CHINESE RURAL VEHICLES: AN EXPLORATORY ANALYSIS OF TECHNOLOGY, ECONOMICS, INDUSTRIAL ORGANIZATION, ENERGY USE, EMISSIONS, AND POLICY

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Chinese Rural Vehicles

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Abstract

Over 3 million Chinese Rural Vehicles (CRVs) were produced in China in 2002, triple that of conventional cars and trucks. Yet these smaller, simpler, indigenous vehicles are virtually unknown outside China. The CRV industry is unusual in that it evolved largely outside the control of government regulation and policy, using local technology and resources. CRVs now consume one fourth of the diesel fuel in China and play an important role in rural development. This report is the first comprehensive assessment (in English or Chinese) of these vehicles and this remarkable industry. We document and analyze vehicle technology, government policy, environmental impacts, market demand, and industry dynamics. We find that increasing government regulation (mostly for emissions and safety) is having profound effects on the industry, with uncertain implications for the growth and globalization of CRV technology.

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1 Introduction

With the Chinese economy expanding 8-10% per year since the late 1970s, the Chinese government has turned to the auto industry to serve growing demand for travel and spur economic growth. It designated the automotive industry as a "pillar" industry of economic development in 1994, and later established a goal of widespread car ownership.[1] Intense effort has been devoted to engaging the international automotive industry.[2] Passenger car outputs are increasing rapidly, from 0.6 million in 2000 to 1.06 million in 2002.[3]

Virtually ignored, in striking contrast, are the even larger numbers of small 3-wheel (3-w) and 4-wheel (4-w) diesel-powered vehicles manufactured by domestic Chinese companies for use in small cities and rural areas. With virtually no governmental financial support, the production of these vehicles, which we refer to as Chinese rural vehicles (CRV), exceeded 3 million units per year in 1999.[4] The total CRV population reached about 22 million units in 2001.[5] The quality and sophistication of these vehicles vary greatly, but are on a steep upward trajectory. These vehicles emerged from the "walking tractors" of the Mao era. They range from simple 3-w vehicles with a one-cylinder diesel engine on a motorcycle frame costing US$300, to sophisticated small 4-w trucks exceeding US$5000.

In some ways, these vehicles are a Chinese analog to the Model T? The analogy is not perfect, though. The two experiences are premised on very different industry structures. The Model T was a set of models built on a single platform by a single company. CRVs are a proliferation of vehicle types built by a proliferation of companies. But the similarities are important. In both cases, the technology was simple and home-grown, and the target market was rural areas and small cities.

1.1 Defining CRVs

CRVs can be defined officially and functionally. Functionally, they are vehicles mostly used for goods transport that are smaller and slower than conventional cars and trucks, with simpler technology developed in China. Officially, the Chinese government treats

[1] The People's Republic of China, the 9th National People's Congress, China's Tenth Five-Year Plan (2001-2005) (in Chinese). Beijing: People's Daily, 2001.

[2] National Academy of Sciences and China Academy of Sciences, *Personal Cars and China*, National Academy Press, 2003 (also available in Chinese from China Academy of Sciences)

[3] According to the National Bureau of Statistics of China

[4] *The 2000 Chinese Automotive Industry Yearbook* (in Chinese)

[5] From available literature, the reported number varies from 20 to 22 million. From three government webpages, we found they use 22 million. See http://sdep.cei.gov.cn/envir_sub/source/af2002070301.htm, accessed on July 28, 2003 (in Chinese), http://qdnj.qingdao.gov.cn/department/nongji.nsf/0/140B87CBC8F135D048256C3F00329C13?OpenDocument, accessed on July 28, 2003 (in Chinese), and http://www.drccu.gov.cn/qcyhj/qchj/200211040390.htm, accessed on Aug 18, 2003 (in Chinese). We also consider the numbers 18 million for 1999 (http://www.cfm623.com/gg/nych.htm, accessed on Aug 19, 2003) and 20.3 million for 2000 (http://www.jsast.com/fx/qg/fxqglt2.htm, access on Aug 19, 2003) before we decide to cite the number of 22 million for 2001. Another supporting number is nearly 25 million as the CRV population by the end of 2002, http://www.amic.agri.gov.cn/pages/infopage.asp?ino=3757, accessed on Oct 8, 2003.

CRVs as part of the Chinese farm machinery industry, not the automotive industry. CRV is a specific official vehicle category with the Chinese name, Nong2yong4yun4shu1che1 or, for short, Nong2yong4che1, and technologically defined by an official government standard, *Technical requirements on safety for CRVs* (GB18320-2001). Later, we define CRVs more definitively.

CRVs are part of a spectrum of motorized vehicles produced and used in China. In rural areas, vehicle diversity is greatest. Motorized rural transportation technologies in China include CRVs, 3-w motorcycles, farm tractors, 2-w motorcycles, and mini gasoline trucks and diesel trucks, with CRVs, 3-w motorcycles, and tractors being most common.

More than 2 million tractors are sold each year in China, and they serve as an important means of rural transportation, but they are designed and used principally for farming. The annual output of 2-w motorcycles is far more than that of CRVs or tractors,[6] but 2-w motorcycles are mainly exported or sold in large or mid-scale cities, while CRVs are more concentrated in rural areas and small cities. 3-w motorcycles are common in some rural areas, but most seem to be illegally produced, and the number of 3-w motorcycles and their makers are difficult to discern.[7] We find, based on personal observation, vehicle data, and scattered literature, that CRVs dominate rural transportation in China, with strong advantages in price and general utility.[8]

The CRV industry, Chinese motorcycle industry, and Chinese automotive industry are quite distinct in terms of ownership and government regulation, though this is likely to change over time.

1.2 Question and Motivation

The emergence of this CRV industry raises the following questions, which we address in this report:

1) Using indigenous technology, might this domestic industry complement, supplant, or combine with the better endowed international automotive companies now entering the Chinese car market – perhaps even becoming major exporters?
2) To what extent will these vehicles and this industry continue to play a central role in China's rural development?
3) How serious are the adverse environmental and energy impacts of these simple vehicles?
4) What are the distinctive features of the CRV industry, in terms of policy enforcement and consumer behavior, which cause the complexity and confusions?

[6] During the year 2002, nearly 13 million motorcycles were produced in China and 3.44 million were exported. China became the No.1 for motorcycle production and No.2 for motorcycle exportation. See http://www.china.com.cn/chinese/EC-c/408380.htm, accessed on Oct 7, 2003 (in Chinese)

[7] One article (http://www.newsmotor.com/mtzy2002/motor3/sczj2.htm, in Chinese) describes the chaos of 3-w motorcycle production in China, which can be verified by our experience (interview #31). According to that article, most 3-w motorcycles sold to rural areas are illegally produced.

[8] For example, see Y. Chen, "Market is more important than technology for automotive industry development", http://www.e-works.net.cn/ewkArticles/Category116/Article13166.htm, accessed on Oct 7, 2003 (in Chinese)

This report is the first comprehensive assessment (in English or Chinese) of these vehicles and this remarkable industry. We document and analyze vehicle technology, government policy, environmental impacts, market demand, and industry dynamics. We explore the trend of increasing government regulation, and its impact on industry concentration and globalization.

1.3 Research Approach and Data Sources

The available English language literature contains limited information about China's CRVs (indeed, there is not even an accepted English name for this group of vehicles). Almost nothing is available regarding energy use and emissions, the nature of the industry, nor the effects of these vehicles on rural development. In August 2002, Peter Hamilton, a graduate student at UC Davis, traveled to China to gather further information. In China, he was assisted primarily by Zhenhong Lin (an incoming graduate student at that time still resident in China) and Haifeng Yu, who served as colleagues and interpreters. Emeritus Professor Zheng Liu of Tsinghua University provided expert assistance on technology, and Hanming Huang of the Chinese Economic Information Network provided invaluable assistance in accessing government data and troves of information found on various web sites.

During the trip to China over 100 Chinese farmers and CRV users were interviewed, and the two largest CRV manufacturers visited. All interviews and the trip reports are summarized in Appendix A. Interviews are cited in the text (as "trip note xx").

2 Evolution of CRVs

The concept of inexpensive CRVs is compelling. Rural areas tend to be less affluent than urban areas, and have distinct transport needs. High quality vehicles built to high standards of performance, comfort, and reliability by global companies, and at high cost, may not be most appropriate. Yet, China appears to be the only country in the world with a large rural vehicle manufacturing industry.[9] To some extent this was true in the United States with the Model T. Henry Ford designed that vehicle with the needs of farmers and rural residents in mind.[10] The Model T was designed to navigate muddy and poor quality roads, to be easily repaired with minimal tools and parts, and to carry goods as well as people. In contrast to CRVs, the Model T was practically the sole product for the rural transport market in the United States from 1909 thru the 1920s, and eventually was supplanted by more expensive and sophisticated vehicles for passenger and goods movement, and more specialized vehicles for farm use.

2.1 Indigenous Efforts Elsewhere

There have been various indigenous efforts elsewhere in the world, apart from the Model T, to produce vehicles appropriate to rural needs, which we denote as "rural vehicles" (RVs). We briefly review experiences in other countries, both developed and developing, since they may provide insight and context for assessing the future of the CRV industry.

In developed countries, motorization of rural transportation accompanies agricultural mechanization and generally follows one of four pathways.[11]

- Transformation of farm tractors into RVs
- Transformation of automotive vehicles into RVs
- Development of versatile RVs that can serve as either farm tractors or automotive vehicles
- Development of sophisticated 3-w RVs with similar but more advanced designs than 3-w CRVs

Since World War II, industrialized countries with their advanced automotive industries have largely used conventional passenger cars and trucks for rural transportation outside farms. The large economies of scale kept costs low and discouraged the introduction of a new category of RVs. The market for RVs in these countries remains small, mainly targeted at off-road infra-farm transportation.

The story in developing countries is quite different due to low income of rural households, lower technology expectations, and poor road conditions. Price becomes a prime factor in terms of customer acceptance. Experience shows that demand for

[9] Motorized vehicles for rural transportation can be seen in other developing countries, but they are either modified motorcycles or stripped-down versions of conventional cars and trucks.

[10] Frontenac Motor Company, The Ford Model T: A Short History of Ford's Innovation, http://www.modelt.ca/background-fs.html, accessed on Oct 7, 2003

[11] Y. Zhao, *A Brief Introduction To The Development Of Foreign CRVs*, Agricultural machinery 2000 supplement, p 9-11 (in Chinese)

sophisticated, versatile and costly RVs is limited in these countries. RVs coexist with animal-drawn carts, human-powered 3-w vehicles, motorcycles, and farm tractors, with the relative mix of vehicles varying greatly among different countries. In Thailand, human-powered 3-wheelers and motorcycles account for 85% of vehicles in rural areas, while in India, most vehicles in rural areas are animal-drawn carts and small tractors pulling trailers, due to the low level of Indian agricultural mechanization and poor road conditions. In comparison, rural road conditions in the Philippines are much better and vehicles tend to have speed and technology attributes more similar to conventional cars. The Asia Utility Vehicle (AUV) is a competitive rural vehicle with prices lower than those of cars. The yearly output of this model was 206,000 units in the early 1990s. [12]

An indigenous RV industry emerged in Crete (a Greek island with a half million people at the time), with many parallels to the CRV industry, though on a smaller scale.[13] Largely isolated from the international automotive markets, local repair and machine shops began building small RVs using imported engines. The rest of the 3-w vehicles they built with local parts. Within a few years, in the 1970s, about 20 factories were building a total of several thousand vehicles per year.

The local Crete industry failed rather abruptly, however, when tariff barriers were reduced and international automotive companies swamped the island with more sophisticated pickup trucks. By 1982, only 8 companies were left. One of the last companies left, Regina, saw its sales drop from 250 in 1976 to 40 in 1983. But Dr. Meier, who chronicled the rise and fall of the Crete CRV industry, notes that the failure was also due to the failure of small shops to organize into full-scale businesses, as well as the rapid rise in farmer wealth at that time.[14] As indicated later, the Chinese RV industry appears to have overcome the challenge of growing into full-scale businesses, but may still be threatened by outside competition.

The conditions under which the CRV industry has evolved differ in some important respects with these other national RV industries:

- China's economy was largely closed to outside technology and investments during the CRV rapid growth period.
- Economic growth was rapid and sustained for an extended time from the 1970s onward.
- The population base was huge, the income of rural households was low and the government was sensitive to rural issues.[15]

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[12] Y. Zhao, *A Brief Introduction To The Development Of Foreign CRVs*, Agricultural machinery 2000 supplement, p 9-11 (in Chinese)

[13] Alan Meier, The Broader Consequences of Improved Rural Transport: Three-Wheeled Vehicles in Crete. Lawrence Berkeley Laboratory, May 1979, LBL-9076. The author wrote a later unpublished "1983 Addendum" in which he told how the industry died.

[14] Ibid.

[15] Although economic conditions of rural areas have improved since 1950s, the economic gap between rural and urban areas have been increasing since 1970s. The poor living conditions of most farmers and their lack of access to many modern services has been widely reported, and are a continuing issue for the Chinese government.

- During this period, building a car industry drew most of the attention even though CRVs are privately owned.[16]
- Ambiguous CRV policies have long existed.

The CRV industry is probably not replicable. But important lessons can be learned from this experience. Importantly, there may still be an important role for this industry to play, not only in China but also as an exporter to other countries.

2.2 Organization and Development of CRV Industry

The roots of the CRV industry date to early efforts of the Communist government to aid rural development. In the 1960s, "Commune and Brigade Enterprises" (CBEs) were organized to stimulate industrial activity in the poverty-stricken rural areas of the country.[17] These communal enterprises evolved in the late 1970s and 1980s into Township Village Enterprises (TVEs). TVEs were not privately owned but were allowed to operate similarly to profit-seeking businesses.[18] The increasingly market-friendly central government realized the value of the TVEs and encouraged their development with public pronouncements and tax incentives. Since 1984, TVE ownership has been shifting from cooperative to private ownership.[19] The central government's recent focus on market liberalization led to privatization of TVEs, greatly increasing pressure for TVEs to succeed without government assistance. In response, some TVEs have developed new products or emulated successful products of others.

Many Chinese TVEs evolved into modern, privately owned and innovative firms. TVE output grew 25 percent per year on average from 1980 to 1995. Zhang reports that "By 1995, TVEs accounted for approximately a quarter of China's GDP, two-thirds of the total rural output, 45 percent of the gross industrial output, and more than one-third of China's export earnings."[20] It is the TVE that gave China the industrial capacity to build the CRV manufacturing industry with products designed for local needs.

The rapid economic growth in rural areas, together with the evolution of large rural-based enterprises, played important roles in the expanding CRV market. The rapid economic growth created demand for transportation – of both goods and people – and the evolution of CBEs and TVEs into large businesses provided the organizational basis for increasingly sophisticated manufacturing.

The growing demand for transport began attracting the interest of the large government-run automotive and agricultural machinery industries in the mid and late 1990s. Automotive businesses proposed serving this rural demand using existing light-duty truck

[16] Eric Harwit, *China's Automobile Industry: Policies, Problems, and Prospects,* M.E. Sharpe, Inc., 2003
[17] Zhang, Zhihong, *Rural Industrialization in China: From Backyard Furnaces to Township and Village Enterprises.* East Asia, Autumn 1999.
[18] Karen Fisher-Vanden, *Management structure and technology diffusion in Chinese state-owned enterprises*. Energy Policy, v31, 2003
[19] Zhang, Zhihong, *Rural Industrialization in China: From Backyard Furnaces to Township and Village Enterprises.* East Asia, Autumn 1999.
[20] Zhang, Zhihong, *Rural Industrialization in China: From Backyard Furnaces to Township and Village Enterprises.* East Asia, Autumn 1999.

technology, inserting diesel engines in place of gasoline, and the agricultural machinery sector proposed the development of small tractors with trailers. Neither proposal succeeded. Meanwhile, the local CBEs and TVEs, who better understood farmer needs, designed and produced unique CRVs without any financial support from the government.

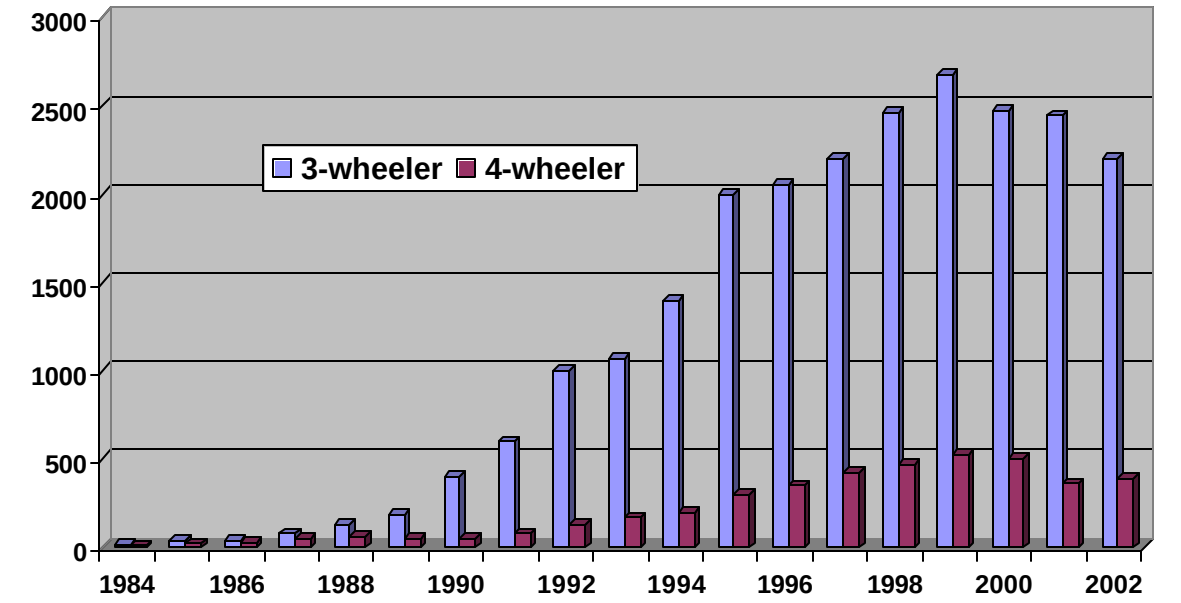
These small enterprises flourished largely independent of national and provincial governments. They were disadvantaged in receiving little (if any) financial support, but the flip side was little regulation or intervention. The success of these small enterprises is attributed in part to their close connection with their customers – producing inexpensive vehicles designed for local work needs.

One senior expert of the Chinese automotive industry said: "Our biggest mistake in understanding the Chinese automotive market is that we did not expect that the CRV industry can develop into such a good condition today all by itself without one cent from the government."[21] (Here he views the CRV market as part of the Chinese automotive market.)

