling, and profiting from pork and agricultural products more generally. As these firms are becoming increasingly capitalized and invested, they are also becoming increasingly powerful in global agrifood markets. The Shuanghui acquisition of Smithfield Foods is but one example of this phenomenon; it is a profound example given the scale of the deal and the media attention it has garnered, but it is by no means an isolated incident. The central government adopted a set of policies in 2000 to encourage Chinese state and private firms to invest in operations and infrastructure abroad. This “go out” (*zou chuqu*) strategy continues today, and is related to new forms of global consolidation in the pork industry, as well as to China’s much-reported land grabs (see IATP’s *The Need for Feed: China’s Demand for Industrialized Meat and Its Impact* in this series). Firms like Beidahuang, COFCO (the China National Cereals, Oils, and Feedstuffs Corporation), the Chongqing Grain Group, the New Hope Group, the China National Agricultural Development Group, and others have all “gone out” for land, agricultural resources, and/or other companies abroad.

The pork industry in China is massive, as are its implications for soil and water pollution, climate change, public health, and rural livelihoods. But the industry in China is in many ways the industry in the US and elsewhere, a fact that analyses and policies need to take into account. Critiques of China’s pork miracle must also be critiques of the practices and structures of industrial livestock agriculture on the whole. At the same time, as Chinese domestic firms play ever more important roles in global markets, it seems likely that agribusiness politics in the future, both in China and on the world stage, will be increasingly Dragon-Headed. Understanding what is general and what is particular, and how the two influence one another, is crucial for understanding the rise of *agribusiness with Chinese characteristics*. It is also necessary for framing and implementing more just, sustainable, and diverse agrifood systems that can reverse the damages wrought by decades of global agricultural industrialization. This, surely, is our most pressing task.

I. INTRODUCTION: CHINA'S PORK MIRACLE?

Agriculture has helped fuel the “China miracle.” Since 1978, agricultural and food output has soared, Chinese agribusiness firms have become key players in domestic and international markets, and by all accounts, China has been highly successful in overcoming land and resource constraints to feed its population of 1.3 billion people. The country is celebrated for its successes in reducing poverty and hunger over the last 30 years, and more recently, for creating an agrifood system that makes eating “high on the hog” a possibility and reality for many Chinese people. From the food shortages and famines of the mid-20th century, to the proliferation of calories and food options in the present-day, China’s miracle is in many ways a food miracle.

Pork is at the heart of this miracle. A hallmark of the post-1978 agricultural development model is ramping up the production, sale and consumption of meat. Since 1980, average per capita meat consumption in China has quadrupled, such that in 2009, the average person ate 128 pounds (58 kg) of meat.¹ Processed and packaged meats are the fastest growing market segments, reflecting the increasing influence and operation of pork processors, and the more general trend towards processed foods that can be shipped, stored and sold with a longer shelf-life in super- and hyper-markets. These trends are also reflected in the Shuanghui (in English, “Shineway”) buyout of Smithfield Foods, a move that will increase China’s pork supplies, strengthen Shuanghui’s brand within China (as “safer” meat with higher consumer status because of its U.S. origin), and further generate and shape consumer demand for industrial pork. The Shuanghui-Smithfield deal is a matter of political and economic interest, but also signals a much more basic insight: pork, and the systems and actors that produce it, are central in China’s agrifood system with increasingly global inter-linkages and implications.

Government officials support increased pork production and consumption through subsidies, investments and favorable policies for medium- to large-scale industrial operations. Agribusiness firms control much of the production and sale of meat (and agricultural products more generally), often through production arrangements with commercial farmers, and with financial support from public and private investment. Smallholder farmers either opt out of pig production in the context of increasing consolidation of the industry, become specialized hog producers, or are transformed into waged, typically migrant, laborers.

Consumers eat more pork than ever before, with wealthier eaters preferring industrially produced meat, which is viewed as more strictly regulated, and therefore, safer. Pork is available today in greater volumes, and in a wider variety than ever before. It is a capital- and resource-intensive sector that has become highly productive, highly profitable, and is held up in policy and commerce circles as a paragon of modern agricultural development. Yet, food safety, public health problems and environmental pollution associated with the sector are also increasingly becoming bottlenecks—evident in the starkly vivid images of dead pigs floating in a river near Shanghai earlier in 2013. This dialectic between pork’s sociopolitical importance in China and its mounting externalities will shape Chinese policy towards pork production, trade and consumer choices in the coming decade.

While both Chinese and foreign investors are chomping at the bit to get in on “China’s pork miracle,” a number of questions remain about the country’s demand for pork, and how it will be satisfied: How much will China’s appetite for pork continue to grow? How much of its demand will be met from imports and how much meat as opposed to animal feed imports? Will Chinese firms continue buying foreign companies and investing in foreign land and infrastructure to satisfy domestic processors and consumers? Can the world produce enough feed for ever-increasing numbers of industrial swine in China without impacting global food security? Can it produce enough meat to satisfy China’s demand? Can China’s scarce land and water resources handle the onslaught of billions more tons of untreated manure flowing from more and more mega pig farms and afford the mounting public health costs related to antibiotic overuse in its production? Will increasing consumer concerns about food safety eventually create a fundamental shift away from industrial meat production toward more healthy and ecologically sustainable practices?

This report builds on Mindi Schneider’s 2011 IATP report, *Feeding China’s Pigs: Implications for the Environment, China’s Smallholder Farmers and Food Security*.² It addresses the question of how and why China’s animal husbandry sector has shifted toward increasingly industrialized meat production, which in many ways replicates the dominant and unsustainable U.S. model, but at an even larger scale. The analysis reveals and describes an interrelated set of drivers, both state-led and otherwise, that have increased industrial meat production and consumption in China throughout the reform era.

The report is not intended to definitively answer all of the questions posed in this introductory section, nor does it aim to outline or resolve all of the challenges of industrial livestock production. Our intent is to provide a framework for understanding and acting on these challenges, through a deeper analysis of how the pork sector has developed and is currently changing in China, and the key policies, players and dynamics that are shaping its future direction.

Section II provides a synopsis of pork industry development in China, including a historical overview of pork production, a summary of reform-era policies, production and consumption trends, and an analysis of current and continuing restructuring, including some Chinese perspectives on the Shuanghui-Smithfield deal. Section III examines some of the motivations that underlie swine sector industrialization, including the politics of government production goals and food safety, and how these drivers play a role in the construction of consumer demand. Section IV examines some of the key actors, ideas, and mechanisms of pork development. It details leading agribusiness firms called Dragon Head Enterprises, and the Chinese versions of vertical integration and contract farming. Analysis in this section reveals that ownership and operation in China's pork industry is largely domestic, but based on logics and practices common to agribusiness-led industrial production everywhere. Section V discusses the presence of foreign firms in China's pork industry, serving as a trace on global consolidation as it touches down in China, and as China simultaneously begins to change the dynamics of consolidation. The last section addresses some of the impacts of this industrial mode of livestock production, which Chinese officials and agribusiness seem to have embraced whole-heartedly. It describes some of the challenges the U.S.—as the originator of the model—is facing in public health and environmental pollution today, relating them to development in China with the hope that these issues can be faced and effectively confronted.

II. DEVELOPING CHINA'S PORK INDUSTRY

As China's leading meat category in terms of popularity, production and consumption, pork is at the center of the country's animal husbandry sector. At the same time, because the processes of industrialization in China's other livestock sectors (chicken, dairy, beef and aquaculture) share similar goals, logics and actors, analyzing

pork provides a lens on the trajectory of China's livestock industry more broadly. This is not to say that each livestock sector is identical; rather, pork is a representative case of China's industrial meat boom, and it is the sector with the most pressing environmental and social implications to date.

All the pork in China: a brief historical overview

While meat, and especially pork, has been a part of agricultural and food traditions in China for thousands of years, it was peripheral in diets until very recently. For most of history, and for most Chinese people, eating meat was limited to social and ceremonial events, never produced in quantities that would allow routine consumption for the entire population. Before 1949, Chinese farmers (the vast majority of the population at the time) received only one percent of their food energy from animal products, while grains made up the bulk of their diets.³ The situation today has changed dramatically: livestock production is skyrocketing, meat consumption is increasing across the board, and for urban middle- and upper-class consumers in particular, meat is moving steadily to the center of the dinner plate, and to the center of modern diets.

These 21st-century agricultural and dietary changes represent radical departures from most of China's history. Starting 6,000 to 10,000 years ago, when pigs were domesticated in various parts of China, each place had its own locally adapted pig breed, and most households raised at least one or two pigs each year.⁴ Pigs were more valuable alive than dead, acting as efficient converters of kitchen and agricultural scraps into nutrient-rich fertilizer, before becoming pork that could be given as a wedding gift, used to curry political or social favor, or eaten as part of Chinese New Year celebrations.⁵

Pigs were a staple of Chinese farming systems and households, while for the vast majority of people, pork was a rare treat. Although this long tradition of pork consumption in China includes variation across different times, places and social relations, the smallholder model of raising pigs as part of diverse crop and livestock agroecosystems, coupled with only occasional meat eating, defines much of the country's 7,000 years of agricultural history.

The sweeping political and social changes in China since the People's Republic was established in 1949 in turn changed the ways meat was produced, sold and eaten.

Perhaps the most profound changes have occurred in the wake of Deng Xiaoping's "Reform and Opening" in 1978, which launched the idea of "Socialism with Chinese Characteristics".⁶ The reforms loosened central control over agricultural production and distribution, increased state purchase prices for grain and re-introduced the possibility for farmers to keep and sell some of their surplus through private markets. The Chinese government also invested heavily in (and subsidized) chemical fertilizers, pesticides, irrigation and high-yielding seed varieties—China's green revolution. As agriculture boomed and incomes rose, markets became more and more central to the distribution of social goods such as food which had primarily been allocated by collective institutions. Pork became a commodity and agribusiness was opened as a new site for investment and profit.

It should be noted that the extreme corporate concentration and industrialization of pig production is a relatively recent phenomenon globally. In the United States, home of the industrial livestock model that is world-dominant today, the number of hog farms dropped by 70 percent from 1991 to 2009.⁷ Contract farming increased dramatically in just 12 years—from five percent in 1992 to 67 percent by 2004.⁸ U.S. farms started specializing in a single phase of production with "greater reliance on purchased rather than homegrown feed" as independent family farms gave way to industrial large-scale producers tied in an exploitative contractual relationship to a few meat packing companies.⁹ The average hog farm grew from 945 head in 1992 to 8,389 by 2009, though confined animal farm operations (CAFOs) started developing in the 50s in the country.

In China, too, the speed and scale of change has been phenomenal, conditioned by policies, investments and the transforming economic system. However, unlike the U.S., the sheer number of farmers in China has meant that the transition from small backyard farms to mega-industrial farms was slow in the 80s and 90s and rapidly accelerated in 2006 after the government made factory farms a priority to solve food safety problems (see next sections). Thousands of small producers are still in the process of exiting the sector today.

Moreover, whereas in the U.S., only four major meat-packers control the terms of trade. China has many domestically supported companies, though the sector is rapidly becoming more concentrated. The U.S. model has heavily influenced China's model, however and pork industries in both countries drive the distribution of global feed

resources and add to the social, environmental and health problems endemic to this mode of production. Yet, China's story is both particular and general.

Industrializing pork

Throughout the reform era (post-1978), industrialization of the swine sector proceeded at a rapid pace, with larger-scale specialized and commercial farms displacing small-holder farmers, and to a considerable degree, replacing household self-provisioning with markets. This happened in three broad stages. The first push to industrialize came in the wake of Reform and Opening, when agribusiness firms emerged, import restrictions were relaxed or removed, and market logics began to replace state planning. One result was that the rise of commercial animal feed in 1980s meant that raising pigs was no longer dependent on on-farm resources. Another was the scaling up, industrialization and commercialization of pig and pork production.

The next phase began in the mid-1990s, when the Chinese government was negotiating the country's accession to the World Trade Organization (WTO). In order to meet WTO protocols, and to increase pork production and consumption, the state cut tariffs on soybean imports for use in livestock feed, effectively bypassing the country's land and demographic challenges that might otherwise limit pork production.¹⁰ This move was crucial to the emergence of industrial livestock feeding (see IATP's *The Need for Feed: China's Demand for Industrialized Meat and Its Impacts* for more details). Finally, the most intensified and recent phase of industrialization began in 2006. In that year, an outbreak of "blue ear pig disease," or porcine reproductive and respiratory syndrome virus (PRRS), swept through the country, and pork prices sky rocketed. The government responded with measures to increase state support for large-scale, industrialized, and standardized pork production as a way to address food safety concerns, stabilize the industry and protect against future shocks.¹¹ The impact of these developments on consumer demand is discussed in more detail below.

Pork industry production, consumption and imports

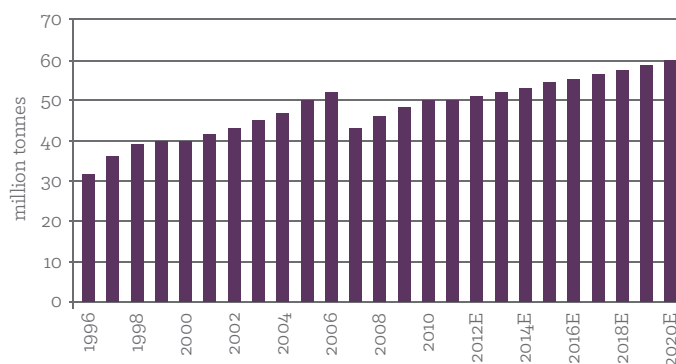
In terms of global meat production, pork is the world leader and its largest market is in China. Currently, half of all pigs on the planet are raised and eaten in China. In 2012, Chinese farmers and companies produced 50 million metric tons of pork from a domestic swineherd of 660 million head. This was twice the amount of pork produced in all 27 European Union countries combined, and five times the amount in the United States.