The history of the CRV industry can be divided into three periods, as suggested by Figure 2-1:

- Expansion of small rural collectives and enterprises in the 1980s
- Shift to private ownership and rapid economic growth in late 1980s and 1990s
- Industry stabilization in 2000 to present

Figure 2-1: CRV Production (in Thousands), 1984-2002



Sources: Data through 1998 are from GM (2001). Data for 1999-00 are from the 2000 Chinese Automotive Industry Yearbook (2000), and for 2001-02 from China Machinery Economic Information (2002).

[21] L. Li, *Can The Auto Industry Counterattack The CRV Industry?*, http://www.auto-society.com.cn/forum/qita/sc3.htm, accessed on June 16, 2003 (in Chinese)

The CRV industry is maturing steadily – in terms of organizational sophistication and technology. In the early years of the CRV industry, the technology was crude and produced in small quantities. The focus was on market exploration, institution-building, and skill development. The ratio of 3-w CRVs to 4-w was about 6:4. Total yearly output for the country reached only 64,000 in 1986. It was not until the late 1980s that growth began to accelerate.

Production reached 1.1 million in 1992, and 2.3 million in 1995. Average growth exceeded 50% per year during this period. The production of 3-w CRVs far exceeded 4-w CRVs. The CRV industry became the most valuable part of the Chinese agricultural machinery industry, with yearly sales growing from 1.3 billion RMB (US$157.4 million) to 23 billion RMB (US$2.78 billion) during this period.

Growth continued after 1995, but at a more moderate rate, and in 2000 to 2002, it declined. After peaking at 3.2 million in 1999, production dropped about 7% per year from 2000 to 2002. Sales of the more expensive and sophisticated 4-w CRVs recovered in 2002 and posted a 7% gain in sales. As indicated later in the report, the declining production appears to be largely attributable to increasing government regulation and intervention – reducing the profitability and viability of the less sophisticated products.

A critical factor is research and development. Currently, CRV enterprises invest very little in R&D – averaging less than 1% of revenue – and most of that is devoted to slight upgrades in models year to year. In contrast, major automotive companies typically spend 4-5% of revenue on R&D,[22] with revenue streams of tens of billions of dollars. (Honda is among the smaller international automakers, and still has annual revenues over $50 billion.)

The future evolution of the industry is quite uncertain. It is widely believed that because 4-w CRVs tend to be more technically sophisticated than 3-w CRVs, they will be the vehicle of the future for rural China, and that the more primitive 3-w CRVs will slowly disappear. The logic behind this statement appears suspect. While China has been growing rapidly, the vast majority of rural Chinese cannot afford even the cheapest 3-w CRVs. Nevertheless, as the Chinese central government becomes more involved in regulation and oversight of this industry, this perception could become a self-fulfilling prophecy. The government can adopt rules and policies – for emissions, energy use, noise, performance, minimum payload, and allowable hours and places of operation – that effectively destroy the market for 3-w vehicles. Note that production of 4-w CRVs increased in 2002, while the simpler 3-w CRVs continued to decrease.

The question, then, is how aggressively governments will intervene in the development, marketing, and use of the technology, and how this indigenous industry will respond. Will it continue to upgrade product quality, gradually competing against automotive manufacturers, or will it retrench as low-cost vehicle suppliers? Will it fragment? Will it

[22] National Academy of Sciences and China Academy of Sciences, *Personal Cars and China*, National Academy Press, 2003 (also available in Chinese from China Academy of Sciences)

tie in more closely with larger conventional vehicle manufacturers? We address these questions later.

In the following section we trace the development of CRV technology in China, and document the current state of technology.

2.3 Technology Evolution and Development

As indicated above, the evolution of CRV technology in China followed a natural economic and technological pattern. The earliest motorized vehicles in rural China appeared in the 1950s. They were small tractors pulling small trailers. Then small 3-w vehicles followed, based first on simple motorcycle technology and more recently on more advanced non-motorcycle designs. Now more sophisticated small 4-w vehicles are being produced, some approaching international standards for small trucks (similar to mini-trucks produced in Japan). CRVs were designed for carrying goods, not people – although people are often squeezed into or piled on the vehicles. Only in recent years has passenger transportation gained some attention from the vehicle designers and manufacturers, but the overwhelming use of these vehicles continues to be goods movement.

The technology evolved with only minimal technology transfer from outside China. Simple motorcycle technology was brought to China from Germany in the 1950s[23] for military application and later from Japan for civil purposes. A flourishing motorcycle industry emerged in China that now accounts for half of all the motorcycles produced in the world, though they are much smaller and less expensive (mostly less than 125 cc) than those sold in more affluent countries. This technology was the core for early 3-w CRVs in China. But since then, CRV technology has been almost wholly developed by local Chinese enterprises.

[23] *The First Homemade Motorcycle In China*,
http://www.chinamotorcycle.com/motoliker/detail.asp?id=19, accessed on Sep 12, 2003

3 CRV Technology Today

3.1 Engine Technology

About 80% of the 22 million CRVs are powered by single-cylinder diesel engines originally designed for stationary agricultural machinery.[24] These one-cylinder engines are very inefficient, especially in mobile applications, and produce large amounts of pollutants and GHG emissions. While reliable data do not exist, Chinese sources suggest that the average emissions per unit of energy consumed by a CRV are twice those of an uncontrolled diesel truck[25] and those of a CRV with one-cylinder engine are even much worse.

The preference for single-cylinder diesel engines lies in technology, economics and policy. Diesel fuel is safer than gasoline, and less prone to explode and burn. Diesel engines are also easier to maintain, and operate satisfactorily on poor quality fuels. With minimal mechanical skills, farmers can deal with the problems of the injection pump, the principal source of diesel engine problems. In contrast, common maintenance problems with gasoline engines are related to carburetors and ignition systems, which require considerably more skills. Diesel engines are also easier to manufacture. In the 1970s and early 1980s, the only available small engines were single-cylinder diesel engines widely used for walking tractors. Farmers themselves can even produce these single-cylinder diesel engines. When CRVs became popular in 1980s, many counties had their own single-cylinder diesel engine factory. One province could have tens of such factories.[26] Perhaps most important has been fuel costs. Diesel engines use less fuel because they are 20-30% more energy efficient than comparable gasoline engines. Also, diesel fuel used for rural applications in China was priced 1/3 to 1/2 that of gasoline prices until the 1980s, though gasoline and diesel prices have long been similar due to policy changes in the mid-1980s.[27]

The difference in engine technology between today's 3-w and 4-w vehicles is great. As indicated in Figure 3-1, almost all 3-w CRVs use single-cylinder diesel engines, while many of the 4-w CRVs use larger and more sophisticated engines. Model 195 and model 1100 are two common engine models for CRVs (see Appendix D for typical technical specifications). In many ways, it is the CRV engine industry that suffers the brunt of increasingly stringent CRV emission standards.

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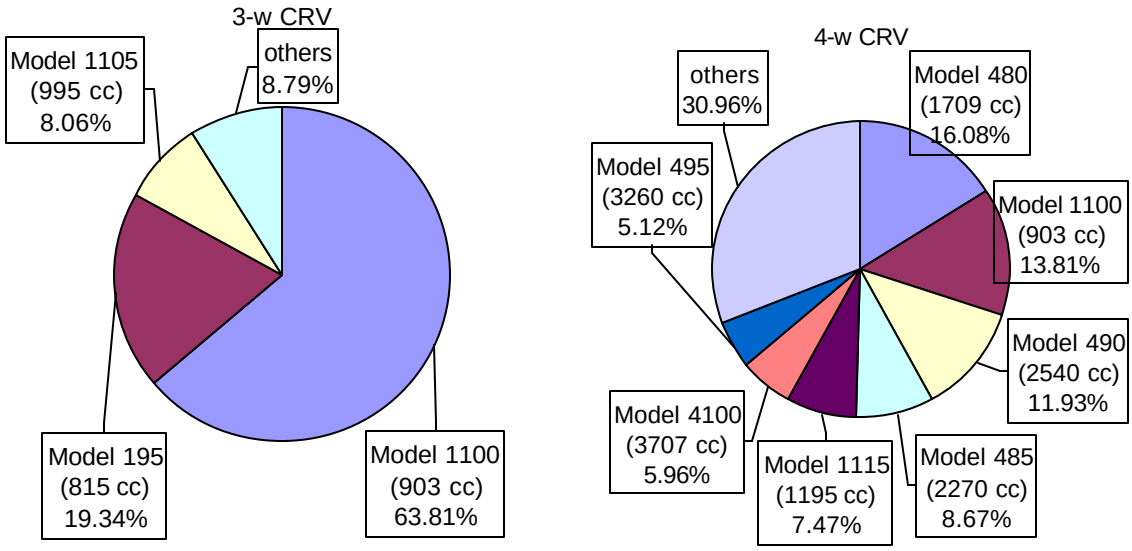
[24] China Agricultural Resources Network, *The Small Diesel Engine Industry Needs Technology Breakthrough*, http://sdnj.gov.cn/data/2002/tg/1115214.htm, accessed on June 17, 2003 (in Chinese)
[25] China Agricultural Resources Network, *The Small Diesel Engine Industry Needs Technology Breakthrough*, http://sdnj.gov.cn/data/2002/tg/1115214.htm, accessed on June 17, 2003 (in Chinese)
[26] According to phone interview with Prof. Zheng Liu on Jul 3, 2003
[27] *Notification about the Approval by PRC State Council on the Proposal of Abolishing Allowance Policy for Rural Diesel Consumption,* http://www.china-njx.com/zcfg/040.htm, accessed on July 23, 2003 (in Chinese)

Figure 3-1: Engine Model Distribution of CRVs Produced the 1st Quarter of 2000[28]



The Chinese government is beginning to pursue aggressive policies to reduce emissions from motor vehicles. In 2002, the government announced that by 2004 diesel trucks must meet standards equivalent to the EURO 2 standards[29] (that had taken effect in the European Union in 1996) and CRVs must meet the equivalent of EURO 1 standards by 2005[30] (effective in European Union in 1993). A more lax version of these rules applies to the CRVs, but even so they present a huge challenge for the CRV industry. It is uncertain how this will play out. Certainly the standards create pressure for CRV companies to consolidate to support enhanced engine and emissions R&D, as well as seek investment and expertise from international car makers and parts suppliers. Indeed, that process has begun, with the largest CRV company (Shifeng) forming a joint venture with a large agricultural machinery company (Yanmar) in June 2003.[31]

3.2 3-w CRV

3-w CRVs are available in a variety of sizes. The least expensive (~US$300) are small open-cabin single-seat vehicles with motorcycle handlebar, hand-crank starting, and 3-speed (plus reverse) transmission. The most sophisticated 3-w CRVs have closed, car-like cabins with steering wheel and radio/cassette player, electric starting, dumping capability (for the cargo bed on the back of the vehicle), and a low-range gearbox that complements the standard 3-speed transmission. Fully equipped, top-of-the-line models cost up to US$2200. Between these extremes are vehicles with almost every conceivable combination of features. Most 3-w vehicles have the following attributes:

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[28] Displacement of each model might vary due to slight variation of stroke.

[29] China Environment News, *Chinese Diesel Motor Vehicles Heading for Euro 2*, http://www.envir.gov.cn/info/2003/3/325119.htm, accessed on 7/12/03 (in Chinese)

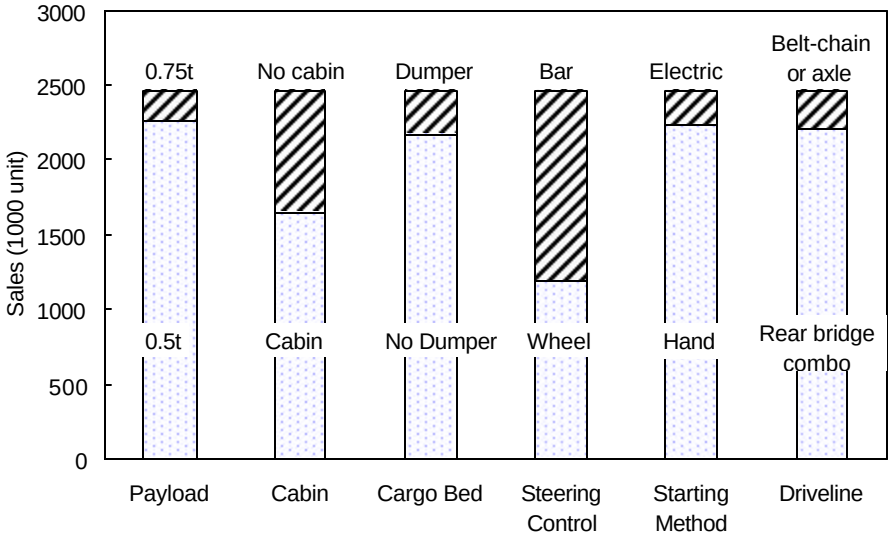
[30] X. Hu, *Market Can't Compete With Environmental Protection*, http://www.qiche.com.cn/files/200204/02048.html, accessed on June 26, 2003 (in Chinese)

[31] YANMAR Co., Ltd, *Yanmar Agrees to Establish a Joint Venture with Shandong Shifeng Group, China's Largest Farm Vehicle Manufacturer* , http://www.yanmar.co.jp/english/aboutus/whats-new/news/0301/conts01.htm, accessed on June 19, 2003

- one-cylinder diesel engine
- 12 to 15 horsepower
- Evaporative water-cooling (no water pump)
- Belt drive from engine to transmission, mounted on rear axle
- Payload capacity of 500kg (though vehicles are often overloaded)
- Top speed of 50 km/hr (specified by law)

The up-scale vehicles have enclosed cabins, powered dumping capabilities (for cargo bed), steering wheels, electric starters, axle or transmission-mounted rear axle. But these features are more expensive and therefore less common, as indicated in Figure 3-2.

Figure 3-2: 3-w CRV Sales in 2000 by Vehicle Attribute



3.3 4-w CRVs

4-w CRVs are generally faster, quieter, more powerful, comfortable, and expensive, but have only slightly greater payload capacity, according to the declared product data. Prices can vary from as little as $600 to as much as $5,400. See Appendix C for detailed prices and specifications. Most 4-w CRVs share the following characteristics (see Figure 3-3):

- Single- or multi-cylinder indigenous diesel engines
- 20 to 35 horsepower
- Steering wheel
- Fully enclosed, car-like cabin
- 500 kg payload capacity (but many have considerably greater capacity)
- 70 km/hr legal top speed
- Modern appearance, similar to a small light-duty truck
- Manual dumper
- One bench seat

As with 3-w CRVs, the most popular 4-w CRVs are those that are simpler and less expensive – with manual dumping capabilities and one bench seat (see Figure 3-4).

Figure 3-3: Sales of Open-cargo bed 4-w CRV in 2000 by Attribute

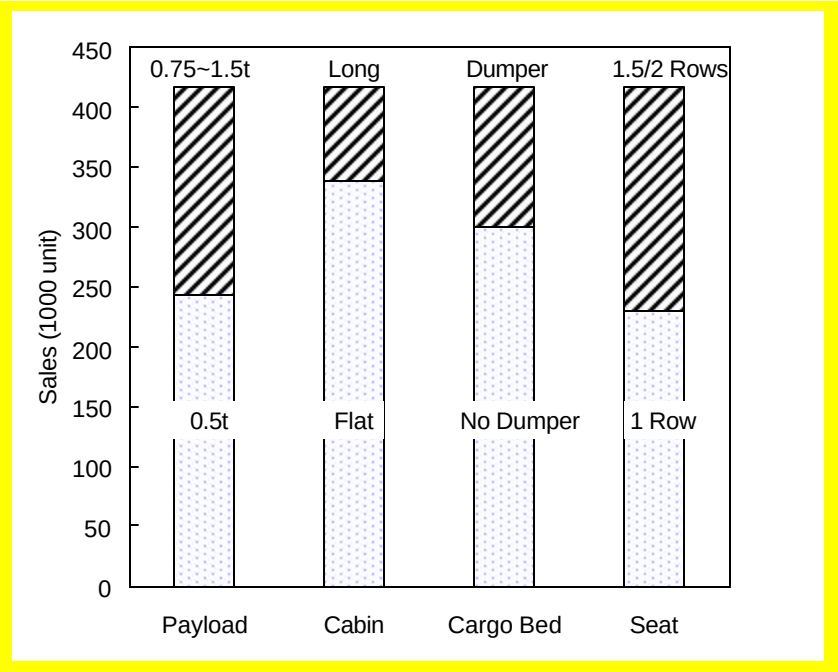


Figure 3-4: Typical 4-w CRV

4 CRV Industry Today

4.1 Industry Consolidation

The CRV industry is consolidating. In only one year, from 2001 to 2002, the number of registered CRV manufacturers dropped from 204 to 120, although it is believed that many of those no longer registered are still in business. In any case, the market shares of the ten largest is increasing. The top ten 3-w manufacturers increased their share from 59.5% to 65% from 2001 to 2002, and the top ten 4-w manufacturers increased their share from 93% to 96% (see Appendix E). Two companies, Shifeng and Juli, accounted for 61% of the 3-w CRV market.

The government appears to favor consolidation of the CRV industry, as well as the automotive industry,[32] as a means of creating companies with greater resources and greater capability to develop and adopt advanced technologies, including emissions control. The large number of companies in the CRV industry, ranging from small backyard shops to large industrial enterprises, is indicative of low entry barriers that have existed in this industry – in terms of capital investment and government licensing and rules. With low entry barriers, the industry has been highly competitive and focused on small and inexpensive vehicles. Price competition is severe, with strong downward pressure on prices. Until recently, there were few incentives to invest in advanced technology, especially for attributes such as reduced emissions that do not add much to consumer-perceived utility.

The new emission standards and policies being adopted by the central government, if aggressively enforced will undoubtedly lead to further consolidation, with small CRV manufacturers and those with poor vehicle quality and no R&D capability disappearing. In early 2003, Yanmar Co., Ltd., a Japanese company specializing in diesel engines, and Shandong Shifeng Group Co., Ltd established a joint venture to produce and market single-cylinder diesel engines that comply with new CRV emission regulations. The engines will be used in Shifeng vehicles, but will also be supplied to other 3-w CRV makers. It remains to be seen how this collaboration will play out in terms of the health of the industry, the creation of a supplier industry, and the industry's responsiveness to the low end of the market.

The potential transformation of the 4-w CRV industry is more complex, in part because the products overlap with those of conventional vehicle manufacturers. A key to understanding recent changes is the catalogue administration process for the automotive industry.

In the post-Mao 1980s era, as the country began building its industrial capability, it was believed that there was a need to "stem the mushroom-like proliferation of vehicle factories" and consolidate these "small but complete" factories.[33] The use of the catalogue registration process was a mechanism for doing so.

[32] Eric Harwit, *China's Automobile Industry: Policies, Problems, and Prospects,* M.E. Sharpe, Inc., 2003
[33] Eric Harwit, *China's Automobile Industry: Policies, Problems, and Prospects,* M.E. Sharpe, Inc., 2003

Catalogue registration has come to play a key role in the Chinese automotive industry. If a company wants to enter the business, it must expend considerable time and money to gain a catalogue entry. An appealing strategy has been to buy or join an already listed company. Shandong Zhucheng Motor Vehicle Factory (SZMVF), a former major 4-w CRV maker, succeeded in this by indirectly co-founding and joning Beiqi Futian. In 1996, Beiqi Futian was founded by consolidating over 100 companies, one of which, Beiqi Motocycle, was a joint venture of the Beijing Automobile Factory (BAF) and SZMVF. BAF was an automaker in Beijing and had an entry of the catalogue. When the CRV market became more competitive and less profitable, the joint venture Beiqi Futian started in 1999 producing light-duty trucks as well as 4-w CRVs. By 2002, Beiqi Futian was the largest light-duty truck maker in China, with annual sales of 130,000 and 40% of the market. Shifeng's general manager remarked, "The current yearly light-duty truck output of Beiqi Futian is about 100,000. Shifeng sold 60,000 4-w CRVs in 2002, which were manufactured by standards for light-duty trucks. Should we have the auto catalogue entry, they would be light-duty trucks as well."[34] This observation points out the technological overlap between 4-w CRVs and light duty trucks. The distinction mainly lies in policy, i.e., the two types of vehicles face different regulations. CRV companies such as Shifeng, producing sophisticated 4-w CRVs, are eager to enter the automotive industry, which they perceive as bing more profitable. In 2002, Shifeng ventured into the auto industry by buying Yantai Motor Vehicle Factory, which had a catalogue entry.

4.2 Product Quality

The CRV industry is highly competitive – but competition has been more on price than quality. In a 2002 survey of CRV product quality conducted by the China General Administration of Quality Supervision, Inspection and Quarantine, less than 70% of all CRVs achieved the minimum standard, and only 11.8% of "transformed tractors" (a special category of small 4-w CRVs described later). In Henan province, none of the CRVs met the minimum quality standard. In contrast, a survey of automobiles conducted by the same governmental department found that 100% qualified.[35] Another indication that competition is based more on price than quality is the low number of patents. From 1996 to 2000, only 185 patents were granted to 16 CRV makers. Most of these related to design features; only 3% of this already small number of patents was for inventions.[36] These very unsatisfactory numbers for CRVs can partly be explained by the recent tightening of product quality standards and the fact that standards are linked to oft-ignored legal specifications (such as maximum speed). In any case, CRVs are widely viewed as having low reliability and quality.

[34] F. Xu, N. Wang, *Shifeng Bought Shuangxing to compete Beiqi Futian*, http://www.qiche.com.cn/files/200303/07007.html, accessed on June 19, 2003 (in Chinese)

[35] Eight products from eight producers were surveyed. These eight producers' outputs shared 91% of the total output of automobiles in 2001. http://www.people.com.cn/GB/jinji/32/178/20010618/490764.html, accessed on July 8, 2003 (in Chinese)

[36] X. Hu, *Market Can't Compete With Environmental Protection*, http://www.qiche.com.cn/files/200204/02048.html, accessed on June 26, 2003 (in Chinese)

The national government has been aware of CRV quality problems for many years. In 1993, the State Bureau of Quality and Technical Supervision and the previous State Machinery Industry Bureau conducted several investigations of vehicle and part quality, and adopted technical specifications for safety and emissions.[37]

This failure of most CRVs to comply with national standards is partly due to lack of enforcement, poor quality control inside the CRV companies, intense price competition that leads to use of inferior parts, and minimal or absent R&D activities. Many vehicle manufacturers and parts suppliers are very small with poor manufacturing equipment and capability. They produce low quality engines that generate considerable pollution and are relatively energy inefficient.

The predominant quality problems found in those governmental examinations were related to safety, including malfunctioning safety signals, top speeds that exceeded legal limits (for the respective vehicle class), and fuel system integrity. Other defects related to noise and smoke.[38]

It is interesting that CRV users currently define and value quality somewhat differently from the government. In interviews of users conducted by two of our co-authors during August 2002, CRV users reported a range of experiences with respect to reliability. Some had owned vehicles for many years, driven long distances, and had no problems. Others reported numerous problems in only two or three years of ownership. Problem areas included clutches, bearings, tires and wheels, lighting, and drive belts. The drive belts appear to be the most common maintenance item for CRVs. Many people replace the belts themselves once per year as a preventative matter, at a cost of about RMB35 (4 USD) in parts. Many CRV owners reported that, apart from the drive belt, they would not routinely maintain the vehicle. Minor problems, including safety equipment such as lighting and mirrors, were mostly ignored unless they affected vehicle operation.

4.3 Manufacturer Profiles

Most of the CRV manufacturers are small backyard operations, but a few are sophisticated industrial companies. Three of the largest CRV companies – Shandong Shifeng, Shandong Juli, and Beijing Futian – are profiled in Table 4-1. They operate enormous manufacturing facilities, with moving assembly lines and diverse product offerings, and are building extensive R&D capabilities. Their products range from primitive 2-wheel walking tractors to small trucks.

[37] *The Quality Condition of CRVs*, The 2000 Chinese Automotive Industry Yearbook
[38] Wuhan Agricultural machinery Information Network, *Explanation for the Low Ratio of Qualified Number of CRVs*, http://sdnj.gov.cn/data/2003/02/02059.htm, accessed on June 18, 2003 (in Chinese)

Table 4-1: Profiles of Major CRV Manufacturers

	Shandong Shifeng	Shandong Juli	Beijing Futian
Location	Liao Cheng	Weifeng	Zhucheng[39]
Employees	28,000	8,000	N.A.
Production cap.	1,000,000	600,000	200,000
Area	250 acres	Much smaller	(Not visited)
Ownership	State-owned TVE	Publicly traded	Publicly traded
Main product	3-w CRV	3-w CRV	4-w CRV, LD-truck

Source: Company literature and on-site interviews.

The largest and most sophisticated CRV companies are modern engineering and manufacturing firms. Shandong Shifeng Group has been the leading CRV manufacturer since 1996. It has over 28,000 employees, produces CRVs, farm tractors, and engines, and also owns wine, hotel, transportation, vehicle parts, and oil companies. It has a manufacturing capacity of 1 million 3-w CRVs, 0.2 million 4-w CRVs, 1.3 million engines, and 0.3 million farm tractors. In 2002, the group produced 0.87 million 3-w CRVs, 60,000 4-w CRVs, 1.01 million engines, and 188,000 tractors, with 6.8 billion RMB in sales (US$823 million) and 400 million RMB (US$48 million) profit. Its R&D division has 1200 technical employees, and a large computer-aided-design (CAD) capability. Shifeng has exported CRVs to more than 50 countries.[40]

Beiqi Futian Automobile Co., Ltd. was founded in August 1996 by combining more than 100 small enterprises. By 2003, the company expanded its capitalization from the original RMB0.14 billion to RMB3.5 billion in 2003, and increased its employees from 4600 to 15,000. The company is engaged in the automotive, agricultural, construction, and finance industries. It produces a wide range of products, including motors, engines, tractors, reaping machines, chemicals, and lightweight steel construction materials, as well as CRVs. Beiqi Futian has a yearly production capacity of 160,000 4-w CRVs, 60,000 3-w CRVs, 10,000 reaping machines, and 60,000 engines. Beiqi Futian is politically well connected; it is among the 520 key national enterprises designated by the government, one of five key pilot enterprises of Beijing, and a key supported enterprise of Beijing.[41] A company brochure states that the company has invested 2 to 3 per cent of gross profit each year in R&D.

Shandong Juli Group Co., Ltd has a production capacity of 600,000 3-w CRVs and 40,000 4-w CRVs, and has been listed as one of China's One Hundred Best Engineering Enterprises. It has a sales team of 1280, a sales network of 900 offices, and a national vehicle service network. Juli markets CRVs throughout the country and exports to over

[39] Zhucheng is mainly where Beijing Futian produce 4-w CRVs.
[40] the company's website, http://www.shifeng.com.cn/info/introduce.asp?infoTypeID=10072001&infoID=1000000013, accessed on April 6, 2003 (in Chinese)
[41] The company's website, http://www.futian.com.cn/ebusiness/en/index.asp, accessed on June 23, 2003 (in Chinese)

20 foreign countries. It has a large province-level enterprise R&D and CAD center and applies international quality management protocol.[42]

Senior executives at Shifeng and Juli indicated that they had no plans to compete with western auto manufacturers. Instead, they focused on low-cost vehicles. Beiqi Futian, on the other hand, is focusing on the light-duty truck market, and may soon find itself competing with similar products offered by foreign firms. Both Shifeng and Juli expressed interest in producing gasoline-powered vehicles, as a response to tightening emission standards.

4.4 Dealerships, Service and Warranty

Most CRV dealerships are independent, and receive a sales commission from the manufacturer for vehicles sold. In addition to sales, dealerships are expected to provide support, including after-sale service. The government requires detailed warranties for all CRV sales. Warranties are complex and specific, covering each part of the vehicle for a specified period of time. Generally, parts and labor are covered for one year, and labor is free thereafter. Service is generally available from any licensed dealer, not just where the purchase was made. The low quality of CRVs, the high cost of this warranty requirement, and the need to provide a network of service facilities encourages industry consolidation.

4.5 Safety

Lax enforcement of vehicle and transportation regulations and primitive vehicle designs inevitably results in large numbers of traffic accidents. Many local governments ban CRVs from urban streets and intercity roads, in large part because they are perceived to be high polluters and unsafe. Traffic crash statistics, however, do not support this governmental assertion about CRV safety. Data published by the Transportation Administration Bureau of the Ministry of Public Security indicates that CRVs were involved in only 4.9% of all traffic crashes in China (compared to 74.5% for cars, 12.9% for motorcycles, and 5.3% for tractors). Fatality data tells a similar story, with CRVs having a death rate per 10,000 vehicles of 4.36, versus 42.14 for cars, 6.26 for motorcycles, and 4.84 for tractors. [43] The low crash and especially fatality rates for CRVs is presumably due to their low speeds and their use on lightly traveled roads. It may also be that rural crashes tend to be less reported than crashes in urban areas.

In any case, there are many opportunities to improve the safety of CRVs, especially by improving braking and steering. Given that many drivers do not have formal driving training, efforts to enhance (or require) minimal driver skills would also improve safety. Enforcement of rules in rural areas can be difficult. Many local governments impose simplistic but easy to enforce rules: they prohibit CRVs on many streets and roads, and prohibit their use for passenger transportation. These rules dampen CRV demand.

[42] The company's website, http://www.chinajuli.com, accessed on June 23, 2003 (in Chinese)
[43] Z. Lu, *Development and Prospect of Rural Vehicles*, J. of Factory Construction and Design, Issue 2, 1997 (in Chinese)

4.6 Expanding 4-w CRV Sales – The Case of Transformed Tractors

An illustration of the potent effect of government rules and polices on industry creativity is demonstrated by the surge in 4-w CRV sales. About half of the expanding 4-w sales in 2002 were in a new category of CRVs called "transformed tractors". Transformed tractors first emerged in Guangxi Province in 1997, characterized by single-cylinder engines, model-130 chassis and 5 ton maximum payload. By August 1999, there were about 300 transformed tractor makers located in Guangxi, Sichuang, Guizhou and Hunan provinces.[44] These manufacturers had shifted production from farm tractors and other types of CRVs. More recent transformed tractors are sometimes equipped with four-cylinder engines with maximum payloads up to 8 tons. As can be seen from the photos in Figure 4-1, so-called transformed tractors are very like small trucks. They are more sophisticated than most other CRVs, though they tend to have slightly lower top speeds and greater towing capability than light trucks, making them more adaptable to rough roads. They vary in price from about 12,000 to 22,000 RMB (US$1,450-2,600).

Figure 4-1: Shifeng 130T Transformed Tractor

Transformed tractors came about as a response to the increasingly stringent regulation of CRV emissions, safety, and licensing. Transformed tractors are treated, for now, far more leniently than other types of CRVs by government regulations and taxation. Registering the vehicle in this transformed tractor category has one principal disadvantage that it cannot be used in cities and on roads that ban other CRVs and farm equipment. The big advantage relative to trucks is in fees and taxes. Transformed tractors are charged a much lower annual registration fee: about RMB 800 (US$97) compared to about RMB2000 (US$242) for a truck, plus a lower value added tax, though taxes and rules vary greatly. Indeed, the name seems to be little more than a means of evading government rules and taxation.

There is no standard definition of a transformed tractor. This makes it seemingly difficult for the government to control the production activities. In Guangxi and Hunan provinces, any company can obtain permission to produce these vehicles simply by submitting a deposit to the local agricultural machinery agency.

[44] J. Li, Z. Lang, Q. Wu, *Current Situation of the CRV industry and Analysis of Transformed Tractors*, J. of Tractors and Rural Vehicles, Issue 6, 1999 (in Chinese)

4.7 Globalization of the CRV Industry

Integration of the Chinese CRV industry with the global economy will increase, but to what extent is highly uncertain. Exports are likely to increase, though it is starting from a tiny base, and at least some collaboration and integration with international companies is likely.

In 2001, the CRV industry began exporting small numbers of CRVs to other countries. Major CRV makers, such as Feicai, Heibao, Juli, Shifeng, and Wuzheng, export to many countries, mostly in Africa and Asia. In July 2001, Shandong Shifeng exported about 500 CRVs to Mexico via the United States, [45] and in 2002 a Mexican importer announced plans to import 5,000 to 10,000 CRVs annual from Shifeng. [46] Exports data are not available, but sales appear to be a very small share of total production.

The industry leaders interviewed at Shifeng and Juli were optimistic about their prospects. They believe their products are price-competitive on the world market, and anticipate increasing future exports. In keeping with China's new open-market policy, industry leaders welcome foreign investment, and report that the industry as a whole has benefited greatly from diesel engine design improvements engineered with foreign assistance. While none exported more than a few thousand vehicles last year (to a few dozen countries), all three major manufacturers interviewed for this report believed that in the future exports would become an important part of their business, though none foresaw the CRV industry becoming competitive with conventional vehicles manufactured by large international automobile manufacturers.

Thus, engagement with international companies, and even large domestic automakers, is likely. It will not be because of China's accession to the WTO, since CRVs are unique products, and priced lower than rural vehicles manufactured elsewhere.[47] Instead, engagement will come because of government pressure to improve CRV technology. Some improvement will come via internal R&D by the largest companies, but also by acquiring technology from larger automotive companies through licenses and various financial arrangements.

4.8 Future Evolution of CRV Industry

The CRV industry is at a crossroad. As government regulation and intervention increases, as companies gain access to improved technology (through R&D or transfer from others and elsewhere), and as the industry consolidates into fewer and larger companies, one would expect product quality to improve. Yanmar's penetration into the

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[45] China Agricultural Resources Network, *CRVs Facing Two Challenges*, http://database.cpst.net.cn/popul/farms/richs/artic/10926103911.html, accessed on April 7, 2003 (in Chinese)

[46] W. Yang, *Shifeng's Exportation to Mexico*, http://www.amic.agri.gov.cn/njsc/pages/infopage.asp?ino=135, accessed on June 23, 2003 (in Chinese)

[47] L. Hong (Chair of the National CRV Association and Chair of Anhui Feicai Group), *How CRV Deals With WTO*, http://www.camtf.com.cn/gclt/8.htm, accessed on July 28, 2003 (in Chinese)

Chinese single-cylinder diesel engine industry, the core of the 3-w CRV industry, is indicative.

But will the industry continue to move upscale, eventually competing and merging with (or being bought out by) large domestic and international manufacturers of conventional vehicles? Or will the industry retrench and stay focused on inexpensive low-end products. The answer has to do with the nature of CRV demand in China, aggressiveness of governments in enforcing safety, emissions, and quality standards and limiting usage in urban areas, the relative political influence of CRV and conventional automotive manufacturers and local farmers, and decisions by large domestic and international manufacturers of conventional vehicles to invest in CRVs and in some cases expand their product line downward.

The desire by the central government to upgrade CRV technology is at odds with rural demand for inexpensive vehicles (as we indicate later).

The ambivalent reaction of CRV makers to regulatory pressure provides insight to the future of the industry. More advanced CRV makers believe they can produce trucks with their 4-w production platforms and are attracted to the prospects of competing in the automotive market. They are exploring the possibility of merging with or buying an automotive company to gain entry to the automotive market. Beiqi Futian did so, and Shifeng and other CRV makers are exploring the possibility. Others are staying focused on farmer demand for cheap vehicles and have responded by producing transformed tractors, a new type of 4-w CRVs. In fact, larger companies are simultaneously producing a variety of products. For example, Beiqi Futian is producing light-duty trucks, conventional 4-w CRVs and also transformed tractors. All in all, CRV makers perceive a threat from governmental policies, but seem to recognize that their competitive advantage is in understanding and serving rural demand for inexpensive vehicles.

The nature of CRV demand in China is not well understood, though. Income plays an important role in demand in the long term, but for Chinese farmers, a large portion of their income is in-kind and can not be used for purchase. If data become available, further research can be conducted to explore the relationship between cash income and CRV demand. An important short term factor in determining CRV demand, which we expand upon later, is the perceived effect of government policies and activities.

Thee automotive market has largely ignored the CRV market, largely because the urban market for conventional vehicles has been expanding rapidly, and because of the low incomes in rural areas. However automakers and other investors are likely to play important roles in the future of the CRV industry. Some automakers perceive an automotive golden age arriving in which substantial rural economic growth effectively merges the CRV and Chinese auto industries to create huge demand for simple, high-quality, and low cost vehicles that are somewhat upgraded versions of today's CRVs -- analogous to Ford's Model T. Driven by this vision, automakers and other investors have started scrutinizing the CRV industry. Automakers involved in the CRV market as of mid 2003 include First Automobile Works (FAW), Dongfeng Motor Corporation, Beijing

Automotive Industry Corp, FAW Jinbei Automotive Company Limited, FAW Hongta Automotive Company Limited, and a number of diesel engine and motorcycle makers.[48] In early 2002, Morgan Stanley, the financial services company, signed a memo of intent to pay US$30 million for a 17-percent interest in Shifeng.[49]

[48] D. Zhong, Y. Chen, *The Automotive Industry Is Paying More Attention to the Rural Mmarket*, http://www.qiche.com.cn/files/200204/10025.html, accessed on June 19, 2003 (in Chinese)
[49] L. Xun, *Morgan Stanley made a $30m trial on Shifeng CRVs*, http://www.qiche.com.cn/files/200203/30008.html, accessed on June 19, 2003

5 Governmental Policy and Regulation

Until recently, the Chinese government largely ignored the CRV industry. Into this vacuum emerged a successful entrepreneurial industry responsive to customer needs, unlike what one might find in a well established competitive market economy. But with success has come increasing scrutiny – manifested in a patchwork of rules on driver licensing, vehicle registration, safety, emissions, and vehicle usage. These many rules are now transforming, and impeding, the growth of the industry. Government policy is beginning to play a key role in shaping China's RV industry.