Growth will continue in 2014: swine production is expected to reach 723 million head, pork production is expected to increase by two percent to 54.7 million tons, and consumption expected to rise to 55 million tons.¹²

In the longer term, the OECD-FAO predict that China's total meat production will reach 93 million tons in the next decade, premised on a 1.5 percent annual increase from 2013 to 2022.¹³ While this expansion is still massive, it is actually a decrease from the 2.3 percent annual growth boom in the previous decade. Pork production in particular is projected to increase 1.6 percent annually, with poultry growth at 1.9 percent and beef at 1.7 percent. Despite these other meat categories keeping pace and surpassing the growth rate of pork production, pork will continue to account for the largest share of production (in retail weight) at 63 percent, compared to 25 percent poultry and 7 percent beef in 2022.¹⁴ The OECD-FAO also predict that Chinese consumption growth of all meats sectors will mirror their production. Pork is expected to capture 66 percent of additional consumption, despite the forecast that poultry meat will experience the fastest rate of increase (see also IATP's *Fair or Fowl? Industrialization of Poultry Production in China*). In short, pork will continue to dominate production and consumption overall.

While all agree that the general direction of production is increasing, precise estimates vary amongst experts: Rabobank, for instance, predicts that China's total pork production will reach 60 million tons by 2020.¹⁵

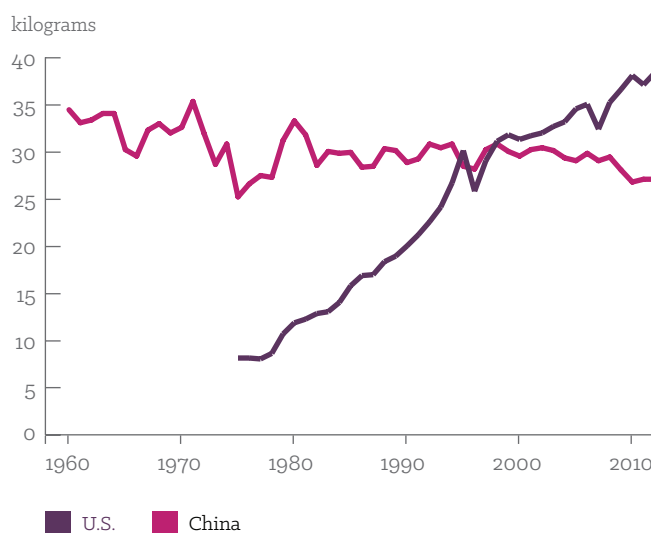
Figure 1: China's pork market, 1996–2020E



Reproduced from Rabobank 2012. Industrialization of China's Pork Supply Chain: Finding the Best Business Model. Industry Note # 329—September, Pg. 4.

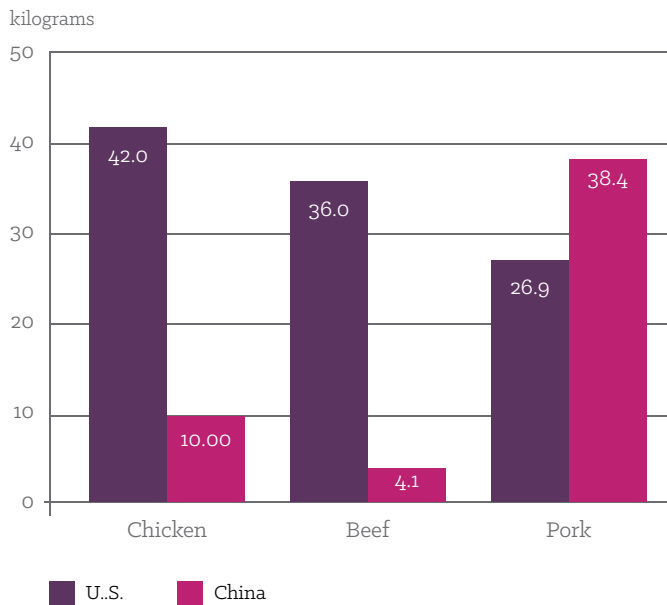
On a per-person basis, the Chinese consume an average of 39 kg of pork a year, compared to 27 kg in the U.S.¹⁶ Virtually all of this production is from pig farms inside China: domestic consumption matches production, and pork imports and exports are currently negligible relative to China's overall production. China's per capita pork consumption is projected to be 10 kg higher than OECD's annually by 2022.¹⁷ But these estimates aren't set in stone. It should be noted that food safety scares can dramatically affect demand for meat in China (see section on food safety below), and these concerns will affect production policies and consumption trends in the coming decades.

Figure 2: Pork Consumption Per Person in China and the United States, 1960–2012



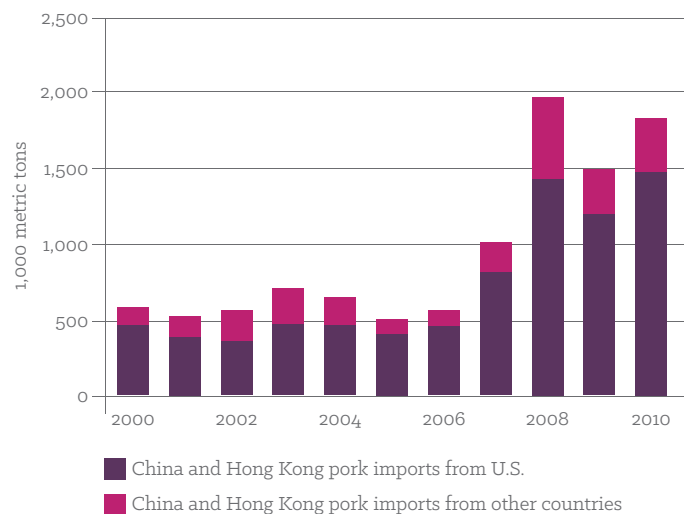
Reproduced from Earth Policy Institute; http://www.earth-policy.org/datacenter/xls/update102_8.xlsx

Figure 3: Meat Consumption Per Person in China and the United States, 2012



Reproduced from Earth Policy Institute; http://www.earth-policy.org/datacenter/xls/update102_6.xls

Figure 4: China and Hong Kong have become a larger market for pork imports



Note: Data include fresh, chilled and frozen pork; sausage casings; offal; and processed pork products (Harmonized System codes 0203, 020630, 020641, 020649, 0210, 0504, 160241, 160242, 160249)

Reproduced from Gale, F et al 2012. China's Volatile Pork Industry. USDA ERS, February, pg. 3

Imports

“Negligible” imports in China’s pork sector can translate into sizable exports from the world market, especially when Hong Kong is included in the equation. From 2000 to 2006, China and Hong Kong together imported between 500,000 to 600,000 metric tons of pork, though this figure was less than one percent of consumption.¹⁹ In 2014, China is expected to import 775,000 tons of pork²⁰ from a world market with a little more than 7 million export tons.²¹ This equates to a little over one percent of domestic consumption, but close to 12 percent of the world’s exports.

Food safety issues are largely driving China’s pork sourcing decisions. Since 2007, China has been the primary export destination for the U.S. pork industry. During the country’s peak pork import year in 2008, U.S. sales to China-Hong Kong accounted for 18 percent of U.S. pork exports, which was double the share from 2000 to 2006.²² But in the first half of 2013, Germany overtook the U.S. as China’s top pork importer, with U.S. market share dropping from 48 to 18 percent and Germany’s rising to 23 percent.²³ Germany’s ability to provide ractopamine-free pork at a cheaper price (see section on food safety) seems to make it a more competitive exporter.

Pork imports are one part of the story, and pig imports are another. According to Morgan Stanley 2011, China is the world’s third largest importer of live hogs. As the sector is increasingly industrialized, in addition to CAFO buildings and technologies, it also needs pig breeds that have been developed to thrive in these conditions. Importing breeding stock in the form of live hogs has been a common method for genetically transforming the country’s swine herd. In 2014, the country’s hog imports are expected to increase by 10 percent to 22,000 animals.²⁴ The U.S. is

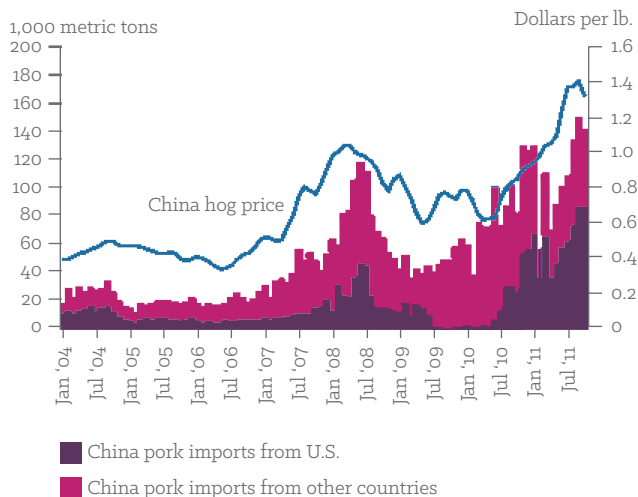
China's largest live swine supplier, accounting for half of the market. Canada supplies 20 to 30 percent of pigs, and the remainder comes from the EU.²⁵

China's major live swine and pork export destination is Hong Kong, with China exporting 1.8 million head to Hong Kong and Macau in 2014.²⁶

Import Prospects

Reported volatility in China's pork market has exporters enthusiastic about their prospects for gaining market share. This was most evident following the outbreak of PRRS in 2006, when pork supplies and prices became unstable, prompting increased imports the following year. As feed and labor prices in China continue to rise, exporters hope that the high cost of domestic production will open further opportunities for imports to fill in with pork produced abroad. The U.S. hog industry in particular reacts strongly to any changes in the Chinese market: an announcement to remove the ban on U.S. hog imports to China resulted in a three month high for U.S. lean hog prices in 2009.²⁷

Figure 5: China monthly pork imports vary with domestic hog price



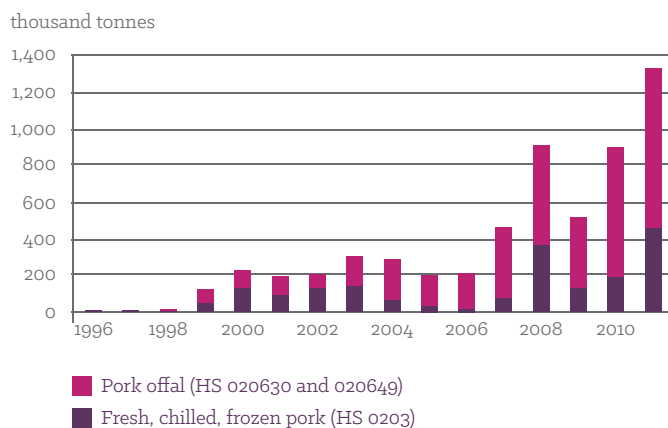
Note: Data include fresh, chilled and frozen pork; sausage casings; offal; and processed pork products (Harmonized System codes 0203, 020630, 020641, 020649, 0210, 0504, 160241, 160242, 160249). China hog price converted to U.S. dollars at the official exchange rate.

Reproduced from Gale, F et al 2012, pg. 4

The nature of pork imports into China gives an indication of how companies view the market currently, and in the future. A large proportion of meat imports are either

high-end packaged meat products, fresh offal (organ meats), or other variety meats.²⁸ Because Chinese food culture includes dishes that use liver, kidney, stomach, spleen, feet and other body parts, China is seen as a profitable destination for the byproducts of global meat processing companies; meat has been the primary slaughter product, sold in consumer markets in the global North.

Figure 6: China's pork and by-product imports, 1996–2011



Reproduced from Rabobank, 2012, pg. 17.

Processed meat products are increasingly common in China, but fresh meat remains the most important part of the market, and of consumer preference. This too is related to pork imports. According to Rabobank, factories, schools, institutions and further processors are the main market for imported pork in China. Given rising costs of production, in some cases it may be cheaper for these entities to import frozen pork than to buy domestic fresh meat.²⁹ Mainly used by small processing companies, some frozen pork also flows into retail and wholesale channels. Offal, on the other hand, typically goes directly into wholesale and food service. Imports of offal are projected to increase in the coming years, but are not likely to dominate the retail market given the strong consumer preference for fresh meat.³⁰

Getting global pork to market in China, and predicting future imports, involves a number of considerations. First, China has no import quotas on pork, but it does require bilateral agreements for trade. Overseas plants must get approval through China's General Administration of Quality, Supervision, Inspection and Quarantine (AQSIQ).³¹ Second, factors that impact pork price—such as supply, disease epidemics, feed costs, labor costs and policies—will combine with changing consumer demand and

Box 1: The Shuanghui-Smithfield Merger: Views from China

In May-June 2013, just as news about the possible merger broke, IATP interviewed various experts in Beijing including representatives from Chinese research institutes, the feed and pork industries and policymakers. They had wide perspectives on the merger:

Feed industry expert:

As a fast growing Chinese company, they (Shuanghui) could learn advanced management skills and technology (food processing, breeding management) from abroad to improve their competitiveness. By acquiring a foreign firm, Shuanghui could quickly and soundly achieve its goal: going global...So I think it is a good trial, even though there might be some challenges in management due to the cultural difference.

It is cheaper to raise hogs in the U.S., but processing, marketing and sales costs are high. China could import whole (slaughtered) hogs and process here. It should not import processed pork products.

Food security and agriculture expert:

The Smithfield deal is a big mistake. Better to invest \$7.1 billion improving the meat industry domestically. International meat trade is very high risk and world trade won't meet Chinese demand. It would be amazing to me if U.S. imports met five percent of China's demand.