5.1 Sorting Out Governmental Authority and Responsibility

Local and provincial governments are quite powerful in China, not unlike state governments in the federal system of the United States. Policies and laws made by the central government sometimes conflict with policies and laws issued by local governments. For example, according to a senior Chinese professor, local governments play an important role in preventing the replacement of road fees with higher fuel taxes.[50] Local governments prefer to impose road fees, which they can retain, than central government fuel taxes. In many cases, such fees are imposed on CRVs. The nature of these intergovernmental conflicts is complicated and beyond the scope of this study, but are likely to play a key role in governmental policy and regulation affecting the CRV industry.

To illustrate the increasing complexity and confusion regarding governmental authority and regulation, consider the following. A farmer (or any individual) can register a 4-w CRV today as a CRV, truck, or tractor – but not in more than one category. If registered as a truck, the vehicle can enter urban areas otherwise restricted to CRVs. But if registered as a tractor or CRV, it is taxed less. In practice, CRV buyers seem to determine how to register the vehicle, not the manufacturer. Rules about vehicle registration vary across regions. For example, CRVs access to urban areas is banned in most provinces; however in Guizhou Province, CRVs can legally drive inside the city and commonly do so.[51] We were not able to determine the extent to which buyers truly have discretion, and the extent to which local laws are being ignored or violated. What is known is that the same vehicle types are being registered in different categories.

5.2 Official CRV Definition

Governmental authority over CRVs is founded on technology definitions and specifications. The most recent CRV definitions were adopted in 2001. CRVs were described as diesel-powered ground transportation vehicles with small to mid payloads, and low to medium speeds. They include 3-w and 4-w CRVs, but not farm tractors,

[50] Road fees are based on the payload class of the vehicle (encouraging overloading). Fuel taxes relate directly to the amount of fuel consumed, and therefore encourage the purchase of fuel economic vehicles. Fuel taxes are collected by state-owned petrochemical companies or national government agencies, replacing local governments as the tax collector.

[51] Z. Guan, et al., *Nice Purchase Power But Bad Soft Environment: A Comment by An Auto Dealer on the Auto Market In Guizhou Province*, http://www.gog.com.cn/jqpd/pd02008/ca319827.htm, accessed on July 10, 2003 (in Chinese)

walking tractors or walking transformed tractors.[52] Precise legal specifications for 3-w and 4-w CRVs are provided in Table 5-1.

Table 5-1: Official Technical Definitions of CRVs

CRV type	**3-w**	**4-w**
Speed (km/hr)	= 50	= 70
Total mass designed (kg)	= 2000	= 4500
Length (m)	= 4.6	= 6
Width (m)	= 1.6	= 2
Height (m)	= 2	= 2.5

Source: *Technical requirements on safety for CRVs* (GB18320-2001)

This 2001 definition replaced an earlier set of specifications set in 1988 by the previous Ministry of Machinery Industry and the Ministry of Public Security. The earlier specifications responded to the more primitive technology of that era, and more closely resemble the 2001 rules for 3-w CRVs. In addition to specifying diesel engines, the 1988 rules specified a maximum of 1.5 ton payload, 50 km/hr speed, and climbing gradient of 25 per cent, and a minimum of 200 mm ground clearance and 11m turning diameter Revised technical specifications are expected in the near future, motivated in large part by the emergence of "transformed tractors," which are currently treated as tractors and controlled by the agricultural machinery department.[53]

The drafting of these technical definitions is motivated by the desire to regulate, tax, and license CRVs. In fact, considerable confusion remains, primarily related to the unresolved question about whether CRVs are to be treated as motor vehicles or agricultural machinery. Historically, CRVs were under the purview of the agricultural machinery industry. As CRVs began to proliferate, Public Security departments became involved in controlling their use. The underlying issues are money (who gains the revenue from licensing the vehicles and their drivers), road safety, and air and noise pollution. The progression of CRV technology into more advanced 4-w vehicles and "transformed tractors" that closely resemble small conventional trucks is exacerbating the confusion about how the vehicles should be treated.

5.3 Economic Regulation

While the Chinese government largely ignored the CRV industry until recently, it did play one significant role early in the industry's history. Beginning in 1988, the Ministries of Machinery Industry and Public Security attempted to control entry to the industry by requiring companies to register annually, through the catalogue administration.

Catalogue administration was created and conducted in the environment of a directed economy. It was intended to rationalize the expansion of the CRV industry, avoiding the creation of many undercapitalized companies. Each year, a list of approved vehicle manufacturers and their product models was issued. The effectiveness of the catalogue

[52] *Technical Requirements On Safety For CRVs (GB18320-2001),* one Chinese standard (in Chinese)
[53] Note that transformed tractors are now commonly treated as 4-w CRVs in statistics and news reports.

administration rules is unknown, since the enforcement mechanism was complicated and the government commitment apparently not very strong. Indeed, small-scale illegal CRV production seems to have been common. Gaining a catalog entry was reportedly difficult for private companies without strong political connections, but somehow large companies were able to get registered. For large CRV companies, on the other hand, catalogue administration seems mostly to have been an annoyance. It meant that the company had to await government approval for new products, often delaying product launches and dampening competition.

The transformation to a market economy rendered the catalogue administration process obsolete. The industry management functions of the previous Machinery Industry Bureau were taken over by the State Economic and Trade Commission (SETC) and the State Development Planning Commission (SDPC), and the Department of Industrial Policy of SETC assumed responsibility for the CRV industry. In 2001, the SETC abolished catalogue administration and announced that it would be replaced with a new administrative process. The intention is to impose an internationally recognized certification process, with the implication being that the CRV industry would be integrated into the Chinese automotive industry. These are scheduled to take effect in 2006, but so far no rules or processes are known to have been issued or carried out. In March 2003, SETC, Ministry of Foreign Trade and Economic Co-operation and SDPC are combined into newly established Ministry of Commerce. No information is available about the functionality of Ministry of Commerce on the CRV industry entry issue.

5.4 Policy Evolution

The CRV industry has long been treated as part of the farm machinery industry (with corresponding taxation and policy advantages relative to conventional vehicles). Initial policies and rules directed at the CRV industry were focused on manufacturing oversight. These rules and policies evolved in response to CRV technological upgrading and output growth. Now increasing attention is being devoted to emissions and product quality and performance.

The first explicit recognition of CRVs by government was in 1987, when the Ministry of Machinery Industry issued the *Basic Technical Requirements for CRVs (JB/NQ 160-87)* and *Test Methods for CRVs (JB/NQ 116-87)*. Then in 1988, the previous Ministry of Machinery Industry and the Ministry of Public Security issued the first official definition for CRVs. The intent of these policies was to support the CRV industry in supplying a low-price diesel-powered product characterized by "low-mid payload, low-mid speed, intermediate technology, and big ground-clearance."[54] These policies succeeded in supporting the creation of practical and affordable products valued by farmers. Although enforcement details are unavailable, these policies reduced uncertainty for the industry, encouraging companies to invest more capital and expand their operations.

The rapid growth of the CRV industry in early 1990s drove the government to strengthen the transportation administration on CRVs. In 1993, the Ministry of Public Security

[54] L. Zhang, K. Zhu, *An Exploration in the Development of CRVs*, J. of Motor Vehicle Research and Development, Issue 2, 1997 (in Chinese)

issued *the Basic Safety Standards for CRVs* and the 46th document *Regulations for the On-road Transportation Management of CRVs*. These two policies provided guidelines and rules on vehicle registration, driver training, and driver licensing.

As rural road quality improved, vehicle makers increased vehicle power and speed, especially for 4-w CRVs. In 1996, the actual maximum speed of most 4-w CRVs exceeded the legal limit of 50 km per hour, sometimes being as much as 80 km per hour.[55] An increasing number of manufacturers began violating *Basic Technical Requirements for CRVs (JB/NQ 160-87)* by illegally enlarging vehicle dimensions and employing more powerful engines, even though the official rated maximum speed, payload and power remained under the legal limits. Buyers were readily informed of the actual technical specifications.

Rule violations inspired debates about how to reform the rules, but also provided opportunities and excuses for unauthorized local policies, such as the imposition of additional fees. According to some surveys,[56] in 1996 there were over 20 distinct non-purchasing fees being imposed by local governments. For example, various local and provincial transportation, taxation, and motor vehicle agencies were collecting fees for road use, excess payload, bridge crossing, registration, road finance, bridge maintenance, parking, passengers, driver licenses, license plates, insurance, and emissions. In Shandong province, non-purchase fees for 4-w CRVs amounted to 16-23% of the purchasing price.[57] In Anwei and Liaoning provinces, the fees were a bit higher. Some farmers, as reported, purchased their CRVs in one province and registered them in a different province so as to avoid taxes and fees.

Starting in 1997, the government began strengthening CRV industry standards and adopting new related standards. Remarkable is the issue and modification of *Safety Specifications for Motor Vehicles Operating on Roads (GB 7258-1997)*. This set of rules specifies maximum limits for CRV payload and engine power and provides basic guidelines for driving safety, product technical design, and quality inspections.[58] As concerns for safety, environment protection, and energy use increased, and as CRV technology advanced, some items of GB 7258-1997 became obsolete. Thus, in 2001 new standards and rules were issued in *Technical Requirements on Safety for CRVs (GB 18320-2001)*. For the CRV industry, this new set of rules supplemented and in some cases modified the 1997 rules. The new rules abolished the payload and engine power restrictions for CRVs, but imposed new rules for maximum size and mass. It also relaxed the speed limits for CRVs.

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[55] L. Zhang, K. Zhu, *An Exploration in the Development of CRVs*, J. of Motor Vehicle Research and Development, Issue 2, 1997 (in Chinese)
[56] L. Zhang, K. Zhu, *An Exploration in the Development of CRVs*, J. of Motor Vehicle Research and Development, Issue 2, 1997 (in Chinese)
[57] L. Zhang, K. Zhu, *An Exploration in the Development of CRVs*, J. of Motor Vehicle Research and Development, Issue 2, 1997 (in Chinese)
[58] J. Li, Z. Lang, Q. Wu, *Current Situation of the CRV industry and Analysis of Transformed Tractors*, J. of Tractors and CRVs, Issue 6, 1999 (in Chinese)

While most rules and policies treat CRVs more leniently than conventional vehicles, there are some contrary cases. For example, the Ministry of Transportation and the SPC specified in 2000 that road fees should be charged to 4-w CRVs based on the number of engine cylinders.[59] This means that some tiny 4-w CRVs are charged the same as much larger trucks with the same number of cylinders. As previous indicated, one result of this tax policy was the rapid rise in transformed tractors, which are technologically 4-w CRVs but taxed as farm tractors.

In 2001, the government began focusing more on emissions and noise. New standards specific to CRVs were issued for noise in 2001(GB 18321-2001) and smoke in 2002 (GB 18322-2002). Sales of vehicles that could not meet the two standards are forbidden. Most government policies and standards for the CRV industry are listed in Appendix G.

[59] *New Trend in CRV Development*, http://sdnj.gov.cn/data/2002/zh/0814105.htm, accessed on June 27, 2003 (in Chinese)

6 Explanations for Sales Decline in 2000-02 and Market Rebound in early 2003

As indicated earlier, CRV sales declined in 2000 to 2002. One important factor has been increasing government oversight and intervention, although other factors also played a role. Below, we explore the principal hypotheses of sales decline, with an eye to understanding whether the sales decline is likely to be permanent or was retrenchment leading to renewed growth and a stronger industry.

6.1 Explanations for Sales Decline in 2000-2002

We note that the sales decrease in 2000 to 2002 was matched by falling prices. One explanation seems to be the decreasing prices of rice, wheat, and other agricultural products during this period and the resulting effect on farmers' income.[60] But according to one study[61] by Institute of Agricultural Economics, Chinese Academy of Agricultural Sciences, the price change of agricultural products has little effect on their cash income, especially for low income farmers, which is the source for purchasing durables such as CRVs. Based on this conclusion, we presume that reduced demand was largely due to changes in CRV taxes and governmental restrictions placed on CRVs.

Governmental initiatives aimed directly and indirectly at modernizing the CRV industry and integrating it with the automotive industry were pursued in the late 1990s and into the new century. These strategies included:

- Significant reductions in air pollutant emissions
- Improvements in CRV quality and safety
- Simplification and consolidation of taxes and fees imposed on CRV companies and CRV users
- Encouragement to automotive industry to invest in or compete with CRVs

The automotive industry did not invest much, and the short term effect of the other initiatives was to discourage CRV sales.

On the demand side, farmers' perceptions greatly affect their purchase behavior. Farmers and other rural business owners may not be highly knowledgeable about the details of government policies, but they readily observe indicators of shifting government priorities. For instance, they report the following changes:

- More and larger CRV-related fees
- Increasing fines for CRV-related infractions
- Increasing risk of being caught by police for overloading their CRVs or illegally entering urban areas

[60] *Prospect into the 2003 China Auto Market*, CEI, 2003

[61] W. Li, S. Wang, *The effect of price change of agricultural products on income and expenditure of farmers in poor areas*, J. of Statistics Reports, issue 2, 2002, available at http://www.iae.org.cn/2003zjlt.htm, accessed on sep 14, 2003 (in Chinese)

- Increasing difficulty and cost in dealing with police after being caught

We could not document these perceptions, though they seemed to be widespread and seemed to play a key role in explaining the demand response to some policy changes discussed below.

One change, indicated earlier, was the imposition in 2000 of road fees based on the number of engine cylinders.[62] This means the road fee for 4-w CRVs is more than that for trucks with similar technology specifications. This discouraged the sales of 4-w CRVs since they were now charged the same as much larger trucks with the same number of cylinders, and still could not enter urban areas.

Changes imposed on 3-w CRVs are even more instrumental. Not only are government rules on emissions and safety becoming more stringent (though enforcement is still uncertain), but more cities seem to be banning them from urban areas. While we do not have data on how many cities ban CRVs, the overall sense from interviews and media reports is that there is increasing concern about CRV safety and emissions.

CRVs remain economically attractive, but relatively less so. Considering fuel prices, insurance and other factors, the operating costs of CRVs are about one third to half of cars with similar payload.[63] The road fee for CRVs is about US$8 per ton per month, but seems to be increasing. And the annual vehicle license fee is about $250 less for CRVs than for conventional vehicles (roughly equal to a farmer's average annual income).[64]

In late 2001, the central government ordered local governments to strengthen enforcement of rules against overloading,[65] which apparently contributes to many accidents. CRV overloading was often reported on television to document "effective" governmental work.

Increases in enforcement and use of bribes are especially difficult to document, though both activities apparently have been on the increase. Either way, poor farmers are greatly disadvantaged. Moreover, farmers, the principal market for CRVs, are strongly opposed to CRVs being treated as automobiles. They suffer the costs and gain few benefits – and thus their interest in transformed tractors.

Perceptions are important, especially in a country with historical controls on information, and especially in this case where CRVs are huge investments for farmers. One can

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[62] *New Trend in CRV Development*, http://sdnj.gov.cn/data/2002/zh/0814105.htm, accessed on June 27, 2003 (in Chinese)
[63] X. Ke, C. Sh, *Development Trend of Domestic Civil Vehicles and Its Influences on Supply of Oil Products*, China Petrochemical Consulting Corporation, http://www.spc.com.cn/spcspc/Chinese/tep/2000_04/7.html, accessed June 29, 2003 (in Chinese)
[64] Y. Zhang, *A Nice 1st Quarter Start of CRV Market*, http://www.amic.agri.gov.cn/njsc/pages/infopage.asp?ino=393, accessed on June 29, 2003 (in Chinese)
[65] *New Trend in CRV Development*, http://sdnj.gov.cn/data/2002/zh/0814105.htm, accessed on June 27, 2003 (in Chinese)

imagine that increasing government activity to upgrade CRVs and restrict their use in cities would have the effect of depressing sales.

6.2 Sales Rebound in early 2003

CRV production rebounded in early 2003. Production of 4-w CRVs increased by 123,609 and 3-w CRVs by 538,336 units, representing increases of 31 per cent and 7 per cent, respectively, over year-earlier quarterly figures.[66] These production increases, presumably matched by sales increases, are all the more notable because CRV prices increased by $40 to $60 per unit in the first quarter of 2003 to absorb price increases for steel, rubber, and other inputs.[67] Chinese news analyses highlighted favorable changes in governmental attitudes towards the CRV industry as the cause of this market resurgence.

The central government did make a number of favorable changes. A joint document of the Ministry of Finance and State Administration of Taxation of China, issued on June 1, 2002, states that 3-w CRVs will be still treated as agricultural machinery. The full implications with respect to taxes, fees, and regulation are not known, but one highlighted outcome was to reduce the value-added tax (VAT) for 3-w CRVs from 17 per cent to 13 per cent.[68] It also reduced the income tax of CRV (and other agricultural machinery makers).

Another inconsistent action also spurred sales. In early 2003, the Ministry of Public Security issued a draft proposal to require CRV drivers to pass the same stringent tests and pay the same fees as car drivers, implying that new CRV owners would have to pay an additional $230 for a driver license.[69] The immediate effect was to spur CRV sales before more stringent and expensive rules were formalized.[70] In May 2003, the Ministry of Public Security indicated at a meeting held by SETC that the driver license fees and rules will remain unchanged for CRVs.[71]

Apparently, consideration of the financial burden and economic well being of farmers has become another factor, together with safety, environment, and energy use considerations, motivating governmental policies toward CRVs. However, as indicated above by the driver license flip-flop, the many layers of government in China are not always coordinated, especially on relatively narrow issues such as CRVs. It is clear, though, that CRVs are gaining increasing attention, and that they are increasingly appreciated for the

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[66] *Hot CRV Market in This First Quarter*, Agricultural Equipment Network, http://www.nongji-info.com/houtai/details.asp?code=0301&id=396, accessed on June 29, 2003 (in Chinese)
[67] *Hot CRV Market in This First Quarter*, Agricultural Equipment Network, http://www.nongji-info.com/houtai/details.asp?code=0301&id=396, accessed on June 29, 2003 (in Chinese)
[68] State Economic and Trade Commission, ordered another favorable policy—lowering the 13% by 40% (*3-w CRVs Regain the 13%*, http://www.aweb.com.cn/2002/7/12/2002712102525.htm, accessed on June 29, 2003, (in Chinese))
[69] *New bill from the Ministry of Public Security*, http://auto.jsinfo.net/asp/fagui_more.asp?cj1=3826, accessed on June 29, 2003 (in Chinese))
[70] Y. Zhang, *A Nice 1st Quarter Start of CRV Market*, http://www.amic.agri.gov.cn/njsc/pages/infopage.asp?ino=393, accessed on June 29, 2003 (in Chinese)
[71] *Driver License Administration for CRVs Will Remain Unchanged*, China Agricultural machinery Safety News, http://www.sdnj.gov.cn/data/2003/05/05046.htm, accessed on June 29, 2003 (in Chinese)

important role they play in rural development. With China's huge rural population and its lagging rural development, it is likely that CRVs won't be ignored in the future.