Policymaker:

The benefit of importing meat is that we can import less grains, animal feeds and soy beans. Then the interest of the soy bean farmers and grain farmers will not be damaged. The second is the pressure of environment protection. I do not know whether you have been to the villages in China. Many rivers in the villages have been polluted, mainly by animal husbandry. The pollutions mainly come from pig and chicken raising. Why do we have to keep polluting the environment? So I think importing meat is better than importing grains. And in China, the mode of animal husbandry is adopted from the U.S.. This is not good. We used to use traditional raising mode. But in the recent 20 years we used the feed recipe from the U.S. In Liaoning, there are huge pig farms with millions of pigs. It is not suitable for China. So the big pig farms and cow farms all use American mode. I am concerned about such situation. It is not sustainable. The [feed] recipe, breeder and facilities all come from the U.S. But in China, we do not have so much feed, technology and we have bigger pressures on environment protection. The U.S. has a vast territory with a sparse population, but China has so many people.

Meat industry expert:

The operation of Smithfield in the U.S. is very difficult. This is a worldwide problem. The operation of companies in butchering industry and animal husbandry is very difficult in the U.S. and Europe currently, which is mainly due to the shrinking of consumption.

Also, Americans and Europeans do not like hog meat. So Smithfield is having a hard time. Smithfield has liabilities of 2.4 billion dollars (sic). Similarly, Hormel and Agfeed are also in their hardest time. I think there might be two reasons for Shuanghui to purchase Smithfield at this very moment. First, Shuanghui is a Chinese company who wants to extend its business to the world. It feels good to take in the largest pork producer and processors in the world. Moreover, Shuanghui does not need to purchase Smithfield with its own money. Shuanghui only needs to pay a small part, and the rest of the money comes from other funds. Second, Shuanghui wants to transport American pork to China and sell in China because American pork is cheaper and Shuanghui can make profits from it. But Shuanghui forgets to take the eating habits of Chinese people into consideration. The traditional eating habits of Chinese people cannot be altered in a short time. Chinese people like fresh meat, Americans like frozen meat. The meat can only be transported from the U.S. to China after being frozen.

But the thinking amongst policymakers now is, 'Now we want to leave the disease and pollution in U.S., and take the meat.' It is not a written policy, but they have this way of thinking. It hasn't been said openly, but it's understood, because of pollution, land shortage, disease issues."

Analysis

Much has been written about the Shuanghui-Smithfield merger on both sides of the Pacific. In the U.S., there are fears about Shuanghui stealing U.S. pork processing technologies and the know-how of creating and managing a CAFO. However, the merger captures the trend of the global livestock industry and is essentially a harbinger of what is to come in the next years as the global livestock industry consolidates even further and as financial institutions and investment banks continue betting on commodities (grains), natural resources (land) and other agricultural commodities (meat) for profit. In Shuanghui's case, Morgan Stanley predicted even in 2011³³ that Smithfield was a profitable venture for investors interested in Chinese pork. Morgan Stanley, Chinese state-owned banks, the Bank of China, Goldman Sachs and several other finance firms are central to Shuanghui buying \$3 billion USD worth of Smithfield debt and the company itself. It's the increasing power of these firms, along with an extremely concentrated global livestock industry that has gotten less coverage in the merger's news, yet these aspects will play a key role in the way meat is produced within countries and moved from one part of the globe to another—including from within and outside China.³⁴

currency fluctuations to change import-export prospects and projections.³² Third, the increasing power of Chinese pork production and processing companies, their vertical integration and consolidation of the sector as a whole (see sections below), will influence the extent to which transnational companies can enter the market through trade or direct ownership. Global mergers and acquisitions, and the increased financialization of the world's livestock industry in general and pork production in particular, will further complicate this issue. The high-profile Shuanghui purchase of Smithfield Foods is prime example of how the composition of the firms that control pork's movement globally are likely to change in the coming years.

Pork industry restructuring: Who raises China's pigs?

For thousands of years, smallholders produced all the pork in China. As recently as 1985, these so-called backyard farmers, (*houyuanshi siyangchang*) who raise fewer than five pigs per year in addition to crops and other livestock on about half an acre of land, produced at least 95 percent of the country's pork. Throughout the reform era, however, the number of backyard farmers and their share of production has declined precipitously as state policies and investments support the industrial operations that have catapulted China's pork production to its current world dominant position. In 2008 alone, the number of rural households that raise pigs dropped by 50 percent, and in some poor regions, only about 35 percent of households still engage in the practice.³⁵ By 2009, analysts estimate that government policies to encourage scaled-up production after the PRRS epidemic in 2006 were so successful that farms raising more than 50 hogs a year accounted for almost 60 percent of total slaughter, up from less than half in 2007.³⁶

Analysts disagree about how best to define the current structure of pig raising in China, primarily because the range of annual production is enormous: at the household end of the spectrum, smallholders raise fewer than 10 pigs, while at the large-scale industrial end, it is not uncommon for massive agribusiness firms to raise and process 100,000 hogs annually. Exacerbating this spread are plans to further integrate and consolidate the pork chain. For instance, some firms have plans to produce as many as one million pigs per year on mega-farm operations.³⁷ And COFCO, China's largest grain trader, aims to also be the country's largest pig farmer. By 2015, this diversified state-owned enterprise plans to produce 10 to

15 million pigs per year, and will invest 3.5 billion RMB (\$570 million) in slaughter facilities so that it can process the livestock that it raises.³⁸

In between smallholders and megafarms are so-called specialized household farms (*zhuan yehua de jiatingshi yang-zhichang*). The general idea of the specialized household farm is that pig raising is a professional endeavor based on production for sale instead of self-consumption. Operations may be run by individual families, by small-scale companies, or by several backyard farmers who have come together to focus on pig raising more exclusively. Some specialized household farmers produce under contract with large commercial farms, while others sell piglets and meat pigs to local dealers who then sell pigs to slaughter, processing and retail firms. The government incentivizes the specialized household scale of production primarily through investments in infrastructure.

Large-scale commercial farms (*daxing shangye yang-zhichang*) are also aggressively supported by the government, and are intended to work in concert with specialized household farms. These commercial farms breed, feed, rear, slaughter, process, and market pigs and pork. They do so in a variety of ways, from being specialized in one particular phase of production, to operating in some or all phases, to managing contracts with other farms and companies in order to produce and sell an end product. The annual scale of production on these farms typically ranges from 500 to 50,000 pigs, but is rapidly growing. Increasingly, a single farm can produce hundreds of thousands of hogs in one year, either through contracts or in a single production facility.

Many of the largest expansions stem from increased vertical integration (see section below) of the top Chinese meat processing companies into production. For instance, Wens produces 7 million head of swine per year. CP Group, Zhengbang Technology Co, Chuying Agro-Pastoral Group and Munyuan Food stuff Co. Ltd all have farms with more than 500,000 head; while COFCO Group, Shandong Liuhe Group and Agfeed have farms of more than 100,000 head.³⁹ (Agfeed in the U.S. filed for bankruptcy in June and was bought out by three U.S. pork producers in September.)

Rabobank 2012 notes that these mega-farms are drawing financial and industrial investors:

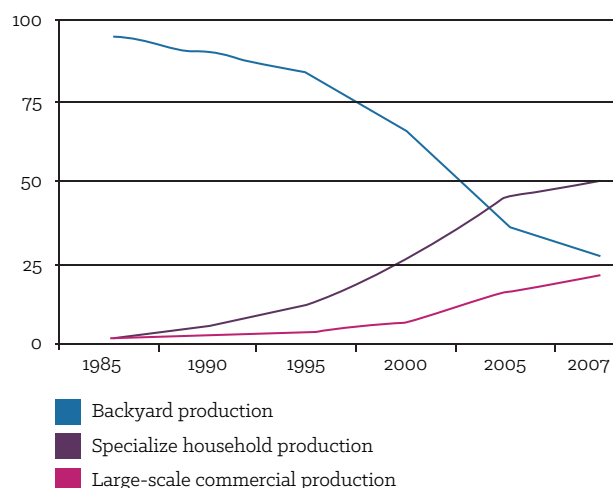
While investment flows into large-sized or mega-sized farms, the types of investors have diversified. Not only do large meat companies have interests in hog farming,

but private equity firms and even investors from other sectors, such as steel and information technology, could also invest millions in greenfield projects.

Commercial farms resemble, or perhaps reproduce, the so-called “factory farm” model that dominates pig production in the United States, Europe and increasingly in other locations around the world.⁴⁰ Most commercial operations in China are domestic agribusiness firms, but transnational corporations are part of the sector in terms of supplying pig genetics, feed and technologies (see global consolidation section). Industrial facilities in China use the same production methods and equipment as similarly sized facilities elsewhere: firms purchase equipment from international dealers like Big Dutchman, from Chinese copycat companies like Big Herdsman, or from other Chinese firms. The Chinese model of industrial production is based on the U.S. model.

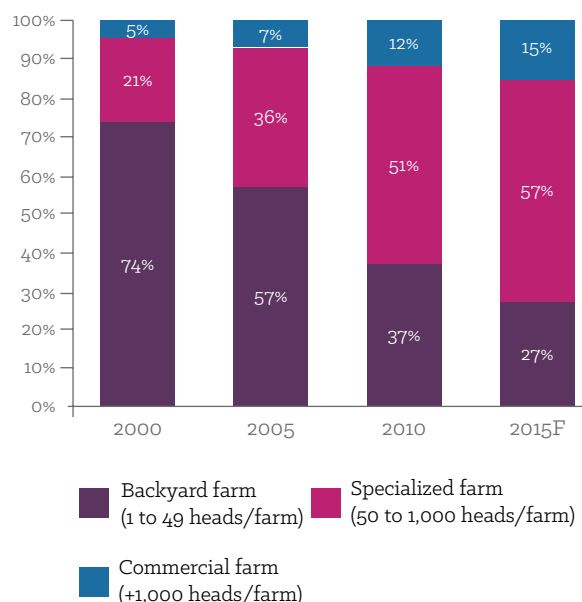
The current structure of China’s pork sector can be described as trifurcated. A study conducted by INFORMA Economics in conjunction with the National Grain & Oil Information Center in 2009 suggests that backyard farmers (1 to 10 pigs/year) accounted for about 27 percent of nationwide pork production, while specialized household producers (50 to 500 pigs/year) accounted for about 51 percent of production, and commercial firms (> 500 pigs/year) controlled about 22 percent. Using different metrics, Rabobank reports that backyard farms (1 to 49 pigs/year) accounted for 37 percent of production in 2010, with specialized household farms (50 to 3,000 pigs/year) producing 51 percent and commercial farms (>3,000 pigs/year) with only 12 percent. Although there may be disagreement about the numbers, the broad trend is clear: larger-scale operations are increasing at the expense of household production. While distinct edges between farm size categories are difficult to define, Rabobank’s specialized household range is too large to capture differences in labor, resource and environmental issues. For now, the 50 to 500 range that INFORMA uses seems most appropriate. Finer scales are likely needed to adequately understand variance in the sector as it continues to be industrialized.

Figure 7: China: Share of total pig production by farm type: 1985–2007 (in percent).



Source: INFORMA

Figure 8: Share of total pig production by farm type: 2000, 2005, 2010 and 2015 (percent).



Source: MOA, Rabobank estimates, 2011
 Reproduced from Rabobank, 2012, page 6

Both specialized household farms and large-scale commercial farms can be classified as concentrated/confined animal feeding operations or CAFOs. Though there has been a great variance in the way specialized farms operate, the government’s push to standardize these farms toward a specific industrial model means that more and more of them could be classified as CAFOs. The government sees CAFOs as the solution to food safety

problems and is thus encouraging specialized farms to become more factory-like in the hopes that greater bio-exclusion and standardized methods of feeding, vaccination and rearing will reduce biosafety threats. However, as more and more animals get confined into the same space, risk of disease is also increasing.

These operations have significant fixed costs, though smaller-scale specialized farms can more readily take advantage of whatever feed is cheapest, while large-scale operations are locked into certain feed mixes. Increasingly, however, even smaller operations are switching to more industrialized feed. Regardless of differences in scale, CAFOs in general are dependent on large-scale slaughter and processing facilities and both tend to be concentrated around the East coast and the major cities of the South East. As a result, pork prices tend to be higher in the southeastern and mideastern provinces around Guangzhou and Shanghai because of higher input costs in commercial farms.⁴¹

Backyard farms still dominate in some areas, but their share of the national total is slipping fast. From the grain the modern pigs eat (not the kitchen scraps they once enjoyed) to the surroundings in which they live their short lives (not a lone animal but one of thousands on the same lot), defecating such quantities as to fill whole lagoons before being taken to the slaughterhouse to be rendered, chilled, packaged and shipped out to supermarkets in pre-packaged cuts: everything has changed. Pig production is expected to grow by another 20 percent in the next five years (BMI, 2012), fulfilling important goals in the government’s plans for livestock development.

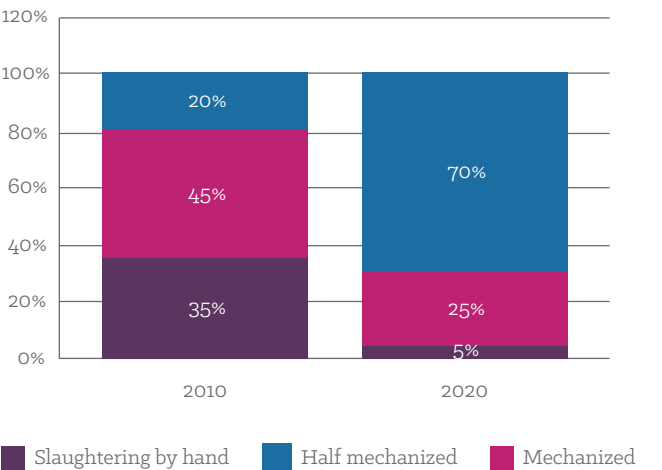
Consolidation and overcapacity of slaughterhouses

Given government incentives to scale up and consolidate the sector, large meat companies are competitively moving towards the north and west of the country to be closer to grain supplies (maize, wheat), as well as to establish a broader marketing network (Rabobank, 12). CP Group, New Hope, Wen’s and Zhengbang are all shifting in that direction.