7 CRV Usage

No comprehensive data or studies of CRV usage could be found, in either English or Chinese. This section is based principally on observations and interviews by Peter Hamilton and Zhenhong Lin during August 2002 (see Appendix A), with corroborating anecdotal evidence from various observers and sources. They traveled through the following provinces and regions:

Table 7-1: Provinces and Cities Traveled

Province	City
	Beijing (Haidian, Changping, Yanqin, Fengtai)
Henan	Luoyang
Hebei	Baoding
Shandong	Zhucheng, Weifang, Qingdao

7.1 Vehicle Purchase and Usage Behavior

They observed CRVs everywhere they traveled in these regions. Indeed, as, indicated by production data by province (Appendix I), CRVs are widely available through much of China -- though only since the mid 1980s. CRVs were observed transporting all types of goods, but never passengers (other than assistants), although it is well known that CRVs are very often used, either legally or not, for passenger transport. All vehicles encountered were privately owned, often purchased with savings, or with money borrowed from relatives. None reported using credit to purchase vehicles, and only a few reported having insurance. None reported renting out their CRVs, since they were not willing to let renters drive the vehicle for fear of abuse -- understandable given the big portion of income for buying a CRV. Most owners are, or recently were, farmers.

CRV usage is extremely varied. The principal uses may be categorized as follows, based on interviews and observations:

- **Intra-farm transport**– carrying produce and farming materials, such as fertilizer, within the confines of large farms (trip notes #11 and #47).
- **Farm to market --**carrying produce from the vehicle owner's farm to wholesale and retail markets in nearby local areas, and to more remote urban and suburban wholesale markets. The distances may be as little as 2 km and as far as 200 km (trip notes #1 and #19).
- **Wholesale to retail**-- carrying perishables, such as watermelons, from wholesale markets or farms to retail markets in towns or cities (trip notes #2 and #37).
- **Contracted delivery of non-produce goods** --vehicle owners being contracted to carry fertilizers, construction materials, and other durable goods in local areas (trip notes #6 and #27).
- **Short-distance passenger transport**– carrying passengers for short trips, though this activity is illegal in many areas.

Many owners use their vehicles for multiple purposes. Some farmers use their CRV exclusively for their own transport needs, including intra-farm and farm-to-market transport. In some cases, this results in an apparent drastic underutilization of transportation capital (trip notes #8, #11). One older farmer (trip note #8) reported an income of RMB 4000 per year. He paid RMB 8000 for his vehicle, and uses it roughly once per month for a 14 km round trip. In contrast, some owners (trip notes #2, #18) drive their vehicles to locations up to 200 km away, usually to wholesale markets, motivated by large price differences between regional markets. Some drivers reported using their vehicles initially only to transport only their own farm goods, but then found it more profitable to contract their services to others.

7.2 Competition with other modes and vehicle types

CRVs are one category of vehicles amidst many. Other vehicle types are two and three-wheeled motorcycles, farm tractors, cars, buses, and conventional light and heavy duty trucks. CRVs compete primarily with three-wheel motorcycles, tractors, and light duty trucks. CRVs are generally the preferred choice for transporting goods for relatively short distances. They have the following advantages:

1) **Suited to poor road conditions.** Rural roads are not well suited to conventional low-ground-clearance vehicles, and high-speed vehicles have little advantage for short trips on bad roads. CRVs' ground clearance is normally greater than 180 mm (7 inches).
2) **Low price**. A 0.5 ton 4-w CRV costs about half as much as a 0.5 ton conventional truck.
3) **Easy to maintain**. While CRVs may break down frequently, they do not require expensive parts or specialized repair skills
4) **Easy to drive**. CRV buyers do not need much driver training, and a driver license for CRVs is cheaper and easier to obtain than for conventional cars and trucks. A driver license for cars and trucks cost $300 or more and often requires two months of training (requirements differ from one locale to another), while a license for CRVs costs only about $70.[72]
5) **More comfortable and faster than farm tractors.** CRVs are intermediate between farm tractors and conventional trucks in comfort and speed. .
6) **Lower fees and taxes than trucks**. CRVs are subject to much lower taxes and fees than trucks, though the amount varies greatly.

The range of CRV models is great. As a result, vehicle owners tend to upgrade within the CRV category. Many drivers indicated that they hoped to purchase a better CRV in the near future. Many had already done so, and were sometime retaining older vehicles for different purposes.

The overriding observation, supported by broader statistics, is that demand for inexpensive goods transport will continue to increase sharply in small cities and towns and rural areas. The nature of this demand is likely to evolve, though, as subsistence

[72] *Driver License Administration for CRVs Will Remain Unchanged*, China Agricultural machinery Safety News, http://www.sdnj.gov.cn/data/2003/05/05046.htm, accessed on June 29, 2003 (in Chinese)

farming subsides and businesses become more integrated into the larger economy. How the CRV industry will evolve to serve this demand is uncertain, though.

Passenger demand in rural areas and small towns will also certainly increase, as farmers leave the land for salaried non-farm jobs.[73] The role of CRVs in serving this increasing demand is uncertain, but could be huge – for both passenger and goods transport.

[73] There are 94 million farmers who left their farms for non-farm jobs in 2002, 4.7 million more than in 2001, according to a survey by the Ministry of Agriculture, see http://www.people.com.cn/GB/shizheng/3586/20030116/908643.html, accessed on Aug 18, 2003

8 Role of CRVs in Rural Development

CRVs provide mobility at low cost. The proliferation of these vehicles into the countryside is revolutionizing China's rural economy. They add value to many existing products and industrial and agricultural activities, and are facilitating the creation of a new entrepreneurial class of vehicle owners and operators.

One salient benefit is the enhanced market for fresh produce. Local entrepreneurs operating small CRVs carry perishable vegetables to urban areas for sale. Consider the case of Ling, who described the advantages of small-scale transportation as follows (trip note #59):

> *Ling lives with her husband in a rural area 200 km from the Baoding wholesale vegetable market (the largest in Hebei province). Before CRVs became available, their village grew only wheat and soybeans, which they sold to large truck transporters for low prices. About two years ago, the first CRVs were purchased by villagers. Now, almost all households in their village own CRVs. Most farmers now grow vegetables, which they transport to this market themselves to sell at a high price. Buyers are mostly operators of long-distance heavy duty trucks that travel to the south of China. Ling and her husband visit this market every three days during harvest times.*

Also consider the case of farmers living near the new Yanxing highway that was built across poor rural areas of three land locked provinces: Inner Mongolia, Gansu and Ningxia.[74]

> *Wanglejing, a village of Yanxing county, was previously isolated. It has little vegetation and often suffers drought. Before Yanxing highway was built, people were so poor that they had to beg when droughts occurred. Years ago, the Xingren government led the people to grow watermelon, as there is a field of 3,300 acres well suited for watermelon growing. However, due to transportation restriction, their produce could not reach the outside market and mostly rotted. Now they make a living through transportation services. In early 2002, Wanglejing had 2400 rural households, 170 large CRVs and 1200 small multi-purpose CRVs (type unknown). In 2001, the village's revenue for transportation service was over 8 million RMB (about 1 million USD), providing the community an average revenue of 4000 RMB (484 USD per household). Now CRVs loaded with watermelons, potatoes, domestic animals and medical materials are a common sight in this area. In 2001, Xingren sold a total of 15,000 tons of watermelon. Other CRV stories related to Yanxing highway can be found in the news article of Road to Prosperity: Anecdotes About Ningxia Yanxing Highway.*[75]

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[74] *Tri-Provincial Highway Project Introduction*, http://www.worldbank.org.cn/English/content/331i1211833.shtml, accessed on 7/10/03

[75] Y. Wu, *Anecdotes About Ningxia Yanxing Highway*, http://www.nx.xinhuanet.com/nxwz/news/08.htm, accessed on 7/10/03

As these stories demonstrate, CRVs allow rural residents choices previously unavailable to them, providing them new business opportunities. Motorization decreases transport costs by encouraging competition for the provision of transportation service and reducing monopolies in underserved areas. Furthermore, increased vehicle populations decrease transport restrictions by providing increased transport frequency and even "on-demand" transport (made possible by inexpensive cell phone technology). In the opposite, high-restriction case, farmers must wait for trucks to arrive at their village, increasing the risk that high-value fruits and vegetables will spoil and deteriorate.

Decreased transport restrictions increase farmer flexibility, allowing them to plant crops according to market demand, not transportation requirements. This in turn raises farmer income and reduces vulnerability. Decreased vehicle costs and increased vehicle populations encourages the development of a rural entrepreneurial class, increasing rural non-farm economic activity. Clearly, much additional work is required to examine the complex interactions between transportation and rural economics.

9 Noise, Energy use and Emissions

CRVs provide large economic benefits, but because of their simple technology, tend to be highly noisy and polluting and high energy consumers. Because of their growing population, in aggregate they consume large quantities of energy and generate considerable quantities of pollution.

9.1 Noise

Public complaints about the noise and black smoke from CRVs are widely reported in China. Noise data are not available, but the following newspaper account highlights the severity of the concern.

Mr. Zhao and his wife, residents in Ha'erbin, the capital of Heilongjiang Province, were reported to have bought an apartment along a road that was then under construction. Soon after the road was completed, some 3w CRVs appeared, passing by the apartment as early as 4:00 am, waking the elderly couple. Mr. Zhao complained humorously to a newspaper: "it is more efficient than an alarm." It was worse for the more fragile Mrs. Zhao. In winter, she closed the windows and covered her head with the quilt to keep the noise out. But in the hot summer, she had to keep the windows open. Mr. Zhao said they understood farmers need to make a living to transport their vegetables in the early morning, but they hoped there would be quieter 3-w CRVs.[76]

Noise standards have been adopted, as indicated in Table 9-1, but are not widely enforced.

Table 9-1: Noise Limits for CRVs from GB 18321-2001

Vehicle Type	Outside, in Acceleration	Driver's Seat
Multi-cylinder 4-w	<= 84 dB(A)	<= 94 dB(A)
3-w and One-cylinder 4-w	<= 85 dB(A)	<= 92 dB(A)

Source: GB 18321-2001, National standard for CRV noise, known as "limits for noise emitted by agricultural vehicles."

9.2 Energy Use

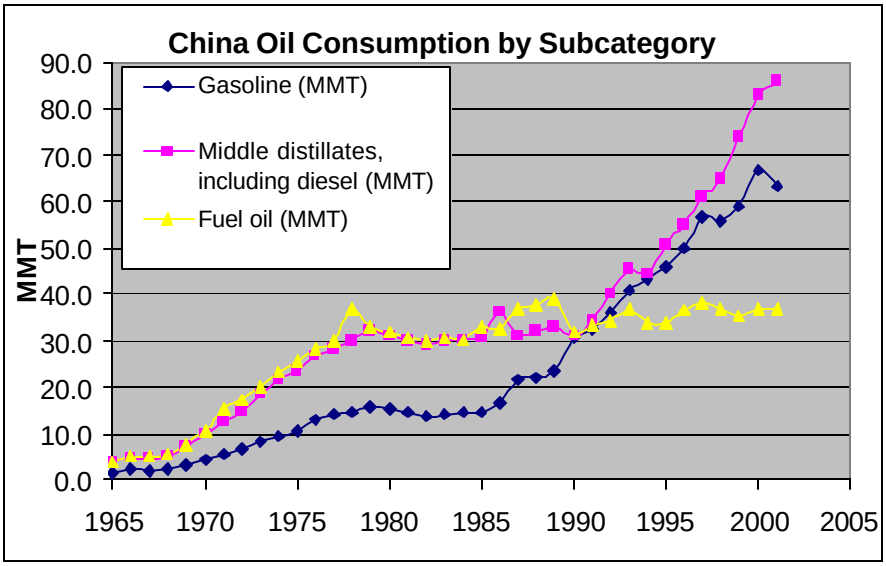
Coal accounts for the majority of energy use in China, 67 percent in 2001,[77] but petroleum consumption is increasing more rapidly. It increased 90 percent from 1990 to 2001, much faster than the 34 percent rate for all energy use, and was accounting for 23.6 percent of total energy consumption by 2001.[78]

Much of the growth in oil use, as indicated in Figure 9-1, is due to increased motorization. Increases in gasoline consumption are indicative of rising automobile use in urban areas and motorcycle use in urban and rural areas. Increases in diesel fuel and

[76] W. Wang, Z. Yang, "Annoying CRVs", http://www.qiche.com.cn/files/200210/22039.html, accessed on June 28, 2003. (in Chinese)
[77] EIA, http://www.eia.doe.gov/emeu/iea/wecbtu.html, accessed on Nov 3, 2003
[78] According to the National Bureau of Statistics of China

other middle distillates are partly attributed to increasing rural diesel consumption, including consumption by CRVs.

Figure 9-1: Chinese Oil Consumption



Source: BP, 2002

What portion of this increasing energy use is attributable to CRVs? Unfortunately, reliable, detailed analyses of energy use by CRVs do not exist. We draw upon fragmented information from the literature and our own knowledge of CRVs. We reconcile bottom-up and top-down approaches to arrive at estimates of energy use by CRVs in China. Bottom-up data are based on vehicle estimates, while top-down are based on aggregate national estimates.

According to a study done by Yang Xunying, total Chinese diesel fuel consumption in 2000 was 69.5 million metric tons (MMT)[79] (see Table 9-1) or 2.96 quadrillion BTU.[80] In his study, highway transportation accounts for 24 per cent of total diesel fuel use, and CRV use accounts for 21 per cent.

Table 9-2: Diesel Fuel Consumption in China in MMT[81]

User	1996	1997	1998	1999	2000
Highway transportation	8.21	8.95	10.09	13.64	16.86
Light vehicle	1.16	1.57	2.02	1.93	1.83
Medium vehicle	5.55	5.60	5.95	8.18	10.10
Heavy vehicle	1.50	1.78	2.12	3.53	4.93
CRV	**9.28**	**10.74**	**13.25**	**13.19**	**14.43**
Railway	4.50	4.60	4.80	5.00	5.20

[79] Gasoline consumption in 2000 was about 38 million tons, http://www.lthcn.com/jswz1.htm, accessed on Nov 4, 2003

[80] Here we assume 44.9 GJ per ton as the energy density of diesel fuel.

[81] Yang Xunying, *Analysis and Forecast of China's Gasoline, Kerosene and Diesel Fuel Market*, Petroleum & Petrochemical Today, 2001, 9(11): 13-18 (in Chinese)

Marine	3.50	3.60	3.80	4.00	4.20
Agriculture	12.00	12.40	13.70	15.00	16.00
Fishing	5.70	6.00	6.10	6.30	6.50
Electricity	4.50	5.00	4.50	4.10	3.80
Others	2.50	2.50	2.50	2.50	2.50
Total	**50.19**	**53.79**	**58.74**	**63.731**	**69.49**

Another study of the Chinese oil consumption, conducted by the China Petrochemical Consulting Corporation, arrives at similar estimates for energy use by CRVs (though assumptions and methods are not provided).[82] It provides estimates for 1997 and forecasts for 2000 and 2005 (see Appendix H). The forecasts are 26.6 MMT for non-military diesel consumption in 2000, somewhat lower than the 31.29 MMT (1.33 Quads) estimated by Yang Xunying's above. It may be that the higher 31.29 MMT estimate includes military transportation. In any case, the figures for CRV diesel consumption for 2000 are very similar for the two studies: 14.28 MMT (0.61 Quads) and 14.43 MMT (0.61 Quads).

Using a bottom-up approach, we asked drivers of CRVs what their fuel consumption is. Responses ranged from 3 to 10 liter per 100 kilometer, averaging 6.5 liter per 100 kilometer (about 43.5 miles per gallon). On the other hand, all the CRV companies report in the product brochure that their products all achieve a fuel economy of 2.8 liter per ton per kilometer, for both 3-w and 4-w, which seems to be one of the industry standard requirements. Both sets of data are plausible.

We believe that company numbers were obtained through dynamometer testing at continuous low speed, assuming no gradient and no loading. Actual in-use fuel economy should be much higher. But we do not know what proportion of the travel was at low speed with no load.

The higher fuel economy data reported by users are plausible. Even the highest numbers reported, near 10 liter per 100 km is possible in circumstances when vehicles are overloaded with 2 ton loads. The difficulty we face is absence of data on exact testing conditions for the company data, unreliable reporting of data by users, and absence of information on how much travel is undertaken at different speeds and load conditions.

According to Appendix B, most CRVs sold in 2000 were rated at a 0.5 ton payload; it is reasonable to believe this rating applies to most CRVs in use. But according to our observations in China, a 1 ton payload is close to reality for much of the driving. Given that the weight of a CRV without cargo and passenger is about 1 ton, the total mass of a CRV in service may approach 2 tons. We calculated fuel consumption for two weights: 1.5 tons (assuming a 0.5 ton payload) and 2.0 tons.

[82] X. Ke, C. Shang, *Development Trend of Domestic Civil Vehicles and Its Influences on Supply of Oil Products*, China Petrochemical Consulting Corporation, http://www.spc.com.cn/spcspc/Chinese/tep/2000_04/7.html, accessed on June 29, 2003, (in Chinese)

In estimating the distance traveled per vehicle per year, we use the government's abolition standard,[83] which states that the useful life of 3-w and 1-cylinder 4-w CRVs is 6 years, that of multi-cylinder 4-w CRVs is 9 years and the accumulated kilometer of travel for multi-cylinder 4-w CRVs is 250,000 kilometer. No official data or standard is available for the accumulated kilometer of travel for 3-w and 1-cyl 4-w CRVs; we use 120,000 kilometer. For our calculations, we use 19 million CRVs (for 2000),[84] 80% of which are 3-w CRVs.[85]

The energy density of diesel for CRVs is not precisely known. One article recommends heavy diesel oil in winter for CRVs and light diesel oil in summer,[86] but one technical article clearly recommends light diesel oil for CRVs.[87] We use the density of light diesel oil, 830 kilogram per cubic meter, for our calculations, using data from one Chinese diesel company.[88]

With these assumptions and estimates, the calculated yearly CRV diesel consumptions in 2000 would have been19.03 MMT (0.81 Quads) and 14.27 MMT (0.61 Quads), respectively, for the 2 ton and 1.5 ton total mass estimates. The latter result is very close to those of the two top-down studies reported above. From this, we guess that those two studies both use company fuel economy data and the rated 0.5 ton payload as part of their assumptions. But based on the high frequency of overloading, we believe that CRV fuel consumption is more likely to be the 19.03 MMT estimate for 2000, representing about 27.4 per cent of the total diesel consumption in that year.