Though consolidation of meat processing companies has been taking place since before the PRRS outbreak in 2006, it accelerated in 2007 as the government closed down many medium and small pork processors and

slaughterhouses. The total number of “designated” slaughterhouses decreased from 30,000 in 2006 to 10,000 in 2012 and expected to further decrease to 2000 by 2020.⁴²

Figure 9: Consolidation trends in China’s pork slaughtering sector, 2010 vs. 2020F



Reproduced from Rabobank, 2012, pg. 8.

One result of concerted policy and financial support for industrializing and scaling up the pork sector is overcapacity in pork processing. The top three Chinese meat packers used less than half of their processing capacity in 2012. According to Rabobank, this trend indicates that companies are expanding much more rapidly than actual market development and hog farm expansion. It also means that there is increased competition amongst the top firms for sourcing hogs, another reason that Shuanghui’s deal with Smithfield could be lucrative, bringing whole carcasses from the U.S. to process in China. In spite of over capacity, Rabobank notes that top firms continue to announce further expansion plans. For instance, Yurun announced plans to reach 70 million head slaughtering capacity by 2015 and Shuanghui sought to reach 55 million (from 45 million head) in 2012.

Figure 10: Slaughtering capacity and actual slaughter numbers for selected companies in 2011

	SLAUGHTER CAPACITY BY THE END OF 2011 IN MILLION HEADS	ESTIMATED ACTUAL SLAUGHTER NUMBERS IN 2011 IN MILLION HEAD
Shineway	25	10
Yurun	46	15
People’s Food	20	8
Shunxin Agriculture	3	2

Source: Company data, Rabobank estimates, 2012

III. CHINA'S PORK AND LIVESTOCK DEVELOPMENT STRATEGY: MORE MEAT, MODERN MEAT, SAFE MEAT

While development economists, supporters of agricultural industrialization and even conventional understandings would have it that the megafarm phenomenon in China's livestock sector is a natural and inevitable step in the process of modernization, each instance of industrialization has its own historical, social and ecological context. In China, the state has played a central role in transforming pig production. Development of the livestock sector has been motivated by the government's drive to increase meat production, to create protein-rich "modern" diets for urban middle and upper class consumers in particular, and most recently, to address public concerns over food safety. This section outlines some of the assumptions and priorities of Chinese policymakers that led them to aggressively promote a U.S.-like industrial hog model, despite the clear social and environmental challenges it creates.

Why more pork?

Of all agrifood sectors, pork is perhaps the most distinctively Chinese—the centuries-long practice of household pig raising is evident even in language. For example, in Mandarin Chinese, the general word for meat (*rou*) refers to pork,⁴³ and the Chinese character for home and family, 家(*jia*), was created some 3,500 years ago by adding the roof radical to the pig radical, or more figuratively, by putting a roof over a pig's head.⁴⁴

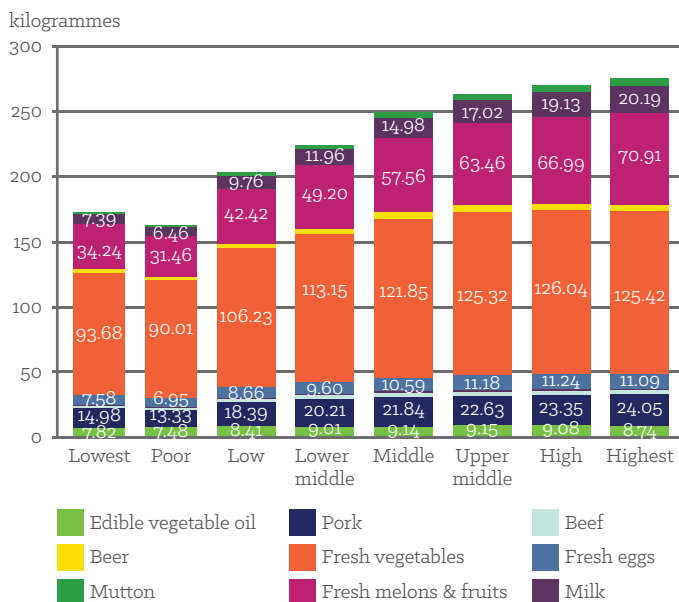
This cultural and historical significance is key to understanding why, in the push to increase meat production throughout the reform era, pork has been a central focus: simply put, consumers want pork. While it is important to note that demand for other meats is rising—and in fact the share of pork in total meat consumption has fallen as others have grown (from 94.1 percent of all meat in 2000 to 64.7 percent in 2005)⁴⁵—pork remains the principal meat in the Chinese agrifood system.

An important driver for increasing meat production in general and pork production in particular is the state's need for legitimacy and public trust. Meat in contemporary China signifies progress against a backdrop of scarcity, and a progress that the government is keen to count among its modern accomplishments. The legacy of the Cultural Revolution and experiences of food rationing inform the state's reform era focus on increasing pork production and consumption. Even though farmers for centuries ate meat only once or twice a year for holidays and special occasions, meat rationing impacted the diets of virtually all Chinese people, changing popular notions and expectations of the frequency and amount of meat consumption. The government has responded by trying to satisfy the notion of "eating meat in revenge" (against past scarcity), and to legitimize the state for its role in creating a bountiful agrifood system that satisfies consumer desires and demands. As an agribusiness executive in Shanghai put it, "Meat [pork] signifies wealth. The more money you have, the more meat [pork] you will eat." And the more meat people are eating, the more secure officials can feel that the agri-food system is modernizing along the lines of countries like the U.S.

"Let them eat pork"

While meat consumption is increasing across the board in China, it is urban-focused and anything but even. As meat moves to the center of urban middle class consumption, grain continues to be the foundation of rural diets. Figure 11 illustrates these differences.

Figure 11: Per capita purchase of key food products by various income groups in China



Reproduced from Rabobank, 2012, pg. 3.

The urban focus in meat consumption reflects other inequalities in China today. Before economic reforms, China was one of the most egalitarian countries in the world. Today, with a Gini coefficient (statistical measurement of income inequality) of 0.61,⁴⁶ it is among the most unequal. Though the government has been celebrated for lifting millions of people out of poverty in the reform era, inequalities are growing with increasing rural unrest.

According to China's National Bureau of Statistics, the 2011 urban-to-rural income ratio was 3 to 1. In order to avoid further social conflict, central authorities have made closing the income gap a political priority. They have implemented a number of measures aimed at increasing income levels for farmers and migrant workers in particular: these include direct farm subsidies, vertical integration and contract farming, abolishing agricultural taxes and adjusting the legal minimum wage for workers at least once every two years. According to the State Council, the annual rural income growth rate remained higher than six percent from 2006 to 2011, but scholars find that these increases resulted primarily from migrant labor remittances, rather than from the success of other government measures.⁴⁷

Metropolitan consumers spend almost three times as much money on food, while rural residents spend a larger share of their income fulfilling basic dietary needs

(44 percent of rural income, versus 38 percent of urban income). When food prices increase, therefore, the rural poor are hardest hit. As the central component of the Consumer Price Index, pork prices are particularly important to state authorities as an important trace on inflation but also as a thing to be regulated to head off social unrest. Increasing pork production and pork availability is seen as a tool for addressing domestic political and economic issues and inequalities. Whether or not that tool is effective is a matter of contention.

Food safety as a demand driver

At the same time that urban consumers in particular are eating more factory farmed meat, a number of food safety scandals have soured the protein party. According to a 2013 report from the Public Opinion Research Laboratory and Crisis Management Center of Shanghai Jiao-tong University, recent scandals involving melamine in milk (see IATP's *China's Dairy Dilemma: The Evolution and Future Trends of China's Dairy Industry*), clenbuterol in pork, "instant chicken" cocktails of feed additives, and rat meat and bandages in dumplings have put food safety at the top of public concern.⁴⁸ Consumers with enough disposable income are increasingly interested in buying food they can trust as being free from illegal additives and other unsafe or imposter materials. For urban consumers in a 2012 study, the most trusted form of pork is from industrial production systems:⁴⁹

From a Chinese consumer's perspective, the industrial approach seems to represent values such as achievement and evolution, as well as quality and safety, since pig production is moving away from low-cost, low-quality, and low-safety family-scale systems (p. 443).

The statement shows that Chinese urban consumers increasingly equate industrial farming as the symbol of modernization and development. It also demonstrates the widely popular urban misconception that smallholder farmers are to blame for China's food safety scandals.

This misconception needs to be critically evaluated in light of what we know about the practice of industrial livestock farming both in general, and in China in particular.⁵⁰ A systemic analysis seems lacking given the rapid scaling up, rate and form of structural changes in the pork industry just in the last seven years. Another issue is a common lack of awareness about the costs of industrializing meat on public health and the environment, (see impact section

below). Antibiotic resistance is an often overlooked food safety threat even as half of China's antibiotics are now fed to livestock, and superbugs are on the rise.⁵¹ Blaming smallholder farmers for the failings of pork safety protects the interests of agribusiness firms and shifts attention away from the industrial system, which is the true source of the problem. The case of ractopamine and other "lean meat powders" is another example (see Box 2).

At this stage, Chinese consumers respond to food safety scares by making dramatic shifts in consumption of one meat to another. For instance, the USDA's Foreign Agriculture Service notes a rising demand for beef this year because of food safety scares in the pork and poultry sector. China's "floating dead pig" incident where over 10,000 pigs were found floating in Shanghai's Huangpu River raised wide concerns. This combined with 44 deaths and 134 infections from avian flu in the poultry sector has had Chinese consumers switching to beef this year. USDA

projects a 20 percent increase in beef imports (primarily from Australia) in 2014, due to this rising demand and good exchange rates.⁵²

IV. DRAGON HEADS, VERTICAL INTEGRATION AND CONTRACT FARMING

Producing meat and getting it to market are activities increasingly controlled by agribusiness firms. Starting in 1998, the Central Committee of the Chinese Communist Party identified vertical integration (*chanyehua*) as the principal mechanism for achieving agricultural modernity, and appointed agribusiness firms called Dragon Head Enterprises (*longtouqiye*) as the vehicles to bring it about (Zhang & Donaldson, 2008). This statement from the Ministry of Agriculture succinctly describes the government's current approach to agricultural development, of which livestock development is a key part: "To support

Box 2 : Food safety scandal...or business as usual?

Food safety issues, and especially residues in meat from illegal additives, are a serious and growing problem in China's agrifood system—for instance the illegal use of clenbuterol and its variants as "lean meat powder" (indicating the drugs' ability to increase muscle in pigs at a rapid rate, making them leaner and heavier in a short amount of time).

However, China's use of these additives is not always as scandalous as depicted in the international press. In fact, some of these additives are problematically endemic in the global meat industry. Ractopamine is a case in point. Ractopamine is banned in China while it is one of a class of "lean meat powders," legally fed to an estimated 60 to 80 percent of the pigs raised in the United States in order to speed the conversion of feed into lean pork. While the FDA approved ractopamine for use in pig farming in 1999, studies on its potential impact for human health are inconclusive, largely because they were conducted by the drug's manufacturer, Elanco, a division of Eli Lilly. Ractopamine mimics stress hormones, making the animals' heart beat faster⁵³ and raising their stress levels.

In the spring of 2011, a food safety scandal broke out in China when Shuanghui, the country's largest meat processor, was found to be buying "lean meat powder"-fed pigs for its processing operations. The powders in question were clenbuterol and ractopamine, growth-promoting feed additives developed by firms in the U.S., and used in U.S. industrial livestock systems since the early 1980s. Both of these additives had been banned for use in China since 2002, but in 2011, in the wake of the Shuanghui scandal, their production and sale was also banned.⁵⁴

Why were these "lean meat powders" being produced and sold in China if their use was illegal there? Clearly some of the powders found their way into pig feed inside China, but more than just an instance of illegal activity or a domestic black market, these additives are produced for export. While clenbuterol has been broadly banned, ractopamine is still allowed for use in 26 countries including the United States, Brazil, Australia, Canada, Mexico, the Philippines, and others.⁵⁵ Controversially, ractopamine was also narrowly accepted under Codex Alimentarius by two votes. In July 2012, this United Nations commission approved international standards for ractopamine residues, which the European Union strongly and vocally opposed.⁵⁶ China, the Russian Federation, India, Turkey and others joined the EU's opposition, calling for an all-out ban of the additive, and reaffirming bans on ractopamine-fed meat imports. But according to insiders present at the negotiations, the U.S. government backed by the meat industry exerted considerable pressure on smaller nations to oppose the ban and succeeded.

This issue is currently playing out in the Shuanghui-Smithfield deal. Pharmaceutical company Eli Lilly sells ractopamine under the trade name *Paylean* in the United States; it is a widely and commonly used feed additive in the U.S. But in order to create the Shuanghui-Smithfield pork channel to China, Smithfield needs to produce ractopamine-free meat. In order to prepare for the take-over, the company vowed to be 50 percent ractopamine-free by June 1, 2013.⁵⁷ In this case, concerns about China's poor food safety record affecting the U.S. food system seem woefully misplaced.

Sometimes a food safety scandal in China is business as usual in the United States.

industrialization is to support agriculture, to support enterprises is to support farmers.” Put another way, the model is intended to replace small-scale farming with agribusiness, local markets with contract farming and dispersed production with vertical integration. According to the State Council in 2012, Dragon Heads are “the major agents for constructing a modern agricultural system, and are the key to advancing agricultural industrialization.”⁵⁸ And they do not have to be state-owned. They are,

not like ordinary commercial enterprises: they are responsible for opening up new markets, innovating in science and technology, driving farm households, and advancing regional economic development. They are capable of driving agricultural and village economic restructuring, driving commodity production development, promoting increased efficiency, and increasing farmers’ income.⁵⁹

According to official statistics, in 2011, the Dragon Head Enterprise-led production model was operating on 60 percent of the country’s crop production area, and covered 70 percent of livestock (pigs and poultry) and 80 percent of aquaculture production (see Box 3). Combined sales revenue of Dragon Heads in 2011 was 5.7 trillion RMB (\$917 billion), and their products accounted for one-third of the country’s supply of farm produce and processed foods, and two-thirds of the average food basket in major cities.⁶⁰ While scholars argue that official statistics in China are not the most reliable measures of reality, even if these numbers are inflated to some degree, they demonstrate the scale and trajectory of Dragon Head power.