9.3 Emissions

Even less is known about CRV emissions. It is clear, though, that CRVs are high emitters of smoke and pollution. Even when new, the primitive single-cylinder diesel engines emit clouds of black smoke, particularly under heavy load and at low RPM – conditions frequently encountered due to widespread overloading and three-speed gearboxes.

No data exist regarding the contribution of CRVs to total pollution, but rough calculations and assumptions suggest that the total amount of pollution from CRVs may be similar to that from conventional vehicles. This conclusion is based on the following information and estimates. First, one governmental document asserts, "CRVs in China are powered by diesels and their emissions per unit of energy are on average twice that of

[83] Z. He, *The CRV Abolition Standard Is Issued*, http://www.hebnet.net/mag1/20010403/colart7824.htm, accessed on 7/10/03

[84] The above two studies assume 18 million. We adopt 19 million according to the 2000 Chinese automotive industry yearbook

[85] *4-W CRVs Should Be Encouraged During The Tenth Five-Year Plan Period*, http://www.autoweekly.com.cn/files/2001/01aug/v8.24/8.24a2.htm, accessed on 7/11/03

[86] *Fuel Choice for CRVs*, http://www.library.hn.cn/nckj1/20020322/Content/00003338.htm, accessed on 7/11/03

[87] L. Li, *Fuel, Lubricating Oil and Other Working Liquids for CRVs*, Agricultural machinery 2000 supplement, p18

[88] *Fuel Product Properties*, http://www.chimbusco.com.cn/chimbusco/html/chinese/grades/ryzb.htm, accessed on 7/11/03

trucks."[89] The situation may be even worse for 3-w CRVs. Second, we combine that assertion with statistics indicating that 88% of the 2.8 million CRVs produced in 2001 were single-cylinder CRVs, and that over 60% of single-cylinder 3-w CRVs and about 30% of multi-cylinder 4-w CRVs can not meet the emissions requirements of GB 18322-2002, *Limits And Measurement Methods For Smoke At Free Acceleration From CRVs.* [90] With these assumptions, we estimate that CRVs emit as much total air pollution in China as all other motor vehicles

China has recently developed emission standards and test procedures for CRVs, but according to available information, those standards do not cover all kinds of emissions and it is not clear that the emissions standards for diesel motor vehicles have been applied to CRVs. Due to the prominence of CRV smoke emissions and the governmental focus on emission regulations of conventional vehicles, GB 18322-2002, *Limits And Measurement Methods For Smoke At Free Acceleration From CRVs*, is the currently most important emission standard for CRVs. [91] On one big CRV maker's website, we can note one sentence common to the specifications for all of its 3-w and 4-w CRVs: "Emission Standard Applied is GB 18322-2002 – the standard for visible smoke."[92] From this we conclude that currently there are no standards for CRV with respect to other emissions, such HC, NOx, CO and invisible PM.[93] This reveals that the so-called application of Euro 1 equivalent standard to CRVs in 2005 is just limited to one pollutant, visible PM or smoke. Thus, it appears that stringent emission standards are being adopted and implemented slowly, with the result that even new CRVs continue to have high emissions.

In large part because CRVs are highly polluting, they are banned from many urban areas. The Chinese central government policies have not directly restricted CRV use in cities. Rather, GB 18322-2002 grants the authority to local governments with a footnote: "The smoke limits for CRVs driving in developed urban areas can be determined by province-level governments." This footnote presumably explains the variation in CRV emission policy among different provinces in China. Regulations do vary, but in many cities, diesels are allowed only during the night (e.g. from 9pm to 6am). CRV owners may purchase special license plates that allow them to enter the city, but these plates are controlled, and can be very expensive. CRV owners can also buy fake plates so as to enter the city, though it is dangerous and costly if caught. Because of the restrictions on diesel vehicles, those wanting to make deliveries to lucrative urban markets have a large incentive to purchase gasoline-powered vehicles, which are not usually prohibited. Often, these larger gasoline vehicles are purchased by goods haulers who began their business

[89] G. Ji, "The Serious CRV Pollution Issue Pushing the Government to Effort in Regulation", http://www.sepa.gov.cn/64909668945756160 0/20020702/1011810.shtml, accessed on April 7, 2003 (in Chinese)
[90] G. Ji, "The Serious CRV Pollution Issue Pushing the Government to Effort in Regulation", http://www.sepa.gov.cn/64909668945756160 0/20020702/1011810.shtml, accessed on April 7, 2003 (in Chinese)
[91] The document can be found on http://www.sepa.gov.cn/65020830430317772 8/20030310/1037159.shtml, accessed on April 7, 2003
[92] Juli's product introduction webpage, accessed on 7/11/03
[93] Smoke refers to visible PM, one of diesel vehicles emissions.

with a CRV, and then when they accumulated more capital, purchased the larger, more expensive gasoline vehicle.

While rural air pollution affects the health of fewer people than urban air pollution, recent studies have suggested that air pollution in the form of ground-level ozone[94] and atmospheric aerosols[95] can substantially reduce crop yields. Aerosols are small airborne particles that can absorb sunlight, and contribute to regional haze. Diesel engines emit large amounts of particulate matter, and can thus contribute to the problem. Furthermore, diesel engines emit relatively high levels of oxides of nitrogen (NOx). NOx combines photochemically with volatile organic compounds (including fuel vapors and evaporative emissions from vehicles) to form ground-level ozone (a component of smog). Much work needs to be done before the linkage between rural motorization and crop yields is established, however it is a potential area of concern in China, due to huge rural population, diminishing arable land, and increasing concern over food scarcity.

[94] Kristin Aunan, Terje Koren Berntsen and Hans Martin Seip. *Surface Ozone in China and Its Possible Impact on Agricultural Crop Yields.* Ambio Vol. 29 No. 6, Sept. 2000

[95] W. L. Chameides, H. Yu, S. C. Liu, M. Bergin, X. Zhou, L. Mearns, G. Wang, C. S. Kiang, R. D. Saylor, C. Luo, Y. Huang, A. Steiner, and F. Giorgi. *Case study of the effects of atmospheric aerosols and regional haze on agriculture: An opportunity to enhance crop yields in China through emission controls?* PNAS, vol. 96, no. 24. November 23, 1999

10 Conclusions and Recommendations for Further Study

Few developing countries have the capability to design and mass-produce a functional vehicle at low cost without significant foreign assistance and national support, yet in China this is precisely what happened. In stark contrast, Mexico has been producing Volkswagens for export under foreign ownership for several decades, but has never made a vehicle specifically for the Mexican market. China's relative isolation from the "modern" world may have provided indigenous industry with a crucial gestation period – but has it been enough? Will China's ascension into the WTO shatter China's protected industries? Or, will industry grow rapidly from increased export activity?

What can be stated with certainty is that China's 900 million farmers are a huge untapped market. Farm income is low, about US$285 in 2001, which is about 1/6 the per capita income of urban Chinese residents. In the rural areas, where 80% of the Chinese population lives, there are approximately 70 million non-motorized vehicles used for rural goods transport.[96] Their owners are the future buyers of CRVs. As farm income rises, some wealthy farmers will be able to afford light-duty trucks, but the potential market for CRVs is likely much larger.

For now, much uncertainty hovers around the CRV industry. Much of the uncertainty is rooted in government policy and strategy. Aggressive government restrictions and taxes on CRV use, and the prospects of increasingly stringent safety, emissions, and energy rules, all imposing higher costs. There is a growing anxiety that perhaps the Chinese government wants to focus on advanced technologies to the detriment of CRVs.

On the positive side are the huge potential domestic market and the prospect for exports. Domestic CRV
growth will be aimed at goods transport, but there are also untapped prospects for passenger transport. Particularly intriguing is the export market. There are many developing countries with similar economic and agricultural patterns, including Pakistan, Bangladesh, India, and Malaysia, among many others. These developing countries have weak machinery industries, and have not created industries to serve rural vehicle demand.

For the CRV industry, increasing government intervention is a mixed blessing. On the one hand, more strict requirements for safety, emissions and quality will enhance those attributes. It will also accelerate the weeding out of under-capitalized companies with weak technical capabilities. These companies will be better able to compete in the world market. On the down side, questions remain whether the industry will serve the low-cost rural markets as well, and whether competing governmental interests will create an even more uncertain and risky financial and market environment for CRV makers.

[96] "The Hope of the Chinese Auto Market", Jilin Scientific Information Network http://218.27.89.158/kjck18.htm#_Toc522952518, accessed on June 19, 2003 (in Chinese)

In any case, the future of the CRV industry plays an important role not only in China, but potentially worldwide. CRVs play a central role in Chinese rural development, and could play an equally positive role in other developing countries. But CRVs, as built today, are inefficient users of petroleum and large emitters of pollution and greenhouse gas emissions.

Until now, the automotive industry has largely ignored China's rural vehicles. Domestic and international automotive companies are rethinking that approach. Some are beginning to think that an automotive golden age could emerge in China if the government were to aggressively stimulate rural economic growth and merge the CRV industry with the auto industry, creating huge demand for simple, high-quality, and low cost vehicles that are somewhat upgraded versions of today's CRVs -- analogous to Ford's Model T. Given the huge and somewhat dispersed rural population, this vision is not implausible. The demand for small inexpensive vehicles for goods and passenger transport is likely to skyrocket as incomes rise.[97]

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[97] Lin Gan, "Globalization of the automobile industry in China: dynamics and barriers in greening of the road transportation", *Energy Policy* 31 (2003) 537-551

Appendices

A: CRV User Field Research Trip Notes

Interviews by Peter Hamilton, Zhenhong Lin, and Haifeng Yu. Notes prepared by Peter Hamilton.

Note:
We use "Trip Note #" to denote each scene where we interviewed a CRV user, visited a CRV company, or noted something interesting. Occasionally we use notes to record insights and observations for a sequence of interviews and visits. We assume an exchange rate of about 8.3Rmb per US dollar. Here we use Rmb to denote RMB Yuan.

Table A-1: Time and Place of Interviews

Time	Place	Team	Trip Note # Range
August 8 - 12, 2002	Beijing Municipal Area	Peter Hamilton Zhenhong Lin	1-20
August 13 - 17, 2002	Luoyang City, Henan Province	Peter Hamilton Zhenhong Lin	21-33
August 20 - 21, 2002	Beijing Municipal Area	Peter Hamilton Zhenhong Lin	34-44
August 24 - 25, 2002	Baoding, Hebei Province	Peter Hamilton Zhenhong Lin Haifeng Yu	45-62
August 26 - 29, 2002	Shandong Province	Peter Hamilton Haifeng Yu	63-68

Table A-2: Trip Note Index

#	Interviewee/Event	Time
1	Yanqing Market 3-W CRV owner	Aug 8, 2002 – evening
2	Yanqing Market 3-W CRV owner	Aug 8, 2002 – evening
3	Yanqing Market Minivan taxi driver	Aug 9, 2002 – morning
4	Yanqing Market 4-W CRV owner	Aug 9, 2002 – afternoon
5	Yanqing Market Minivan taxi driver	Aug 9, 2002 – afternoon
6	Yanqing Market 4-W CRV owner	Aug 9, 2002 – afternoon
7	Yanqing Market MD (?) Truck owner	Aug 9, 2002 – afternoon
8	Yanqing Market 3-W CRV owner	Aug 9, 2002 – afternoon
9	Yanqing Market 4-W CRV owner	Aug 9, 2002 – afternoon
10	Xiaofengying Village Wholesale Market 4-W CRV owner	Aug 10, 2002 – morning
11	Xiaofengying Village Wholesale Market 3-W CRV	Aug 10, 2002 – morning

	owner	
12	Xiaofengying Village Wholesale Market HDD truck owner	Aug 10, 2002 – morning
13	Xiaofengying Village Wholesale Market CRV owners (transaction)	Aug 10, 2002 – morning
14	Xiaofengying Village Wholesale Market 4-W CRV owner	Aug 10, 2002 – morning
15	Small Beijing Wholesale Market Minivan user	Aug 12, 2002 – afternoon
16	Small Beijing Wholesale Market Minitruck user	Aug 12, 2002 – afternoon
17	Beijing Wholesale Market Supervisors	Aug 12, 2002 – afternoon
18	Beijing Wholesale Market 3-w CRV users	Aug 10, 2002 – afternoon
19	Beijing Wholesale Market 3-w CRV user	Aug 10, 2002 – afternoon
20	Beijing Wholesale Market CRV Parts store	Aug 10, 2002 – afternoon
21	Luoyang Market 3-W motorcycle owner	Aug 13, 2002 – afternoon
22	Luoyang Market 4-W gasoline truck owner	Aug 13, 2002 – afternoon
23	Luoyang City Shifeng 3-w CRV dealer	Aug 13, 2002 – afternoon
24	Luoyang City Shandong Juli CRV dealer	Aug 13, 2002 – afternoon
25	Jiaotun Village Farmers	Aug 14, 2002 – morning
26	Luoyang City Small Market	Aug 14, 2002 – afternoon
27	Zhengjiacun Villagers	Aug 15, 2002 – morning
28	Zhengjiacun Grape Farmers	Aug 15, 2002 – morning
29	Zhengjiacun Farmers	Aug 15, 2002 – morning
30	Anle Retail Market	Aug 15, 2002 – morning
31	Small 3-w Motorcycle Manufacturer	Aug 15, 2002 – afternoon
32	Countryside Road Trip Notes	Aug 15, 2002 – afternoon
33	Notes	Aug 16, 2002
34	Changping CRV Dealership	Aug 20, 2002
35	Changping Auto and Truck Mfg: Beijing Futian	Aug 20, 2002
36	Changping Wholesale Market 3wh CRV User	Aug 20, 2002
37	Changping Wholesale Market 4wh CRV User	Aug 20, 2002
38	Changping Wholesale Market 3wh CRV User	Aug 20, 2002
39	Changping Wholesale Market Minivan User	Aug 20, 2002
40	Changping Wholesale Market Gasoline Micro-truck User	Aug 20, 2002
41	Changping Wholesale Market Minitruck User	Aug 20, 2002
42	Hui Longquan Village Resident	Aug 21, 2002
43	Hui Longquan Farmers	Aug 21, 2002
44	Zi Erqi Village Residents	Aug 21, 2002
45	Baoding CRV Dealers	Aug 24, 2002
46	Xuzhuang Village, taxi driver's family (3-W CRV)	Aug 24, 2002
47	Xuzhuang Village 3-W CRV user	Aug 24, 2002

48	Xuzhuang Village, 3-W CRV user	Aug 24, 2002
49	Lizhuang Village, 3-W CRV user	Aug 24, 2002
50	Lizhuang Village, 3-W CRV user	Aug 24, 2002
51	Xuzhuang Village, 3-W motorcycle user	Aug 24, 2002
52	Xuzhuang Village, taxi driver's father	Aug 24, 2002
53	Xuzhuang Village, 4-w CRV user	Aug 24, 2002
54	Xuzhuang Village, 3-W moto and 4-w tractor user	Aug 24, 2002
55	Baoding Shifeng CRV Dealers	Aug 25, 2002
56	Baoding retail market vendor (mini-truck user)	Aug 25, 2002
57	Baoding retail market 3-W moto-taxi owner	Aug 25, 2002
58	Baoding retail market mini-truck owner	Aug 25, 2002
59	Baoding wholesale market 3-W CRV user	Aug 25, 2002
60	Baoding wholesale market HDD truck user	Aug 25, 2002
61	Baoding wholesale market 3-W CRV user	Aug 25, 2002
62	Baoding wholesale market minivan user	Aug 25, 2002
63	Liao Cheng CRV maint. Professionals (gov't accompaniment)	Aug 26, 2002
64	Liao Cheng CRV market (gov't accompaniment)	Aug 26, 2002
65	Liao Cheng: Shandong Shifeng CRV manufacturers (gov't accompaniment)	Aug 27, 2002
66	Weifeng: Shandong Juli CRV manufacturers (gov't accompaniment)	Aug 28, 2002
67	Shouguang vegetable market (gov't accompaniment)	Aug 29, 2002
68	Qingzhou Futian CRV market (gov't accompaniment)	Aug 29, 2002

Trip Notes #1 and #2
Market closes at 7:00pm. We arrived at 6:45, many vendors beginning to leave. Yanqing is a mid-sized city of 300,000 (according to a man on the street), located about 70km northwest of Beijing proper. Yanqing Central Market is both a small-scale wholesale and all-purpose retail market. All sorts of fruits, vegetables, livestock, and household goods can be found either in the temporary stands, or the permanent stores inside the market.

1. Yanqing Market CRV user, August 8, 2002 – 6:45pm
We approached a group of men around a three-wheeled CRV half-loaded with celery. Behind the truck bed was a scale, and a display of the product. Offered cigarettes, all three were happy to speak with us for the duration of our 15-minute interview. Zhenhong talked and took notes in Chinese while I photographed (with the men's permission). We noted that the CRV had minimal controls: turn signals, windshield wiper, stick shift, emergency brake, clutch, brake, and accelerator. Dashboard was sparse, containing only a gauge (-/+20 degrees temperature?) and two green lights on either side (turn signals?). Torque is transmitted from single-cylinder diesel engine to belt drive to transmission attached to rear axle. Orange license plate is in front.

3-w full-cab CRV, manufactured by Shandong Wuzheng CRV, ltd, 7YPJ-950A. Selling celery, the product of a farm owned by the owner's family. The other two men were not associated with the operation. They

also have transported coal and fertilizer. Mainly travel within Huailai (the driver's hometown) – driver's first time in Yanqing.

Cost of CRV was RMB8500 (may include fees). Has been used for 1yr and 3 months. Purchased from "Fei da CRV sales city" in Huairou county (adjacent to Yanqing). Also paid a one-time RMB695 road usage fee. Purchased by driver with savings. Plans to use CRV for another 6-7 years, (about 60-70k km). Also paid RMB57 "transportation control fee" and RMB600 for license and registration fees. Paid no insurance, even though insurance is mandatory. Also paid RMB50-60 for transportation service license fee (business license).

Fuel price is RMB3.2/kg. Fuel consumption about RMB30 per 60-70km. Runs 100km/day. Bridge fees are RMB5 per pass.

Transports produce for others. Example given: 70km, 1.5tons; he charges RMB100, including fuel cost. Note: he is not experienced as CRV service provider. Average payload is 1.5tons, but large variance in load.