The sections that follow detail the definition and operation of Dragon Head Enterprises, the Chinese conception of vertical integration, and the “company and farm” model of contract farming. Together, they provide a sketch of China’s livestock development model, its major actors, relations and logics of operation.

Dragon Head Enterprises:⁶¹ Agribusiness firms take the lead

In Chinese culture, the dragon is a symbol of both the Han majority and the Chinese nation as a whole, and is thought to embody power, wisdom and auspiciousness. Dragon Head Enterprises (DHEs) first appeared in central policy in 1998⁶² when authorities proclaimed that lead firms would be the key for modernizing China’s agriculture by integrating and scaling-up production.⁶³ The name “Dragon Head Enterprise” comes from the dragon dance, a ceremonial dance in China, which dates to the Han Dynasty, and continues to be a fundamental performance at festivals and holiday celebrations.⁶⁴ In the dance, one performer wears a fierce dragon head, leading others who are bent over each other to make up the dragon’s body, in a long line of coordinated and undulating movement. Inspired by this imagery and meaning, central authorities empower DHEs to don the “head” of the dragon in order to guide masses of farmers on the path of industrialization, and to lead the nation on the path of modernization.

With each set of government pronouncements about DHEs, state support for agribusiness grows, as does the power of these firms in restructuring agricultural economies, production systems, and livelihoods. The new Dragon Head Association established in November 2012 in particular provides an institutionalized space for state and private enterprise to work together in the construction of an integrated and increasingly consolidated domestic agribusiness sector.

The Dragon Head label entitles a company to government programs that subsidize these responsibilities, and to bragging rights as a lead firm, which can translate into enhanced legitimacy as a trustworthy company in the market. Today central, provincial and local governments can bestow Dragon Head status, with national-level designation being the most honorable and profitable.⁶⁵

Figure 12 provides a snapshot of the type of subsidies the State has given to the top pork processing DHEs:⁶⁶

Figure 12: A snapshot of the type of subsidies the State has given to the top pork processing DHEs⁶⁵

KEY PLAYERS	2011 SUBSIDIES (MILLION RMB)	2011 SUBSIDY TO NET PROFIT (PERCENT)	2010 SUBSIDIES (MILLION RMB)	2010 SUBSIDY TO NET PROFIT (PERCENT)	TYPES OF SUBSIDIES
Yurun	529.85	36.33	606.63	26.77	6. Merger & acquisition fund from government 7. Supporting fund of Agro-food industrialisation 8. Subsidy on banking loan interest
New Wellful	17.1	23.73	79.98	541.39	1. Live hog reserve subsidy 2. Agricultural, light industry and textile products trade promotion subsidy 3. Special agricultural subsidy 4. Live hog farm and environment-friendly construction subsidy 5. Live hog science and technology subsidy 6. Subsidy on sow raising 7. Frozen pork reserve subsidy 8. Project management subsidy 9. Foreign trade development promotion subsidy
Shineway	120.47	15.94	33.01	2.49	1. Local government financial support
Shunxin Agro	0.31	0.1	5.14	1.94	1. Dazhou commerce business information subsidy 2. Dazhou project supporting fund 3. Subsidy on hog breeding
Gaojin	7.58	11.82	43.33	N/A	1. Live hog slaughtering subsidy 2. Capacity expansion subsidy 3. Live hog processing line subsidy 4. Live hog industrial processing improvement subsidy
Chuying	4.21	0.98	10.19	8.29	1. Purchased breeding pigs subsidy 2. Housing construction subsidy 3. Advanced entrepreneurship subsidy 4. Live hog reserve subsidy

Reproduced from Rabobank, 2012, pg. 15.

To become a Dragon Head, a firm must meet a set of operational, financial, and farm integration criteria.⁶⁷ Operationally, a company must primarily function as an agricultural processor, distributor or intermediary, with processing and distribution accounting for at least 70 percent of the value of the company's products. Also, it must have legal standing as a state-owned or private enterprise, a group or corporation, a China-foreign joint-venture, or a wholly foreign owned enterprise.⁶⁸

Financially, the state sets minimum asset and sales thresholds for attaining Dragon Head status,⁶⁹ depending on a firm's location in the country and operational type. Minimums for processors and distributors by region are as follows:

Figure 13: Minimum for Dragon Head status

	ASSETS MINIMUM	SALES MINIMUM
East	150 million RMB (\$24 million)	200 million RMB (\$32 million)

Data Source: 2003 and 2010 "Provisional Measures" policy documents.

Figure 13: Minimum for Dragon Head status

	ASSETS MINIMUM	SALES MINIMUM
Central	100 million RMB (\$16 million)	130 million RMB (\$21 million)
West	50 million RMB (\$8 million)	60 million RMB (\$9.7 million)

Data Source: 2003 and 2010 "Provisional Measures" policy documents.

DHEs link to farmers

In order to fulfill the rural development responsibilities that come along with the Dragon Head name, lead firms must have a strong "interest coupling mechanism" (*liyi lianjie fangshi*) for integrating farm households into their operations and markets. Mechanisms include contracts, shareholding and cooperation with rural households, and 70 percent of the primary products for the company's processing and distribution must come through these arrangements. Firms in the East are required to integrate 4,000 households, those in the Central region, 3,500

households, and in the West, 1,500 households. Whether or not these minimum thresholds are met, and more importantly, whether or not they are beneficial to farm households, are matters of debate.⁷⁰

Measures to promote DHEs since the turn of the 21st Century fall under two broad categories. First, there are supports for firms directly involved in agricultural processing and distribution. In the period from 2000 to 2005, the central government spent 11.9 billion RMB (\$1.9 billion USD) subsidizing construction and operation expenses of these large-scale, national-level Dragon Heads.⁷¹ In addition to direct payments, authorities also offer tax exemptions and reductions, export tax rebates, discount loans for export-oriented products, and access to special loans with little or no interest.⁷² The second category of policy supports are to subsidize wholesalers and agriculture-related sectors, such as companies that specialize in frozen pork storage, product research and development, and sewage management.⁷³ Support programs for these firms are similarly based in financial, fiscal and tax policies.

As a result of concentrated state support and industry cooperation, lead firms have expanded both in number and in the scope of agrifood system ownership and control. According to official figures for 2011,⁷⁴ China had more than 280,000 enterprises engaged in agricultural industrialization, including 110,000 officially designated national-level Dragon Heads. These firms were working with 110 million rural households, following the model of “radiation-driven” (*fushe daidong*) farming, in which technology, information and market opportunities radiate to farmers through their relationships with Dragon Heads.

Box 3: Dragon Head Enterprises (DHE) at a glance: 2011⁷⁵

Dragon Head Enterprises (DHEs) at a Glance: 2011	
Number of national-level DHEs	110,000
Number of rural households engaged with DHEs	110 million
Sales revenue of all national-level DHEs	5.7 trillion RMB (\$917 billion USD)
Share of production under Dragon Head “radiation-driven” farming	
Crop area	60%
Livestock production (pigs & chicken)	70%
Aquaculture	80%
Total farm produce and processed foods	1/3
Average food basket in major cities	2/3

Dragon Heads and the pork industry

The pork sector illustrates the prevalence of domestic agribusiness firms, and the success of state support for agricultural processors in particular. Based on 2011 sales data, of the top 10 pork processing firms, all but one (90 percent) were Dragon Head Enterprises. Lead enterprises accounted for 80 percent of the top 10 firms in pork slaughterhouses and retailing. While processors are the focus of Dragon Head policy support, based on the idea that these firms can most efficiently coordinate the agrifood system for modernization, companies involved in production are also increasingly designated as leaders. Sixty percent of the top 10 pig breeding and production firms were Dragon Heads in 2011.

Figure 14 illustrates the dominant presence of Dragon Heads in the pork sector, as well as the relative absence of foreign firms.⁷⁶ Across the sector, only two firms have foreign involvement, though not in the typical joint-venture fashion. First, in 2006, Goldman Sachs bought a 10 percent share in the now well-known Shuanghui Group (*Shuanghui jituan*), and then sold half of those shares in 2009 to CDH Investments, a Chinese private equity fund.⁷⁷ Shuanghui International, the entity that is buying Smithfield Foods, is an international holding company that also owns the Shuanghui Group, a former state-owned enterprise.

Second, Jinluo Meat Products (*Linyi Xincheng Jinluo rouzhipin youxiangongsi*) was founded by a medical doctor, a business entrepreneur, and an officer of the planning

department of the Linyi Industrial Bureau in Linyi City, Shandong Province in the early 1990s. The three Chinese co-founders incorporated the company first in the British Virgin Islands, and later in Bermuda to form People's Food Holdings Limited as a conglomerate.⁷⁸ So while Jinluo is a wholly foreign owned firm, its origins are in China, and it is an officially recognized Dragon Head Enterprise. It is also one of the country's top three pork processors.

By way of comparison, chicken is most similar to the pork sector in terms of domestic ownership and control, as in Figure 14. All of the top firms in chicken slaughter and retailing are Dragon Heads, and two have foreign joint ventures. Xinchang Foods (*Shandong Taisen Xinchang shipin youxiangongsi*), the tenth largest chicken processor and eighth chicken retailer, established a joint venture with Tyson Foods in 2009, in which Tyson took a 60 percent share of the company's assets.⁷⁹ Beijing Dafa Chia Tai (*Beijing Dafa Zhengda youxiangongsi*), the sixth largest chicken processor and number one chicken retailer, is a joint venture with the CP Group of Thailand (referred to as the Chai Tai Group in China).

Figure 14: Share of Dragon Head Enterprises and foreign firms in select agricultural sectors, 2011.

	DRAGON HEADS ENTERPRISES AS A % OF TOP 10 FIRMS BY SALES IN 2011	FOREIGN FIRMS AS A % OF TOP 10 FIRMS BY SALES IN 2011
Pig Breeding	60	0
Pig Production	60	0
Pig Slaughter	80	10
Pork Processing	90	10
Pork Retail Brands	80	10
Chicken Processing	100	20
Chicken Retail Brands	100	20
Rice Processing	80	10
Rice Retail Brands	60	0
Wheat Processing	50	20
Wheat Retail Brands	40	0
Maize Processing	10	30
Maize Retail Brands	20	20
Soybean Oil Processing	30	60
Soybean Oil Retail Brands	30	20
Soybean Meal Importers	0	0
Soybean Meal Exporters	10	80*
Soybean Importers	10	30

Figure 14: Share of Dragon Head Enterprises and foreign firms in select agricultural sectors, 2011.

	DRAGON HEADS ENTERPRISES AS A % OF TOP 10 FIRMS BY SALES IN 2011	FOREIGN FIRMS AS A % OF TOP 10 FIRMS BY SALES IN 2011
Feed Processing	50	40
*This figure is out of 5 companies, rather than 10.		
Reproduced from: Schneider, M. (2012). <i>Poor rural and agricultural livelihoods: Discourses, policies, Dragon Head Enterprises, vertical integration, and contract farming in China</i> . Beijing: Oxfam, Hong Kong.		

Vertical integration with Chinese characteristics

Dragon Head Enterprises are intended to fulfill their rural development role by vertically integrating agricultural production through relationships with farmers. Vertical integration in the Chinese sense means coordinated production, processing, distribution, and sales of agricultural products, or in the language of Sinograin, the China Grain Reserves Corporation,⁸⁰ "Constructing the industrial chain from field to dining table" (*jianshe cong tianjian dao canzhuo chanyelian*). It is a form of "value chain integration," with farmers at one end of the chain producing primary products (like pigs), and Dragon Heads Enterprises at the other end processing and selling value-added commodities on local, national and increasingly international markets (like sausages and hams). Outside of China, vertical integration typically describes the activity of a single firm, and the extent to which it owns and controls several stages in a commodity chain. In the Chinese policy context, vertical integration refers to two parallel processes at broader scales: first, regional scaling-up of production, and second, integration of cultivation with processing and marketing at the level of a firm or more likely of the *whole commodity system*.⁸¹ The regional concentration of pork production to service metropolitan areas on the East coast is an example of Chinese-style vertical integration.

Chinese scholars and policymakers celebrate the pork sector as a model of "modern agriculture," and a shining example of successful and continuing vertical integration.⁸² In the pork sector, vertical integration is not only of the Chinese variety as detailed above, but also increasingly reflects the way the concept is used outside of China to connote the activities of single firms. William Heffernan states that, "vertical integration occurs when a firm increases ownership and control of a number of

stages in a commodity system.”⁸³ Figure 15 illustrates this kind of firm-level vertical integration, including the presence of Dragon Heads, among the top 10 firms in different stages of pork production and processing.

Three firms stand out as being on “the cutting edge of modernization” in terms of management, production and marketing in the pork sector, and as vertical integration leaders. Over the past decade, *Shuanghui*, *Jinluo*, and *Yurun* have shared the spotlight in pork processing and sales, vying for the number one position year after year.⁸⁴ Their combined annual sales in 2011 were 115.6 billion RMB (\$19 billion), which accounted for 68 percent of total sales for the top 10 pork processors. Combined annual profits were 6 billion RMB (\$965 million), or 86 percent of total profits for the top 10 pork processors. Together, these three firms employ 119,000 employees, and are concentrating market share in pork processing and sales.⁸⁵ *Shuanghui* is a formerly state-owned enterprise, *Jinluo* is Chinese-founded and British Virgin Islands incorporated, and *Yurun* is a private firm founded in Nanjing. All three are Dragon Heads.

Vertical integration and contract farming: The “company and farm” model

Contract farming between Dragon Head Enterprises and smallholder farmers is the state’s primary strategy for vertical integration and coordinating rural production along market-based lines with a goal to also improve rural livelihoods.⁸⁶ Authorities formalized contract farming and the “company and farm” (*gongsi + nonghu*) model⁸⁷ for linking Dragon Head processors with rural primary producers in 2003.⁸⁸ The model is similar to livestock contracting schemes used in the U.S. and elsewhere, and led by firms like Tyson and Smithfield.

China’s “company and farm” model originated in a chicken start-up operation in the early 1980s when Wen Beiyang, an entrepreneurial farmer, contracted with other farmers in an effort to scale-up and standardize production for his broiler processing and sales business. Wen’s company supplied baby chickens, feed, veterinary supplies, technical training, and services to nearby farm households, and farmers in turn provided the labor and facilities for raising

chickens. The company offered “protective prices” to ensure delivery and farmer loyalty, and to maintain a constant supply of birds for processing.⁸⁹ This small start-up company is now one of the largest domestic agribusiness firms in China—the Guangdong Wens Foodstuffs Group (Wens)—and this early form of contract farming is now widely used across the country and across agricultural sectors.⁹⁰ The “company and farm” model is perhaps the clearest expression of how the state proposes managing farmers and agricultural development, while promoting the domestic agribusiness sector.

Figure 15: Vertical integration among the top 10 firms in China’s pork industry.

	PIG BREEDERS	PIG PRODUCERS	PORK SLAUGHTER	PORK PROCESSORS	PORK RETAILERS
1	Xunxin*	Wens*	Jinluo*	Shuanghui*	Shuanghui*
2	Tieji Lishi	Chuming*	Yurun*	Jinluo*	Jinluo*
3	Fuxin	Bohiya	Shuanghui*	Zhucheng*	Yurun*
4	Zhengyang ZhuMei	Neixiang Muyuan	Zhiyuan	Zhongpin*	Gaojin*
5	Beijing Capital Ag*	Xinwufeng*	Pengcheng*	Delisi*	Tangren Shen*
6	Zhongshan Baihe	Shuangge*	Gaojin*	Jinluo*	Meihao*
7	Shuangge*	Tianzhong*	Zhongpin*	Beixu*	Delisi*
8	Xinwufeng*	Huangjinxiang*	Panyu	Furun*	Ke’erqin Cattle*
9	Chanjiang*	Zhongshan Baihe	Delisi*	Weifang Legang*	Chundu
10	Tianzhong*	Luhuan	Jingyan*	Jitailong	Qianxihe

Firms that rank in the top 10 of more than one stage of production (vertically integrated) appear in bold. Dragon Head are indicated by *.

Reproduced from: Schneider, M. (2012). *Poor rural and agricultural livelihoods: Discourses, policies, Dragon Head Enterprises, vertical integration, and contract farming in China*. Beijing: Oxfam, Hong Kong.

By official estimates, the model has been quite successful. The Ministry of Agriculture established the office for Vertical Integration of Agriculture (*nongye chanyehua bangongshi*) in the mid-1990s, with branch offices now in every province. The Office issued

its first full-length report in April of 2008 (*Zhongguo nongye chanyehua fazhan baogao*), which stated that **by 2005, fully one half of China's cultivated area and 36 percent of farm households (about 87 million) had been vertically integrated, either by lead firms, specialized co-ops (and other brokerage organizations), or specialty markets.**⁹¹ Vertical integration has penetrated agricultural production even further today: official statistics show that products from Dragon Head Enterprises accounted for one-third of all farm produce and two-thirds of the average food basket in major cities in 2011, including 70 percent of pork and chicken production.⁹² When China's officials announce these figures, they are reporting on vertical integration that takes the form of contract farming, the "company and farm" model, and farm integration with Dragon Heads. These relations take on a myriad of forms in various stages of production and processing, in the pork sector and more broadly.

In addition to vertical integration of the Chinese and U.S. varieties, the livestock industry is also consolidating horizontally and globally, as expressed in the Shuanghui-Smithfield deal. Again, Shuanghui is an exemplar of China's model. As a highly capitalized and invested Dragon Head Enterprise, Shuanghui is successful both at home and abroad, reflecting the government's focus on constructing a robust domestic agribusiness sector, while at the same time supporting those firms to become internationally competitive. The Smithfield acquisition signals a new era of global consolidation in which a Chinese firm is the buyer (or, rather, an internationally held corporation with Chinese roots), and subsequently, controls the sale and distribution of products throughout the Chinese agrifood system.

Impacts of this system on small livestock producers

Small producers raising a small number of animals on household-based feed and catering to their local communities are systematically being driven out as we have seen above. While the Chinese government is stressing the formation of farmers cooperatives and contractual arrangements with DHEs, these are often not in the best interests of smallholder farmers. For instance, prohibitively high costs of participation in contracts with large firms,⁹³ unattainable market standards,⁹⁴ lack of farm labour,⁹⁵ declining soil and water quality for production,⁹⁶ and the preferences of firms to contract with larger farms⁹⁷ create often insurmountable barriers for smallholders to enter into contract

relationships. These can be thought of as "problems of exclusion." On the other hand, farmers also face challenges if and when they enter into contract relationships. Firms set the terms of contracts, and have a monopoly on price-setting, which reduces smallholder bargaining power, and often makes rural households dependent on firms as market outlets when other options disappear or become unviable. Smallholders can become dependent on contracts and stop growing food for home use,⁹⁸ they frequently lose decision-making power,⁹⁹ often lack legal understanding which opens them up to being taken advantage of by firms, and they bear most of the risk in contract relationships when prices fall.¹⁰⁰ These can be thought of as "problems of inclusion." In both cases, the deck, so to speak, is stacked against the small-scale farm household.

This kind of transformation, and the problems associated with it, are not unique to China. The U.S. has already lost the majority of its independent pig farmers, and those who remain are beholden to a few powerful meat companies. This seems to be the direction that China's pork industry is taking, though with greater difficulty given the large number and dispersed nature of smallholder farmers and small-scale meat processing companies in the country.

V. FOREIGN FIRMS AND GLOBAL CONSOLIDATION IN CHINA'S PORK INDUSTRY

Despite the largely domestic nature of production, processing, sales and ownership in China's pork industry, foreign firms also play a role. From operating through commercial markets and contracts, to forming joint ventures and wholly-owned subsidiaries, international involvement takes various forms in many different sectors. For instance, all of the world's leading grain traders (**ABCD**, or Archer Daniels Midland with Wilmar, Bunge, Cargill and Louis Dreyfus) operate in China as part of the feed supply chain (see IATP's *The Need for Feed: China's Demand for Industrialized Meat and Its Impacts* in this series and 2011 IATP report, *Feeding China's Pigs*).

Livestock genetics also have significant international connections. **PIC** (the Pig Improvement Company), the self-proclaimed "international leader in providing genetically superior pig breeding stock and technical support for

maximizing genetic potential to the global pork chain,”¹⁰¹ established an office in Shanghai in 1996 to coordinate its China presence. Another world leader in pig breeding, **HENDRIX GENETICS**, operates as **HYPOR CHINA**. The company (Hypor at the time, before the company’s merger with Hendrix) began shipping pigs to China in 2004. It now has regional offices in Beijing, Shandong and Wuning, and has established several joint venture operations to supply local markets and to manage imports from its other production centers.¹⁰²

The global consolidation of pork genetics into just a few world-dominant firms is mirrored in the simplification of China’s rich genetic diversity into just a few breeds of imported pigs. A Ministry of Agriculture official estimates that 90 percent of China’s pork is produced from exotics, predominantly Duroc, Landrace and Yorkshire swine. Firms like PIC and Hendrix-Hypor have been successful not only in selling their breeding stock, but also in selling the industrial production model, which is based on a narrow range of “improved” pigs developed to survive in confinement. The prolificacy, agroecological value, and flavorful pork associated with China’s indigenous pigs suggest this model may not be all it’s cracked up to be.

International firms are also actively involved in supplying China’s pork industry with technologies and equipment. For example, **BIG DUTCHMAN**, the top livestock equipment dealer worldwide, has regional sales offices in Beijing and Tianjin.¹⁰³ In April 2013, Big Dutchman signed a partnership contract with Jiayuguan CP Modern Agriculture and Husbandry Industrial Farmers Cooperation Organization in Gansu Province to supply feeding equipment for a 46.4 million RMB (\$7.58 million USD) pilot pig production project.¹⁰⁴ The company is also involved in chicken production and meat sales in China.



Photo: Big Dutchman at VIV China (trade show), Beijing, 2010. (Mindi Schneider)

In addition to foreign firms operating predominantly as suppliers in China’s pork industry, leading international meat companies also have direct connections to China, with processing operations on the ground. The remainder of this section summarizes the China operations of the world’s top ten protein processors in 2011,¹⁰⁵ in the order of their global standing.¹⁰⁶

JBS is the world’s largest protein processor with 140 production facilities worldwide. Headquartered in the United States, JBS sells pork and most of its beef under the *Swift* label, and chicken largely under its *Pilgrim’s* label. The company has production and processing operations in China, but the primary connection is through China as an export market for pork and chicken. The company website is www.jbssa.com.

TYSON FOODS, the second-largest protein processor worldwide, has extensive operations in China, particularly in Shandong Province and in the area surrounding Shanghai. In 2001, Tyson International Holdings formed a joint venture with Shandong Zhucheng Waimai to form a chicken processing operation called *Shandong Tyson Dalong Foods*. In 2011, after initiating a joint venture in Shandong Province with three poultry plants in 2009, Tyson Foods assumed full ownership of *Tyson Rizhao* and *Tyson Weifang*. The former is a fully integrated poultry complex, and the latter is a partially integrated chicken operation that produces for exports to Korea and Japan. Outside of Shanghai, *Jiangsu Tyson Foods* was founded in 2008 as a wholly-owned, fully integrated poultry complex. *Tyson*

Nantong is a chicken production and processing facility focused on servicing the Chinese market. The company website is www.tysonfoods.com.

CARGILL, also based in the U.S., is the world's third-largest meat processor. Cargill has more than 7,000 employees and operations in 52 locations in China. In 1988, *Shandong-Cargill Ltd.* was formed as a \$10 million joint venture with the People's Republic for cottonseed crushing, and in 2009, Cargill purchased the Yangjiang Port in southern China for its grain importing and exporting operations. The firm initiated an integrated poultry complex in Anhui Province in 2012 that will reach full production in 2015. It also has connections to China's dairy industry through relations with Mengniu. More generally, Cargill operates in China in animal nutrition, animal protein, trade and processing of agricultural products, food ingredients, finance and risk management, and industrial operations. The company website is www.cargill.com. Cargill China is at www.cargill.com.cn/en/.

BRASIL FOODS is number four on the list. Formed in 2009 through a merger of two major Brazilian food companies, the company operates in China through the *Dah Chong Hong Limited* joint venture, and the *Rising Star Food Company* joint venture. Brasil Foods distributes its Sadia and Perdix brands of processed foods (including proteins) to Hong Kong, Macao, and Continental China. The company website is www.brasilfoods.com.

Dutch-headquartered **VION** is the fifth-largest protein processor. It has two offices in China, one in Shanghai and one in Hong Kong. The company produces meat products and food and feedstuffs. The company also exports to China. The company website is www.vionfoodgroup.com.

MARFRIGALIMENTOS, Brazil's third-largest food processor, is the world's sixth-largest protein processor. It operates in China under the brand name *Keystone*, formed from two joint ventures, one as *COFCO Keystone Foods Supply Chain Investment Company* and the other as *Keystone-Chinwhiz Poultry Vertical Integration*. The former deals in distribution and the latter in poultry production and processing. Keystone's focus is on the global food service industry, with McDonalds as the company's main client. The firm plans to increase its business with YUM brands, KFC, Subway, Chipotle and others, and particularly in China. The company website is www.marfrig.com.br.

The current seventh largest protein processor is **SMITH-FIELD FOODS**. By the end of 2013, Smithfield will have become part of Shuanghui.

Japan's **NIPPON MEATS** is number eight on the global list. The company has a trading firm called Nippon Food (Shanghai) for the sale of fresh meat. It sells processed foods through *Shandong Rilong Foodstuffs*, and has production and sales operations through *Tianjin Longhai Foods*, *Weihai Nippon Shukuhin*, *Yantai Baochang Foodstuffs*, and *Shandong New Japanese Foods*. It also has *Nippon Meat Packer Inc.* in Taiwan. The company website is www.nipponham.co.jp/eng.

DANISH CROWN is number nine on the list. It operates two offices in China under ESS-FOOD, one in Dalian and one in Qingdao. ESS-FOOD is a wholly-owned company operating in the meat sector. The company website is www.danishcrown.com.

Number ten on the list of the world's largest protein processors is **HORMEL FOODS**, headquartered in the U.S. In 1994, Hormel entered into a joint venture with Beijing General Corporation of Agriculture, Industry Commerce to form *Beijing Hormel Foods*. The company operates in manufacturing, sales, marketing and distribution of chilled processed meat products. *Shanghai Hormel Foods* was the company's second China joint venture, initiated in 1995 to sell chilled processed meats in Shanghai, Guangzhou and Shenzhen. The company website is www.hormel.com.

The success of foreign firms in bringing their products and models to China's pork industry—with the help of government policies and joint ventures—is evidenced in the country's rural and urban areas. Urban retail food markets in particular are replete with packaged and processed pork products, some bearing the brand of Chinese firms, others international trademarks. Agricultural expos and trade shows are stocked and staffed with international firms selling everything from farrowing crates, to micronutrient feed additives, to dummy sows for artificial insemination programs. Pork production and breeding centers of the large-scale industrial kind are popping up outside of major and midsized cities in suburban and peri-urban areas. Given that they are constructed of the same materials, drawn from the same blueprints, and erected out of the same notion of modern production as industrial farms everywhere, a CAFO in China looks like a CAFO in Iowa, though sometimes at a larger scale with more connected buildings. And in the countryside, the imprint of industrial pork production—as both a homegrown and imported model—is expressed in the relative absence of pigs on

smallholder farms, and perhaps in the steady decline of these farms themselves. The industrial model has no room for small-scale agroecological farming, or the farmers who practice it.