Four wheel bearing failures, RMB30 each. One clutch failure, cost RMB25 – others did work for him. His village has a skilled farmer who provides repair service. As the farmer was from his own village, he trusts that he was not overcharged. He is worried about being overcharged if he breaks down in other village.

Owner has a small child, whom he hopes to send to school. He is worried that with current income, he may not be able to send the child to school. CRV owner is also a welder, and could do that if he lost the vehicle, but would earn less. He spends most of his time as a transportation service provider, but farms as well. Returns to family farm for harvest only, unless he cannot find business as a transporter or a welder.

2. Yanqing Market CRV user, August 8, 2002 – 7:15pm

A middle-aged couple selling watermelons. Man in front with scale, woman sitting in the obviously well-used CRV truck bed. Man did all the talking. Would not let their picture be taken. Did not smoke, did not seem friendly at first, but warmed somewhat as the interview progressed. Zhenhong talked and translated while I took notes.

They are the owners of a 1999 Shaifang 3-wheel CRV with a half-cab (looks as if it may have been a full cab, but the top has been removed). The CRV was purchased to sell watermelons and other fruits that they buy at a wholesale market and sell at a retail market. They travel all across China (Shan1xi, Shan3xi, Hebei, Inner Mongolia provinces) buying and selling produce, but never transport coal or building materials. They travel for several days at a time and cover distances up to 600-700km per trip, averaging 200-300km/day.

Their Shaifang CRV was purchased for RMB5800, RMB8000 including taxes and fees. It was purchased at Shacheng CRV market. They plan to purchase another CRV next year, because they desire a higher top speed.

They pay RMB2.72/liter of diesel fuel, and get 5l/100km. Travel 200-300km/day on trips up to 600-700km. They cannot travel further because the vehicle cannot take it. Report that there is no road fee for CRV's. Report that vehicle specification is ½ ton, but that their typical payload is 1 ton.

Exclusively buy produce, transport, and sell. Independent operators.

Owner reported no major mechanical problems in three years of ownership. Reported that the vehicle was "high quality." The only reported regular maintenance is to replace the drive belt every year, a repair the couple performed themselves at a cost of RMB15 for the belt. Reported that if the vehicle is capable of moving, they will not spend money on any repairs.

The CRV is their sole source of income, and they use it to support three children. Reported that they are doing well. If the CRV were lost, they would buy another (see II)

Note: while we were speaking, a woman on a 3-wheeled bicycle purchased several watermelons, and added them to her day's purchases of potatoes, and other veggies. She was on her way to her small village to set up a small stand to sell the produce.

Want to know:

- What are markets that this couple purchases their produce? Direct from farmers? Wholesale markets?
- When they buy another CRV, will they sell their current vehicle second hand? What will they get for it?
- What kind of profits do they make (IV)?
- Who buys produce at Agriculture Market? Households? Restaurants? Merchants?

Trip Notes #3 Through #9
Streets of Yanqing crowded with 3-wheeled cycle taxies – like rickshaw, but with simple board on back and no shade. We took one from our hotel to the market – a 15 minute walk. It took 5 minutes by cycle-taxi, and cost Rmb2.

Also noticed a preponderance of tiny minivan taxis parked everywhere – probably the most pervasive form of transportation we saw besides bicycles/taxis. Some offered regular route service, and some were for hire. We decided to interview a few drivers to see what service they provided.

I am amazed at the diversity of vehicle types around. Almost any imaginable size of vehicle can apparently be converted for use in transportation – indeed, almost any size of vehicle may be available for purchase as a specially manufactured transportation vehicle! 3-wheeled bicycles, 3-wheeled motorcyclercycles, tiny gasoline-powered CRV's that are essentially motorcycles with cabs (100kg payload reported on one). Also much diversity in size of 4-wheeled CRV's, some having dualie rear axles, and very large beds – much larger than a 1-ton pickup. Small 4-w CRV's are about the same size as 3-w CRV's or minvan taxis. Also many larger trucks, and vans of all sizes.

Note: research methodology includes offering drivers a cigarette. Most of the time they accept, almost all the time they seem happy to talk with us.

We also determined that CRV's can be identified by an orange license plate unique to CRVs and HD diesel trucks. Other trucks have a blue license plate.

3. Yanqing Market minivan taxi owner, August 9, 2002 – 11:00am
Approached a driver in sunglasses cleaning his minivan with a rag – a Songhuajiang model #HFJ6350 manufactured by Hafei Vehicle Mfg, ltd. Driver purchased vehicle in March at a Beijing 2nd hand vehicle market with his own savings and money borrowed from friends and relatives. Vehicle cost was Rmb20,000. Driver reported that minivans must be discarded within 15 years of manufacture.

The driver was unemployed when he purchased the vehicle, so this is his only source of income. He travels from the market to surrounding rural areas. His customers typically purchase their produce here in quantity and bring them to local markets with his vehicle.

Driver reported that all fixed fees for the vehicle are collected when the vehicle was purchased. Reported that road fees = Rmb130/month. Also paid Rmb300 for a used vehicle inspection when he purchased, as well as Rmb150 to replace the license plate.

Reported two types of insurance possible. Comprehensive ins. covers injury and damage to both parties, and costs over Rmb3000/year. The driver had the second type, a limited insurance that only covers damages to the other party. This costs Rmb1400/year. He has no business license, though he is supposed to have one.

Reports that he uses 7l/100km, and pays Rmb2.94/liter of gasoline. Reports that overloading is not a problem with minivans. He charges Rmb10 for trips within 5km, with an additional Rmb0.6/km after. Vehicle is allowed on highways, but not in the center of Beijing. Reports bridge fee in Hubei province, but not in Beijing proper. He never rents the vehicle (reports not allowed by law), but does occasionally lend the vehicle to others. He travels 100km/day on average, and also uses the vehicle to bring his children to school, and take his wife to work. Also uses to take occasional vacation tour with family, or to provide free transport service to friends and relatives. Note: also has a cell phone.

Reports a loss of Rmb10/day if his vehicle sits idle for maintenance or other reasons (driver has calculated daily cost of insurance, fees, etc). He reports spending Rmb300/month on maintenance, "too much," and regularly replaces oils, tires, etc. If he didn't have the vehicle, he would try and get a construction job. The taxi is his only source of income. His wife is unemployed, but gets temporary work. Has one son in primary school, makes about Rmb10,000/yr.

4. Yanqing Market 4-W CRV owner, August 9, 2002

Woman selling fruit at a stand in front of her parked 4-wheeled CRV (photo). Reports that most of the fruit was purchased at Sidaokou wholesale market in Beijing. The plums were purchased from local farmers, as they are grown nearby, but the rest of the fruit is only available in the south of China, so it must be transported to the wholesale market to be picked up.

The woman's husband arrived, and spoke the rest of the time while she tended the stand. The CRV was bought new last year. It is a Changan CRV, used exclusively for their fruit business. They paid Rmb30,000 including all taxes and fees. They are on the same insurance plan as the minivan driver in trip note #3, and reported that they purchased the vehicle with their own savings.

Their vehicle gets 6l/100km, they pay Rmb2.6/l. it is 90km from here to the wholesale market. They pay a road fee for highway use. Example transaction: melons purchased for Rmb1.8/kg at wholesale mkt in Beijing will sell for Rmb2.4/kg at Yanqing. They typically pay Rmb3-4000 for each payload. Vehicle spec is 0.6t, but they typically load 1.6t. They usually get Rmb5-600 per payload in price difference from Beijing to Yanqing. Report paying about Rmb5000/year for all fees, maintenance, insurance, etc. (fuel?)

They have had to fix the clutch, and replace the drive belt once/yr. Their vehicle is their only source of income. They typically take one trip per week, twice per week if transporting vegetables (when in season?). They have two daughters in high school "good students," whom they will be able to send to university with their earnings "without problems."

5. Yanqing Market Minivan taxi owner, August 9, 2002 – 1:25pm

Zhenhong noticed an advertisement for liquor on the back of this taxi. We asked the owner if it was a secondary business. In fact, the liquor producer gave him a bottle of the stuff in exchange for putting the advertisement on his minivan. This minivan is obviously newer than the first, and would look at home on a European street.

Vehicle is a Jiabao from First Automotive Manufacturer purchased Zhonglian automotive market in Liulangzhuang in Beijing. Purchased vehicle new for Rmb37,000 one month ago. Pays comprehensive insurance for Rmb3700/yr. Total fees reported as over Rmb3000. Purchased with his savings. Same business plan as first minitaxi owner—transports passengers with cargo from market to rural areas, and also provides free transport for friends and relatives. Reports regulation of 10yr max life for vehicle, extendable up to 15yrs. Reports that small loans are available for vehicle purchase from banks or manufacturers.

Uses #93 gasoline, gets 6 l/100km, pays Rmb2.94/l. Travels 150km/day at most, charges Rmb10 for first 10km, Rmb0.6/km after. Also reports overloading not a problem. Example: 7 passengers taken 100km; charges Rmb150.

Reports no problems (vehicle only 1 month old). Could take us to Beijing (70km) for Rmb150. No other income sources. Would not allow picture.

6. Yanqing Market 4-W CRV owner, August 9, 2002

Very friendly and helpful couple selling peaches in front of a large 4-w CRV (photo). Purchased 7 yrs ago with savings and money borrowed from friends. Mention that it is sometimes possible to get credit from a bank: you need to find a wealthy man to secure the loan from the bank, and then you get the money from him. In addition to Yanqing, they visit several markets in Hubei province selling produce from their farm.

Purchased new for Rmb27,000, Rmb3,000 for fees. Plan to purchase another in 4-5 years. Make: Jubao ("brings wealth") from Shandong Weifang Vehicle mfg. Bought at Dashizi vehicle market in Yanqing county. Report 3l/100km. Use Diesel #0 in summer, diesel #35 in winter, pay Rmb2.5/l. Pay Rmb10/pass for road fee, and travel 35km/day to farm.

Example: Rmb1 buys 1.5kg of peaches in Yanqing. They transport .25t/day. Reported that alternative would be to sell their peaches to a trucker at their farm, but that the truckers pay very low prices (e.g. Rmb0.1/kg for peaches). They also provide transport service for others (paid) when they have the time. Example: charge Rmb160 to transport 1.5t 100km. 2t is overload for their vehicle. They also transport building materials. They never rent their truck, for they fear it would be harmed.

They have had no major repairs in 7 years (!), and are very happy with the vehicle. The left light has failed, and they will not replace. They purchased this CRV over smaller ones because of its larger capacity.

7. Yanqing Market MD(?) truck owner, August 9, 2002 – 2:25pm

A large truck (approx MD by US standards – the biggest type in the market) loaded with cabbage, carrots, and celery (photo). A young driver is sitting amongst piles of cilantro. Reports that they purchased the vehicle new one year ago for Rmb40,000, plus Rmb8000 in fees. They use it mainly for vegetable transportation. They purchase the produce directly from farmers (current load from Hubei). Purchase for Rmb0.15/kg, and sell wholesale at Yanqing. Today they are selling for Rmb0.3/kg, yesterday for Rmb0.4/kg. They reduced the price because many trucks were present today. They always sell at this market, and buy from Shandong, Hubei, and Beijing.

Driver has two business partners, including his older brother (who is resting somewhere else), driver is single. They pay Rmb40/100km in fuel, purchased for Rmb2.7/l. Driver pulls out a calculator and computes that this makes 13.5l/100km. They mostly purchase in Hubei, about 100km away. Once this year they provided a transportation service: from Guozhuang to Yanqing county (100km) payload of 4.5tons, charged Rmb300. Their max payload is 6tons.

Paid about Rmb5000 in maintenance last year. Driver reports that he is diligent in maintaining the vehicle, and will repair the truck as soon as a mechanical problem is noticed. Service is performed at a shop run by the vehicle manufacturer. Report no other income source, and that it is "easy to make a living" as he does. He gave Zhenhong his cell number if we wanted to ride with them to the Hubei market tomorrow.

Driver reported that very informal wholesale markets organize in rural areas. Farmers bring their produce to locations very near their farms to sell to truckers. Truckers then pick up their produce and drive to markets like Yanqing, where they sell to restaurants or other small businesspeople.

8. Yanqing Market 3-w CRV owner, August 9, 2002 – 3:20pm

Very old-looking CRV with an old farmer in tattered clothes sitting in the bed with large sacks of potatoes (see photos – incredible. CRV's cab has been half removed. Rust everywhere. Air intake collapsed before the filter. Front wheel listing to side.) Vehicle is a Jintuo CRV purchased new in 1997 (!!!) for Rmb8000, plus Rmb1000 in fees. The farmer expects it to last 2-3 more years.

His farm is 7km from his home in a small village of about 250 families. He sells his farm's produce (mostly vegetables) exclusively. 1t/load, sells entire payload for Rmb600, never sells in his home village. Travels to market about 15x per year, and leaves the vehicle in storage for the rest of the year. Reports to have used 10l fuel for a trip to Beijing and back (infer 140km total). Pays Rmb2.74/l. Pays a road fee of Rmb70/quarter. Never rents vehicle. Yearly inspection costs Rmb100, plus Rmb10/month for transportation service license.

Reports two problems in last 5 yrs, paid Rmb350 to fix each problem. Glass on cab shattered, but he will not replace. Income is Rmb4000/yr, has 2 children in school, and had to borrow Rmb10,000 to pay for their schooling.

9. Yanqing Market 4-w CRV owner, August 9, 2002 – 3:45pm
Woman and two small children, and a couple of others under parasol a little removed from main market (photo). Three 3-w bicycle transporters by CRV. Bulk sugar, salt, seasoning sauce in truck. Husband away delivering goods on one of the bicycles.

They purchased the vehicle second hand for Rmb15,000 three years ago after losing a vehicle they purchased new. Paid Rmb100 in fees when vehicle purchased. They use the CRV to transport their goods from storage in their house to the market (2.5km from home). They rent a larger truck 6x/month to transport goods from Beijing to their home (100km away; 7hr round trip) or from further away (250km) if the price is low enough. Woman did not know rental price for the truck. They transport 16t/trip (!) with the larger truck. Their CRV holds 1t of goods, and they make 2-3 trips/day to replenish their supplies. Report income of Rmb20-30,000/yr. Mentioned that they had to pay Rmb30,000 to the government for permission to have a second child. Noted that now the policy is more strict, and that 30,000 would not be enough – and that they would be put in prison for having another child without permission.

Trip Notes #10 Through #14
Left Yanqing in a minivan taxi to get to the smaller wholesale marketplace at Xiaofengying village. Were delayed and arrived later than expected, at about 8:00am, when the market was closing down. The minitaxi ride lasted ten minutes and cost ten yuan (return trip cost Rmb5). Noticed a marking on one minitaxi: "4-cyl 800" infer 800cc. Our minitaxi had a 4-speed + reverse gearbox, and seemed to top out at about 70kph. Along the way we passed a large construction site (ubiquitous everywhere I've been) with a line of 3-wheeled CRV's and small tractors hitched to trailors (and one or two 4-w CRVs) all filled with construction materials.

Arrived at market. Large parking lot with shaded areas for loading and unloading. Large storage buildings in center, cardboard boxes lined up. Large HD trucks docked at storage buildings being loaded with copious quantities of bundled produce. Cabbage everywhere.

Met two curious older ladies. They said that farmers from around here bring their produce here where it is put in storage, then bundled up, loaded onto trucks and shipped to faraway places. Confirms conversation yesterday with trucker, except that the organization of this market is more formal than those he was speaking of.

Again, vehicle diversity is stunning – even more than the Yanqing market. 3-w CRV's clearly dominate the scene. Also present are 3-w bicycles laden, 3-w motorcyclercycles, a couple of horse-drawn wagons, several walking tractors hitched to wagons, small tractors with wagons, 4-w CRVs, small trucks, all brimming with produce -- and the HD diesel trucks to take it all away.

10. Xiaofengying Village Wholesale Market 4-W CRV owner
Met a man unloading catnip from his truck (photo). A Qingqi manufactured by Zibo Mfg. group, purchased new in 1997 for Rmb24,500 plus Rmb2500 in fees. He expects vehicle to last another 5yrs without problems, says, "now CRV's are very cheap in China." Gets 7l/100km, pays Rmb2.7/l. Reports that today's load of catnip weighs 400kg, and has been purchased for Rmb50. Catnip was grown on the man's farm. Reports that no major maintenance has been required, only regular maintenance.

11. Xiaofengying Village Wholesale Market 3-W CRV owner
A man and his son standing by their empty CRV. Purchased vehicle new 2yrs ago for Rmb7000, plus Rmb1500 in fees. They drive to the market only 3x per year from their farm 50km away. Also uses the CRV around the farm to transport fertilizer, and to move his produce to storage. Reports 7l/100km. Never provides service to others. Sold his 0.5t load of cabbage today for Rmb100. Reports that he has

experienced many mechanical problems, too many to talk about. Note: air filter had been removed from vehicle!

12. Xiaofengying Village Wholesale Market HDD truck owner
Two men working on fixing a broken turn signal relay on a large 3-axle 10-wheel straight truck. Report that the two men purchased the truck together new 2 yrs ago on credit. Put down 30% down payment (Rmb 250,000 total) and will pay it off within 3 years. Shitong make from Hubei province. They travel between here and Guanzhou (extreme South of China). Payload is >20t. They did not purchase the vegetables, rather they were contracted by a "boss" living in Guangdong who has hired them for the transportation service. Will earn Rmb10,000 for the 3-day, 2500km trip. Report that they can earn Rmb5,000 on the return trip, transporting household items for supermarkets. They get 34l/100km, pay Rmb2.7/l, and make 2 round trips each month. They have comprehensive insurance.

13. Xiaofengying Village Wholesale Market CRV owners (transaction)
Saw two similar-sized CRV's parked side by side exchanging cabbages (photo). Went over to see what was going on. Farmer with 3-w CRV had sold his payload of 0.5t of somewhat shabby looking cabbage to a man with a 4-wheel CRV for the usurious price of Rmb15. Payloads were obviously the same, as 4-w CRV was almost entirely full. 4-w owner explained while 3-w owner present that he would sell the cabbage at Changping county wholesale market 60km away for Rmb100. However, he must pay a road fee of Rmb20. He explained that the 3-w CRV was not allowed on the highway, but his vehicle was (hence the transaction.)

14. Xiaofengying Village Wholesale Market 4-W CRV owner
A crowd of 6 women (one with a small child) laughing and tossing cabbage up to two young men in the bed of a good-sized, almost full 4-wheeled CRV. 2 young men own the CRV (brothers), a Shandong Shifeng Mfg. group CRV purchased new three years ago for Rmb20,700, or Rmb23,000 including fees. Report that they have purchased the produce from several farmers at different prices according to quality. Will transport to Changping cty market (as in #13) 80km away. Report that their vehicle is allowed to enter Beijing city, but only at night.