VI. IMPACTS OF THE INDUSTRIAL LIVESTOCK PRODUCTION MODEL

Chinese policymakers see the U.S. industrial pork production model as the solution to China's food safety problems. Their incentives to consolidate, scale up and standardize the industry are intended to increase production efficiencies and reduce food safety scandals. Yet it is precisely this system of factory farming (developed in the U.S. over 50 years ago) that confines large numbers of animals together in restricted spaces and creates systems for fast animal growth and short meat-to-market times that has led to drastic environmental, public health and animal welfare problems in the U.S. It has led to the virtual disappearance of extensive and sustainable farming systems run by independent family farmers to one of contractual labor where a few powerful meatpacking companies control the terms of trade and production. Moreover, the system has resulted in widespread land use—change in the U.S. and abroad, as staggering quantities of grains are fed to these large populations of animals, consuming fossil fuel energy, water and land—far more than humanity can withstand as global populations rise in an era of climate change. This section briefly outlines some of the most pressing implications of the industrial livestock production model. It is by no means exhaustive,¹⁰⁷ but gives a sense of what is at stake for China, given the experience in the U.S.

Antibiotic resistance is a serious problem in the U.S. livestock industry, and increasingly, in China's. In 2011, the U.S. used 29.9 million pounds (over 13 million kgs) of antibiotics in livestock production,¹⁰⁸ accounting for up to 80 percent of the total volume of antibiotics sold in the country.¹⁰⁹ The U.S. Government's Center for Disease Control revealed that at least 23,000 Americans die every year because of antibiotic resistance as a result of the widespread overuse and abuse of these drugs. In 2008, China already produced 210 million kg of antibiotics, nearly half of which was put to use in the livestock sector.¹¹⁰ "Superbugs" are emerging,

compromising the ability of medicines to treat disease in both humans and other animals and presaging public health issues on a scale much larger than in the U.S.

The U.S. government has thus far succumbed to the livestock industry lobbies, demonstrated in its failure to phase out and eventually ban the non-therapeutic use of antimicrobials in spite of repeated calls by health professionals and reputable commissions.¹¹¹ Experts are calling on the U.S. to also do much more to create an effective disease monitoring and tracking system for antibiotic resistance. For Chinese officials, this problem is an even greater challenge given the sheer volume of the antibiotics used and China's human and animal populations.

Manure and its management is another profound challenge. The United States Department of Agriculture (USDA) estimates that livestock produce 335 million dry tons of manure each year. While there are some regulations in place to manage manure, these systems are riddled with problems for ecosystems and human health. From lagoons that leach excess nutrients into groundwater and soil, to the use of liquid manure as fertilizer for crops that runs off into surface waters, this manure is an important source of water and soil pollution and climate change. In addition to nitrogen and phosphorus, contaminants from industrial factory farms also include pesticides, antibiotics, antibiotic-resistant and disease-causing organisms, growth-promoting hormones, heavy metals and other pathogens.¹¹² Production and storage of manure also releases air pollutants including ammonia, hydrogen sulfide, endotoxins and "animal dander" (dead skin cells of animals).¹¹³

The drastic impacts of industrial livestock farming in the U.S. stem from producing 9.8 billion food animals on the same land mass as China with a fraction of China's human population. China's total food animal numbers far surpass 10 billion given that pigs alone constitute nearly 800 million. In February of 2010, the Chinese government released results of the first national pollution census. The most startling finding of this nearly three-year, 737 million RMB (\$10 million USD) investigation was that agriculture today is a bigger source of pollution in China than industry. Researchers found that farming was responsible for 44 percent of chemical oxygen demand (the main measure of organic compounds in water), 67 percent of phosphorus discharges, and 57 percent of nitrogen discharges into bodies of water.¹¹⁴ Manure from industrial livestock farms is the most important source of this pollution—in 2008

China's livestock produced 4.8 billion tons of waste.¹¹⁵ As the livestock industry grows, so too will the amount and problems of manure.

Land, water and resource limitations are other important factors that Chinese officials are trying to navigate, and that emerge as social and environmental problems. By most counts, China is land-and-water scarce in relation to the country's 1.3 billion people. Industrial livestock production (including feed) intensifies this high-population-limited-resource problem. From 2000 to 2006, water tables in the North China Plain fell by 61 percent as intensive agriculture shifted to fragile Northeastern stretches of the country.¹¹⁶ This problem will only be exacerbated as the model Chinese policymakers believe is optimal for livestock production—the CAFO model—encroaches even further. Globally, it takes 576 gallons (2180 liters) of water to produce one pound (0.45 kg) of pork (compared to 1,799 gallons for one pound of beef).¹¹⁷ In 2014, China is slated to produce nearly 55 million tons of pork alone. These figures raise fundamental questions about China's ecological limits and the tradeoffs involved for China's food security and its appetite for meat.

The Shuanghui-Smithfield deal from an environmental perspective is therefore also “a trade of water for waste.”¹¹⁸ Increased Smithfield exports to China translate into more water polluted in the U.S. This externalizing of environmental and other negative impacts of industrial livestock production has clearly been identified as one key reason to shift Chinese policy towards greater imports. However, the fact remains that Chinese demand in a business-as-usual scenario is simply overwhelming compared to supply on the world market. The number of hogs slaughtered by Smithfield (a quarter of U.S. slaughter capacity) in 2012 accounts for only three percent of China's slaughtered hogs.¹¹⁹

Clearly, the environmental and health problems related to this production model are not new. The U.S., in spite of overwhelming evidence and numerous advocates for a transition away from so-called factory farming, continues to succumb to the interests of the livestock industry. Powerful corporate players have stymied one regulation after another in the area of public health, environment and even basic transparency of their farm operations. Can the Chinese state learn from U.S. failures? Will it have the foresight to re-assess the DHE incentives to scale-up this mode of production in the interest of public health, environment and resource scarcity instead? Will Chinese

consumers who typically react strongly to food safety and security scares begin to see how the path of this industry is leading to more, not fewer threats?

CONCLUSION

In important ways, China's once diverse agricultural systems are being simplified, eroded and industrialized. Foreign firms play an important role in these changes, whether as sources of ideas and models, or as sources of the materials and supplies—the building blocks—of the system. But foreign firms are not the only influence and they are not the sole actors. Industrialization of meat production in China has been a priority of the state, growing from a need to bolster legitimacy by insuring availability of pork, and a belief that large-scale industrial production is the only way to achieve this goal quickly. This report has shown that in a system that was decentralized in the late 1970s and early 1980s, state support has made Dragon Head Enterprises the leaders in producing, selling, and profiting from pork and agricultural products more generally.

As these firms are becoming increasingly capitalized and invested, they are also becoming increasingly powerful in global agrifood markets. The Shuanghui acquisition of Smithfield Foods is but one example of this phenomenon; it is a profound example given the scale of the deal and the media attention it has garnered, but it is by no means an isolated incident. The central government adopted a set of policies in 2000 to encourage Chinese state and private firms to invest in operations and infrastructure abroad.¹²⁰ This “go out” (*zou chuqu*) strategy continues today, and is related to new forms of global consolidation in the pork industry, as well as to China's much-reported land grabs (see IATP's *The Need for Feed: China's Demand for Industrialized Meat and Its Impacts*). Firms like Beidahuang, COFCO (the China National Cereals, Oils, and Feedstuffs Corporation), the Chongqing Grain Group, the New Hope Group, the China National Agricultural Development Group, and others have all “gone out” for land, agricultural resources and/or other companies abroad.¹²¹

The pork industry in China is massive, as are its implications for soil and water pollution, climate change, public health and rural livelihoods.¹²² But the industry in China is in many ways the same industry in the U.S. and elsewhere, a fact that analyses and policies need to take into account. Critiques of China's pork miracle must also be

critiques of the practices and structures of industrial livestock agriculture on the whole. At the same time, as Chinese domestic firms play ever more important roles in global markets, it seems likely that agribusiness politics in the future, both in China and on the world stage, will be increasingly Dragon-Headed. Understanding what is general and what is particular, and how the two influence one another, is crucial for understanding the rise of *agribusiness with Chinese characteristics*. It is also necessary for framing and implementing more just, sustainable and diverse agrifood systems that can reverse the damages wrought by decades of global agricultural industrialization. This, surely, is our most pressing task.

ENDNOTES

1. FAOSTAT.
2. Available at: <http://www.iatp.org/documents/feeding-china%E2%80%99s-pigs-implications-for-the-environment-china%E2%80%99s-smallholder-farmers-and-food>.
3. Hsu, V.Y.N. & Hsu, F.L.K. (1977). Modern China: North. In Chang, K.C. (Ed.). *Food in Chinese culture: Anthropological and historical perspectives* (pp. 295-316). New Haven, CT: Yale University Press.
4. Li, J. (2010). The decline of household pig farming in rural Southwest China: Socioeconomic obstacles and policy implications. *Culture & Agriculture*, 32(2), 61-77.
5. Zheng, P. (1984). *Livestock breeds of China*. (Report No. 46). Rome, Italy: FAO Animal Production and Health Series and China Academic Publishers.
6. Wittwer, S., Yu, Y., Sun, H., & Wang, L. (1987). *Feeding a billion: Frontiers of Chinese agriculture*. East Lansing, MI: Michigan State University Press.
7. Deng, X. (1984, June 30). Building a socialism with a specifically Chinese character. *People's Daily*. Retrieved from <http://english.peopledaily.com.cn/dengxp/vol3/text/c1220.html>.
8. USDA ERS 2013. U.S. Hog Production from 1992 to 2009: Technology, Restructuring, and Productivity Growth, October. Report Number 158.
9. Ibid.
10. Ibid.
11. For a detailed discussion of soy sector liberalization and its impacts, see Mindi Schneider's 2011 *Feeding China's Pigs* report.
12. Wang, J., & Watanabe, M. (2007). *Pork Production in China: A Survey and Analysis of the Industry at a Lewis Turning Point*. Chiba, Japan. Retrieved from <http://www.ide.go.jp/English/Publish/Download/Asedp/077.html>.
13. http://gain.fas.usda.gov/Recent%20GAIN%20Publications/Livestock%20and%20Products%20Annual_Beijing_China%20-%20Peoples%20Republic%20of_9-27-2013.pdf.
14. FAO-OECD 2013. Agricultural Outlook 2013-2022.
15. Ibid, 78.
16. Rabobank 2012. Industrialization of China's Pork Supply Chain: Finding the Best Business Model. Industry Note # 329—September.
17. FAOSTAT.
18. Ibid.
19. http://www.earth-policy.org/datacenter/xls/update102_8.xlsx.
20. Gale, F et al 2012. China's Volatile Pork Industry. USDA ERS, February.
21. USDA FAS 2013. Livestock and Poultry: World Markets and Trade, November.
22. USDA FAS 2013. Livestock and Poultry: World Markets and Trade, November.
23. Gale et al. 2012.
24. USDA FAS 2013. GAIN Report: China Livestock and Products Annual, September 27 http://gain.fas.usda.gov/Recent%20GAIN%20Publications/Livestock%20and%20Products%20Annual_Beijing_China%20-%20Peoples%20Republic%20of_9-27-2013.pdf.
25. Ibid.
26. Ibid.
27. USDA FAS 2013. Livestock and Poultry: World Markets and Trade, November.
28. Gale et al. 2012.
29. Morgan Stanley 2011.
30. Rabobank 2012, see also Gale et al.
31. Ibid.
32. Rabobank 2012.
33. Gale et al 2012.
34. See Morgan Stanley 2011. China Files.
35. See also IATP's blog:
36. Li, 2010.

36. Woosley, M. & Zhang, J. (2010). *China, People's Republic of: Livestock and products semi-annual report 2010*. (United States Agricultural Service, Foreign Agriculture Service, GAIN Report No. CH10009). Beijing, China.
37. Cui, K. (2009). *Interview on development in the chicken meat industry in China* (in Chinese). Retrieved from <http://finance.ifeng.com/leadership/cygc/20090522/696380.shtml>.
38. Martin, S. (2012, April 30). China to up pork production. *Agweek*. Retrieved from <http://www.agweek.com/event/article/id/19782/>.
39. Rabobank 2012.
40. GRAIN. (2008). *Seized! The 2008 land grab for food and financial security*. Retrieved from <http://www.grain.org/article/entries/93-seized-the-2008-land-grab-for-food-and-financial-security>.
- Nierenberg, D. (2005). *Happier meals: Rethinking the global meat industry*. (Worldwatch Paper 171). Washington, D.C.: Worldwatch Institute.
41. McOrist, S., Khampee, K. & Guo, A. (2011). Modern pig farming in the People's Republic of China: Growth and veterinary challenges. *Revue Scientifique et Technique*, 30(3), 961-968.
42. Rabobank 2012.
43. Zhurou ("pig meat") is the formal word for pork, but in conversation, on menus, and when ordering at a restaurant or butcher, "rou" by itself means "pork." Chicken, beef, and mutton, for instance, must be specified as "chicken meat" (jirou), cow meat (niurou), and "sheep meat" (yangrou).
44. Harbaugh, R. (1998). *Chinese characters: A genealogy and dictionary*. New Haven, CT: Yale University Press.
45. Translated by Sarah H. from Current Production Situation and Suggestion for Development of Livestock Industry in China. 2008.
46. The National Bureau of Statistics stopped releasing official figures for the Gini coefficient in 2001, stating that income data for wealthy households was incomplete. This figure is from the Chinese Household Finance Survey Center of Chengdu's Southwestern University of Finance and Economics.
- Shen, H. (2012, December 10). China's gini index at 0.61, University report says. *Caixin Online*. Retrieved from <http://english.caixin.com/2012-12-10/100470648.html>.
47. Ahlers, A.L. & Schubert, G. (2009). "Building a New Socialist Countryside" – Only a Political Slogan? *Journal of Current Chinese Affairs*, 38(4).
- Göbel, C. (2010). *The politics of rural reform in China: State policy and village predicament in the early 2000s*. New York, NY: Routledge.
- Liu, Y., Chen, Y., & Long, H. (2011). Regional diversity of peasant household response to new countryside construction based on field survey in eastern coastal China. *Journal of Geographical Sciences*, 21(5), 869-881.
48. Wang, Hongyi. (2013, August 21). Food safety tops public's concerns. *China Daily*. http://www.chinadailyasia.com/news/2013-08/21/content_15083963.html.
49. Marcia Dutra de Barcellos, Klaus G. Grunert, Yanfeng Zhou, Wim Verbeke, F.J.A. Perez-Cueto, and Athanasios Krystallis. "Consumer Attitudes to Different Pig Production Systems: A Study from Mainland China," *Agriculture and Human Values*, 30 (2013): 443-455.
50. For a general critique of industrial livestock farming, see Daniel Imhoff (Ed). *The CAFO Reader: The Tragedy of Industrial Animal Factories* (Berkeley, Watershed Media, 2010). For details on the situation in China, see Mindi Schneider's 2011 report for IATP.
51. Tom Philpott, "Half of China's Antibiotics Now Go to Livestock," *Mother Jones*, September 10, 2013, <http://www.motherjones.com/tom-philpott/2013/09/chinas-antibiotic-meat-livestock> (accessed October 1, 2013).
52. USDA FAS 2013 PRC Livestock Annual Update, September 27.
53. Helena Bottemiller, "Dispute Over Drug in Feed Limiting U.S. Exports." *Food and Environment Reporting Network*, January 25, 2012, <http://thefern.org/2012/01/dispute-over-drug-in-feed-limiting-u-s-meat-exports/> (accessed September 10, 2013).
54. Xinhua News. "China Bans Production, Sale of Ractopamine," *Xinhua News*, December 23, 2011, http://news.xinhuanet.com/english/china/2011-12/23/c_131323957.htm (accessed August 23, 2013).
55. Vincent ter Beek. "Codex Approves Standard for Ractopamine Use in Pigs and Cattle," *Pig Progress*, July 6, 2012, <http://www.pigprogress.net/Health-Diseases/Health/2012/7/Codex-approves-standard-for-ractopamine-use-in-pigs-and-cattle-PP009017W/> (accessed August 23, 2013).
56. European Union. "Statement by the EU on Ractopamine," *Latest Swine News*, July 9, 2012, http://www.pig333.com/latest_swine_news/statement-by-the-eu-on-ractopamine_6031/ (accessed August 23, 2013).
57. Helena Bottemiller. "Smithfield Sale Raises New Questions About the Future of Ractopamine," *Food Safety News*, June 4, 2013, <http://www.foodsafetynews.com/2013/06/smithfield-sale-raises-new-questions-about-future-of-ractopamine/#.UheqrGR8dU5> (accessed August 23, 2013).
58. From "Views on Supporting the Development of Lead Enterprises for Agricultural Industrialization" policy document. Retrieved from http://www.gov.cn/zwqk/2012-03/08/content_2086230.htm (in Chinese).
59. Translated by Mindi Schneider from *Baidu Baike* entry for Dragon Head Enterprise, <http://baike.baidu.com/view/125729.htm> (in Chinese).
60. From the inaugural speech given by Hui Liangyu, Deputy Prime Minister of the State Council, at the launch of the *China Association of Leading Enterprises for Agricultural Industrialization* in 2012. Full text of the speech available at <http://baike.baidu.com/view/9676144.htm> (in Chinese).
61. Throughout the report, Dragon Head Enterprise, lead firm, and leading firm or enterprise are used interchangeably. All signify the Mandarin word, longtouqiye (龙头企业).
62. "Decision of the Central Committee of the Chinese Communist Party on Several Major Issues in Agriculture and Rural Work," issued by the Third Plenary Session of the 15th Central Committee of the Chinese Communist Party, October 1998.
63. Zhang, Q. F., & Donaldson, J. A. (2008). The rise of agrarian capitalism with Chinese characteristics: Agricultural modernization, agribusiness and collective land rights. *China Journal*, 60(60), 25-47.
64. For a detailed description of the dragon dance, see <http://baike.baidu.com/view/102578.htm> (in Chinese).
65. Criteria are less evident and financial support less assured at the local level, such that the Dragon Head title may be the only payout (Zhang & Donaldson, 2008).
66. Rabobank 2012.
67. As outlined in the 2003 and 2010 "Provisional Measures" documents.
68. Currently, it is uncommon for foreign firms to be designated as Dragon Heads. Schneider (2012) analyzed 216 agribusiness firms from eight different agricultural sectors (pork, chicken, soy, maize, rice, wheat, peanuts, livestock feed) in 2011. Only one of the foreign firms had Dragon Head status (Schneider 2012). That firm was People's Food Holdings Limited, which is discussed in the next section.
69. Additionally, Dragon Heads must be profitable (returns on assets must be higher than interest on bank loans, etc.), have an asset-liability ratio under 60 percent, and a bank credit rating of at least "A." Their products must be competitive in the market, and they must first have provincial Dragon Head status before applying for national-level designation.
70. See Schneider, M. (2012). *Poor rural and agricultural livelihoods: Discourses, policies, Dragon Head Enterprises, vertical integration, and contract farming in China*. Beijing: Oxfam, Hong Kong.
71. Huang, P.C.C. (2011). China's new-age small farms and their vertical integration: Agribusiness or co-ops? *Modern China*, 37(2), 107-134.
72. Zhang, H., Fan, S., & Qian, K. (2005). The role of agribusiness firms in agricultural research: The case of China. *Annual Meeting of the American Agricultural Economics Association*, Providence, RI: July 24-27.
73. Ibid.
74. Hui Liangyu speech, 2012.
75. Ibid.
76. Sales data were compiled from industry and government resources, and then cross referenced with official lists of national-level Dragon Heads. Data sources are listed below the table.
77. Goldman plans to sell Shineway stake to a Chinese fund. (2009, November 4). *China Daily*. Retrieved from http://www.chinadaily.com.cn/bizchina/2009-11/04/content_8914246.htm.
78. See Chinese agribusiness profiles at <http://pigpenning.wordpress.com/agbiz-profiles/>.
79. Mickelson, G. (2008, September 2008). Tyson enters third poultry joint venture in China: Venture involves vertically-integrated operations in Eastern China. *Globe Newswire*. Retrieved from <http://globenewswire.com/news-release/2008/09/10/384521/150109/en/Tyson-Enters-Third-Poultry-Joint-Venture-in-China.html>.
80. Sinograin website: http://en.sinograin.com.cn/eng/index_Eng.jsp (in English).

81. Zhang & Donaldson, 2008.
82. People's Government of Jilin Province. (2012, December 14). China-Singapore Jilin food zone speeds up construction. [Press Release.] Retrieved from <http://www.noodles.com/view/1EA92B5F1EE4665A00BB7DFC2E7DFEA3DF0C0585>.
83. Heffernan, W.D. (2000). Concentration of ownership and control in agriculture. In Magdoff, F., Foster, J.B., & Buttel, F.H. (Eds.). *Hungry for profit: The agribusiness threat to farmers, food, and the environment* (pp. 61-76). New York: Monthly Review Press, p. 68.
84. People's Government of Jilin Province. (2012, December 14). China-Singapore Jilin food zone speeds up construction. [Press Release.] Retrieved from <http://www.noodles.com/view/1EA92B5F1EE4665A00BB7DFC2E7DFEA3DF0C0585>.
85. Schneider, M. (2012). *Poor rural and agricultural livelihoods: Discourses, policies, Dragon Head Enterprises, vertical integration, and contract farming in China*. Beijing: Oxfam, Hong Kong.
86. Authorities also proposed farmer professional cooperatives as a way to scale-up and coordinate smallholder production.
- Hale, M.A. (2013). Tilling sand: Contradictions of "social economy" in a Chinese movement for alternative rural development. *Dialectical Anthropology*
- Huang, P.C.C. (2011). China's new-age small farms and their vertical integration: Agribusiness or co-ops? *Modern China*, 37(2), 107-134.
- Looney, K. (2011). *The New Socialist Countryside, rural modernization in the Hu Jintao Era*. Paper prepared for the Association for Asian Studies Conference, April 1.
87. Other variations of the model include "company and production base and farm" (*gongsi + jidi + nonhu*), "production base and farm and industry and processing" (*jidi + nonghu + qiye + jiagong*), and "company and farm and cooperative and production base" (*gongsi + nonghu + hezuo + jidi*).
88. The "company and farm" model was formalized in the "Provisional Measures for the Administration of Dragon Head Enterprise Identification and Operation Monitoring" policy document from 2003.
89. Liu & Lu, 2008.
90. Zuo, W., Lu, R., & Ou, X. (2008). Strategizing corporate social responsibility: evidence from Guangdong Wen's Foodstuffs Group Co. *International Journal of Business and Management*, August.
91. Huang, 2011.
92. From our interviews in China, it seems that poultry farming looks more like contract farming and vertical integration in the U.S., while pork is more integrated at the sector level.
93. See: Guo, H. et al. (2007). Contract farming in China: Perspectives of farm households and agribusiness firms. *Comparative Economic Studies*, 49(2), 285-312; Lu, H. et al. (2010). Guanxi networks, buyer-seller relationships, and farmers' participation in modern vegetable markets in China. *Journal of International Food & Agribusiness Marketing*, 22, 70-93; Miyata, S. et al. (2009). Impact of contract farming on income: Linking small farmers, packers, and supermarkets in China. *World Development*, 37(11), 1781-1790.
94. Stringer, R. et al. (2008). Producers, processors, and procurement decisions: The case of vegetable supply chains in China. *World Development*, 37, 11, 1773-1780.
95. Miyata, S., Minot, N., & Hu, D. (2009). Impact of contract farming on income: Linking small farmers, packers, and supermarkets in China. *World Development*, 37(11), 1781-1790.
96. Ibid.
97. Stringer, R., Sang, N., & Croppenstedt, A. (2008). Producers, processors, and procurement decisions: The case of vegetable supply chains in China. *World Development*, 37, 11, 1773-1780.
- Zhu, J. (2007). *Three essays on contract farming in China* (Doctoral dissertation). Retrieved from ProQuest Dissertation and Theses database. (3289392).
98. Lingohr, S. (2011). *Industrialization and rural livelihoods in China: Agricultural processing in Sichuan*. New York: Routledge; Lingohr, S. (2007). Rural households, Dragon Heads and associations: A case study of sweet potato processing in Sichuan Province. *The China Quarterly*, 192, 898-914.
99. Hu, Y. & Hendrikse, G. (2009). Allocation of decision rights in fruit and vegetable contracts in China. *International Studies of Management and Organization*, 39, 4, 8-30.
100. Lingohr, 2007, 2011.
101. Quoted from the PIC website at www.pic.com/us.
102. Hypor website at www.hypor.com/en/local-activities/china/.
103. Big Dutchman website at www.bigdutchman.de/en/.
104. Pig Progress, "China: Big Dutchman Partners with CP Group," Pig Progress, May 21, 2013, <http://www.pigprogress.net/Growing-Finishing/General/2013/5/China-Big-Dutchman-partners-with-CP-Group-1260031W/> (accessed September 30, 2013).
105. Tuo Jiang provided research assistance for this section.
106. Hannah Oakman, "The World's Top 100 Food & Beverage Companies – 2012," Food Engineering, October 4, 2012, <http://www.foodengineeringmag.com/articles/89672-the-worlds-top-100-food-beverage-companies> (accessed September 30, 2013).
107. See Imhoff, 2010.
108. Kim, B. et al 2013. Industrial Food Animal Production in America: Examining the Impact of the Pew Commission's Priority Recommendations. A Project of the Johns Hopkins Center for a Livable Future.
109. Ibid.
110. <http://ehp.niehs.nih.gov/wp-content/uploads/121/6/ehp.1206446.pdf>.
111. Ibid; See also: Pew 2008???. Putting Meat on the Table: Industrial Farm Animal Production in America. A Report of the Pew Commission on Industrial Farm Animal Production.
112. Kim, B. et al 2013. Industrial Food Animal Production in America: Examining the Impact of the Pew Commission's Priority Recommendations. A Project of the Johns Hopkins Center for a Livable Future.
113. Ibid.
114. First National Pollution Census Office. (2009). Zhongguo Wunanyuan Pucha (National Pollution Source Census). Retrieved from <http://cpsc.mep.gov.cn/gwgg/>. (in Chinese).
115. See *Feeding China's Pigs*, Schneider, M. (2010, July 19). China's pollution census, manure and biogas [Blog post]. Retrieved from <http://www.iatp.org/blog/2010/07/chinas-pollution-census-manure-and-biogas>.
- Watts, J. (2010, February 9). Chinese farms cause more pollution than factories, says official survey. The Guardian. Retrieved from <http://www.guardian.co.uk/environment/2010/feb/09/china-farms-pollution>.
116. Langzhi et al. 2011. Land use change and environmental stress of wheat, rice and corn production in China. *China Economic Review* 22 (2011) 461–473.
117. <http://www.gracelinks.org/blog/3329/water-hogs-smithfield-pork-deal-trades-us-water-for-waste>.
118. <http://www.gracelinks.org/blog/3329/water-hogs-smithfield-pork-deal-trades-us-water-for-waste>.
119. <http://finance.fortune.cnn.com/2013/06/04/smithfield-china/>.
120. Armony, A.C. & Strauss, J.C., "From going out (*zou chuqu*) to arriving in (*desembarco*): Constructing a new field of inquiry in China-Latin America interactions," *The China Quarterly*, 2012, 209, 1-17.
121. "Chinese Agriculture Goes Global," Economic Observer, February 13, 2012, <http://farmlandgrab.org/post/view/20030> (accessed October 1, 2013).
122. See *Feeding China's Pigs*.