They make one trip to the market each day, with a 1-ton payload. Report a price difference between buy and sell of Rmb0.04/kg, and an average purchase price of Rmb0.5/kg. The women helping them are being paid to assist in loading the truck (they go from truck to truck.)

Trip Notes #15 Through #20
Returned by bus to Beijing City to quickly visit Beijing's wholesale markets and depart for another province. Visited a mid-sized produce market, then the largest wholesale produce market in Beijing. Enormous! Located just at the edge of the city proper. Filled with mostly 3 and 4-w CRV's. I guesstimated 50% 3-w, 40% 4-w, and 10% HD trucks. Also many 3-wheeled bicycles, and even a couple of 3-w bicycles that appear to be retrofitted with tiny 2-stroke motorcycle assists. At the gate are swarms of 3-w motorcycle-taxis. Also present are many "Changan" brand 4-wheeled transport vehicles. They look like a tiny 4-w CRV, or perhaps a minivan taxi with the roof chopped off. Small 2-passenger closed cab, and pickup-style bed. Gasoline powered, blue plates. Much quieter, more "car-like" than CRVs, but appear to be less "heavy duty."

Also worth mentioning: Beijing has a large number of electric bicycles.

15. Small Beijing Wholesale Market Minivan user
Full of 3-wheeled bicycles. We spot a couple loading a minivan (like those used for taxis) with cabbage. They report to have owned the truck for 3 years. They purchased new for Rmb30,000 plus Rmb5000 in fees. Busy couple, had to go. (photo)

16. Small Beijing Wholesale Market Minitruck user
Dualie rear axle, closed box. Loading a variety of vegetable produce. They will drive to Tiajnin wholesale market 75km away and sell their load. They make this trip every 1-2 days, loaded with 2t of payload. Report that they earn about Rmb100 per trip after fuel costs and all fees.

17. Beijing Wholesale Market Supervisors
We are escorted into the office of 2 female party members to talk about the Beijing market. They cite official statistics: the market sees over 10,000 vehicles per day not including bicycles. The market is 333,000 square meters in area. The seemingly bustling market we are witnessing is actually in the middle of its daily lull right now (2:00pm-ish). The real rush comes late at night and early morning. Transactions are completed in the early morning, and vehicles arrive late at night to prepare (and, I suspect, because CRV's are not allowed in Beijing's center during the day.)

They explain that to enter the market, vehicles must pay a fee. The amount is recalculated daily in an attempt to capture a percentage of the market value of the vehicle's cargo. Typical fees for 3-w CRV's are Rmb10-40, and for 4-wheel CRV's Rmb15-50. Obviously, high capacity vehicles are charged more.

18. Beijing Wholesale Market 3-w CRV user
Couple sitting by a pile of celery. Woman sleeping in empty truck box. Large 3-w 2000 Sheifung Juli CRV, hand start, full cab and box. Owner reports purchased for Rmb 8000 including fees, and notes that it is now worth about Rmb6000. Reports their typical payload is about 2t (nom. Payload is .5t). They arrived at the market last night and slept in their vehicle. They will return to their home tonight in Zhangjiakon (200km away) and then make another trip to the market to arrive the night after they return.

Price difference depends on type of vegetables selling: vegetables that spoil quickly can bring a higher profit, but higher risk. Reports Rmb100 profits on average. Buys direct from farmers in Zhangjiakon, or sometimes buys at Yanqing as well as other nearby counties. He plans to replace the CRV with a minitruck or a minivan so that he can do business inside Beijing city for much higher profits. (photo)

19. Beijing Wholesale Market 3-w CRV user
2 men with a beat-up looking 1999 Sheifung 3-w CRV half-cab selling large bags of onions. They are farmers selling their crop. They make 1 trip per day from Tianjin city. They also transport goods purchased from other farmers. Average 2t/trip (overload). Report Rmb180/trip in revenue. Spend Rmb17/trip on fuel. Their vehicle cost Rmb7000m plus Rmb700 in fees. Mostly purchased with savings, plus some money lent by relatives. Report that the produce at this market is purchased by small wholesalers, but also by some very large trucks.

20. Beijing Wholesale Market CRV Parts store
Tucked into the corner of the market is a hole-in-the-wall CRV parts store. Tiny store jammed with parts from tires, rims, engine blocks, crankshafts (all outside) to small parts, gears, clutches, oil, cables, etc.

Owner reports that their customers are primarily the owners of CRV maintenance shops. These tiny shops are scattered in small villages. He picks up a clutch plate. Cost wholesale to his customers is Rmb10. They will charge Rmb15, or Rmb35 with installation. Reports that farmers will almost always go to a stand to get a non-routine servicing done.

Trip Notes #21 Through #24
Luoyang is a very badly polluted industrial city of 6M people. Pollution is worse than Beijing (at least today) and to my recollection at least as bad if not worse than the worst parts of northern Mexico City. Zhenhong reports that there are worse towns to be found. Fumes coming from sewer smell like Bondo. Lungs seared with diesel fumes on road. All vehicles seem to emit visible pollutants. Excellent food though! Luoyang's largest market is medium to small size. Much higher percentage of 3-w CRV's here (one man reports that 70% of farmers at the market have 3-w CRV's). Also many more 3-w motorcycles than Beijing.

21. Luoyang Market 3-W motorcyclercycle owner
Young man driving beat-up 3-w motorcycle with his mother standing in the bed. Their farm is 15km away. Purchased motorcycle for Rmb2000 (!!!) 3 years ago. Reports that they "don't use it too often" yet they take it to the market every 2 days to sell their produce.

22. Luoyang Market 4-W gasoline truck owner
Young man loading his truck with a large quantity of vegetables. Transports a variety of vegetables to sell at a local market 40km away, makes the trip once per day. Purchased truck 8 months ago for Rmb22,000, plus Rmb6000 in fees. Bought instead of an CRV because it is faster (top speed 110kph) and he prefers gasoline to diesel. He says that his vehicle is under the same regulations as CRVs (Note: may be that CRVs are unrestricted in Luoyang.) Truck says .6t payload, but the vehicle has clearly been overloaded, as its rear leaf springs are flat.

23. Luoyang City Shifeng 3-w CRV dealer
Long search for CRV dealers turns up an unfriendly dealership selling exclusively Shifeng 3-w CRV's. Reports prices as Rmb8000 for a full-cab, and Rmb7000 for a half-cab. Also sells parts: has a roomful of engines, and a large diesel truck unloads tires and shocks. About 75AV's are on the lot.

24. Luoyang City Shandong Juli CRV dealer
Dealer across the street sells a wider variety of CRV's: 3 and 4-w, including vehicles with dumping capability. Also sells tractors. Interestingly, he has two 4-w CRVs in beige – the first CRV's I've seen that are not blue. Reports that 80% of his customers are farmers. Prices: 4-w dumping CRV w/ dualie rear axle, shaft drive: Rmb22,000. 3-w dumping CRV: Rmb8800.

Zhenhong sweet-talked the dealer (and offered a cigarette) and I got a test drive on a half-cab 3-w dumper with hand-crank start (luckily he started it). Impressions: very difficult to drive. Clutch is a little unpredictable, and grabby as hell with the 1-cyl engine. Black smoke poured out of the back – a brand new vehicle! Also, it was VERY LOUD. Ear-ringing loud for the driver. Three speed gearbox is very difficult to shift – much like a tractor, you almost roll to a stop by the time you get it into the next gear. Got it into 2nd in the parking lot. Imagine that top speed in 3rd will be very low – quite possibly only 40-50kph, as regulated. Also, I doubt that the vehicle is capable of climbing much of a grade fully loaded. However – there was one lever I didn't ask about: possibly a low-range? Will ask next 3-w CRV owner. (photo!)

Trip Notes #25 and #26
Took a taxi to the nearby village of Jiaotun across the river from Luoyang, perhaps only 5-10km away. – thankfully the air is a little better there. Arrived at about 10:00am. According to people on the street, Jiaotun consists of about 3800 farmers. All streets inside village are dirt, and extremely narrow. Bricks and construction materials everywhere, all houses made of brick, except for a couple of wealthier gated houses covered in tile. No vehicles inside of city except for 1-2 CRV's holding construction materials. Wandered through mostly-deserted streets for a while – a maze of 2-story partially-completed buildings. Save a few old women, and a couple of families building their houses, the place was quite empty. Asked a woman where they bought food, she replied that they either bought from vendors selling produce on 3-w bicycle, or selling on the street by the village.

We headed through the village and to the fields. (photo) Beautifully cared for plots – many quite small, very diverse produce. Many people in the fields working. Ditch irrigation system. Met a couple of farmers and soon a group of four appeared around us; a man and three women, with two bicycles.

25. Jiaotun Village Farmers
Asked where they sell their crops. Said that they sell them in a nearby market, transporting them by 3-w bicycle. Said that they were not allowed to sell their goods legally, so they must risk fines in order to sell their crops. Why? "because the government does not care about us." We asked for the name of the market they sold at, and directions. Started walking.

26. Luoyang City Small Market transporters
Market turned out to be back on the Luoyang side of the river, perhaps 5km away. We walked for a while, then got a ride on a motorcycle-taxi. Medium-sized wholesale market, mostly empty. Few vehicles – couple of CRV's, some minitrucks. Met a group of 6 people and talked. They were transporters, buying goods from farmers and selling them here market to larger trucks for export to the south of China.

Asked about farmers transporting their own goods to the market. At first, it seemed like this was an illegal practice (perhaps because of road use restrictions on farmers' vehicles) but clarification revealed that it is in fact legal for farmers to transport their crops to the market via bicycle, but that farmers often tried to sell their goods directly, which was illegal. To sell goods legally, they apparently should be sold at a registered market, and the retailer must pay a fee to sell. Farmers often risked fines to sell direct to customers in retail markets without buying a space, or by selling illegally in a non-market space (e.g. the side of the road). (Note: is this where Jiaotun woman buys her goods?)

One man (seemed to be somewhat bitter compared to the others) expressed great frustration when speaking about vehicle regulations. Turns out he had just been fined for overloading. He is part-owner in a cooperatively owned 2t truck. He makes his living buying from farmers and transporting to this market. Claims that every vehicle in the city of Luoyang is illegal in one way or another, and that anyone can be fined if they encounter the police. His vehicle was fined for carrying 9t of cargo, which he considered totally safe. Says his vehicle can transport 15t(!) without trouble.

Ideas:

- Visit site of farmer-transporter interaction
- Visit illegal roadside markets
- Try and interview non-agricultural CRV users

Trip Notes #27 Through #33

Decided that we need more time in the countryside. Took Scott's advice, hired a cabbie for the day and headed out into the villages surrounding Louyang. Driver was a young man, proved quite helpful talking with locals and sharing his own knowledge. Drove like a maniac, constantly honking horn to clear our way through crowded market streets. Felt like I was in a police car in a high speed chase. Speeds on main roads were around 95kph, about 35kph faster than the traffic flow. Roads are extremely dangerous – I saw one accident (photo), and we nearly murdered countless pedestrians. We arrived in Zhengjiacun at about 8:00am (photos). Village much like the last one, brick houses, dirt streets, various equipment scattered around the side of the road.

27. Zhengjiacun Villagers

Came across a middle-aged woman sitting by herself in a pink plastic chair. As we talked, several others joined in, including our driver. We asked where farmers bought and sold their produce. Reported that farmers eat mostly their own food, and buy their meat at a nearby market. When asked about transporting and selling their produce, it was evident that they were quite angry about the situation. It took a while to sort out exactly what the situation was, as the villagers tended towards dismissing the entire transport-sales system as impossible – our initial impression was that it was illegal for them to transport goods, and also illegal to sell them on the roadside. We asked why, and the woman replied, "because this society is crazy, the government is crazy, and we have no rights to protest." After a while, we sorted out the source of their discontent (or at least a part of it.) CRV's, 3-w motorcycles, and bicycles laden with produce are only allowed in the city from 8pm to 7am. Vehicles on the road outside of these hours risk confiscation (our driver confirmed that the other day two 3-w motorcycle taxis were confiscated.) Villagers also reported that it was sometimes possible to transport between 12-2pm, as the police generally did not work during those hours.

Also, it is illegal for them to sell in the city without reserving a retail stand location. Competition for these permits is difficult, and few farmers can secure one. As a result, farmers often transport their goods in the early morning, and are forced to sell them at a low price to someone with a permit. Farmers generally have to sell their crops wholesale unless they are willing to stay at the market all day long.

Asked about transporters coming to the village to pick up crops, replied that it never happened in this village. Reason: they grow a very diverse crop, and thus the quantities are too small to warrant a pickup. Reported that in villages that only grew a single crop, pickup was more common. Villagers reported that many families (around 40%) buy motorcycle 3-wheelers at a cost of around Rmb2000 – mentioned a popular brand: Yong Sheng. Reported that because the local terrain is so flat, few familes buy CRVs

(~10%), and that 3-w CRV's were most commonly used for coal or building materials transportation. (Note: man selling bean sprouts from a 3-w bicycle passes). Also mentioned that gasoline minitrucks are used to transport furniture. They are purchased by farmers to provide transport services. They are allowed in the city at all times, but drivers must purchase passes for permission. (Note: have seen gas trucks transporting furniture in city.)

28. Zhengjiacun Grape Farmers
Drove out into fields, stopped at first people we saw: a group of 3 men, 4 women, and 3 small children under a lush canopy of grapevines clipping and packing beautiful bunches of grapes into large Styrofoam containers (photo). Farmers were a happy group, obviously satisfied with the harvest, and much better off than most of the farmers we have seen. They offered us several bunches of grapes (delicious!) and were happy to talk. Also under the canopy were 2 3-w motorcycles and a 2whl motorcycle.

Reported that vines were owned by 2 families working together here. They will sell the worst of the crop in Luoyang, as the prices here are very low. The best they will sell in the south of China (Guongdong) because the price there is very high. Zhenhong recognized the grapes and confirmed that they are quite expensive in his province. To transport the crop, they pay a rail freighter, as trains are more reliable than trucks (fewer breakdowns, traffic delays, less vibration.) They travel to the south to receive the grapes and sell them wholesale. To transport the grapes to the train, they hire several gasoline trucks.

29. Zhengjiacun Farmers
Drove to another field, parked, and started walking. Passed an acetylene factory, and a couple burning corn stalks right outside the gate! Saw an older couple hoeing furrows into their plot (perhaps 3/4acre), which appeared to have been recently tilled. They dare not go into the city to sell their crops, as it is too risky to transport them there, besides, a typical bicycle-load of crops only fetches Rmb10-20, so it is not worth the risk for them. Instead, they sell at a nearby rural market in Anle (see next interview). Zhenhong asked if they had had difficulty making a living here, reply: "it will be difficult to find a family around here that does not have difficulty making a living."

Continued walking, saw three people in a field – a woman and two children. Woman hoeing furrows. 12 year old girl and 6 year old boy are both mentally retarded. The woman is caring for them for a friend. They are clearly very poor, tattered clothes and bare feet. Husband is transporting crop to local market with a 3-w motorcycle.

30. Anle Retail Market
Took the cab to the retail market mentioned (photos). Talked to an apple vendor selling out of a hand pushcart. Reports that he must pay a "health fee" of Rmb1/day, plus a "control fee" of Rmb1/day to legally sell in the market. Market is populated mostly with 3-w bicycles, and a couple of 3-w motorcycles and pushcarts. Very narrow streets, and large numbers of pedestrians and carts make passage by autos or trucks very difficult. Nearby I saw an CRV filled with coal. Vendor reports that he sells apples (delicious!) for Rmb0.8/kg. If he sold in the city, the price would be over Rmb1.

31. Small 3-w Motorcyclercycle Manufacturer
On a road out of town we saw what looked like a 3-w motorcycle dealership, by the new 3-w motorcycles displayed out front. It turned out to be a primitive manufacturing plant! We spoke with the owner and toured the facilities. He would not allow photos of their production process, as he did not want trouble from the government. He purchases engines, wheels, and front forks, and manufactures all other components here. His motorcycles sell for Rmb2000 for the base model (2stroke), Rmb2200 for a slightly larger one, or Rmb3000 for a 4-stroke model.

The whole facility was very small – basically a metal shop. Dirt floors, broken glass and frayed electrical cables everywhere. Sheet metal cutter, bender, drill press, hand tools, MIG welder, some frame jigs. Possibly 30 employees, perhaps 10 vehicles/day production (wild guess). Very shoddy construction techniques. Owner did not seem to know whether one motorcycle I pointed to was 4stroke or 2stroke (it was obviously 2stroke). Not quite sure how the differential works – noticed one chain from motorcycler to

shaft, then two chains to the axle, didn't look closely enough to see what was going on. No visible gears, just sprockets.

Zhenhong once again got me a test drive on a vehicle that just came off the factory "floor" -- the mid-sized 2stroke model. Impressions: MUCH easier to drive than the 3-w CRV! Quiet, easy to start (kick), a fairly smooth transmission, decent clutch. All in all, a surprisingly decent machine given its construction. Seems like the gearing might not be optimal for heavy loads.

As we drove away, we asked our driver about motorcycles. Reported that 3-w vehicles have same restrictions as CRVs, but 2whl vehicles are allowed in city at all times. Cheapest motorcycles locally available are around Rmb3000.

32. Countryside Road Trip Notes
Traveled about 1.5hrs out into the countryside to Shaolin (closest mountainous area) and back. Saw many vehicles on different types of roads than those traveled thus far (mostly flat.)

Motorcycle-taxis: Ubiquitous throughout rural areas, have seen as many as 8 people in the bed! Some taxis have boxes to protect occupants from elements (photos), some are open.

3-w CRVs: Saw many on larger roads, fewer in small towns. Often very heavily laden. Watched on a steep road for several minutes as CRVs slowed down to a crawl to downshift and climb the grade. Single cylinder motorcyclers on CRVs at full power and low RPM sound almost exactly like a jackhammer – stunningly loud, much louder than all other vehicle types. Drivers must sustain hearing damage after prolonged exposure. Saw many 3-w CRVs transporting logs, sacks of grain, etc.

Walking tractors: More common than 3-w CRVs, particularly in semi-populated areas. Always hitched to trailor. Capable of climbing steep grades. Look extremely uncomfortable to operate. Most are very old-looking. Single cylinder.

Small tractors: Also more common than 3-w CRVs, always hitched to tractors. Single cylinder, similar distribution to walking tractors.

Questions:
- What are benefits to such a broad range of cheap transport sources? Who benefits most?
- What are costs, who pays costs?
- Costs, details about walking tractors, small tractors?

33. Notes
Attempted to find dealerships for the small tractors and walking tractors I noticed yesterday. Found a large tractor manufacturer in Luoyang, but they mostly produced more heavy duty equipment. Only one single cylinder tractor model left, and no walking tractors. Got their brochure. Model 180 1cyl tractor (seen on road a few times) sells for Rmb8300, plus Rmb4000 for the trailor. Trailor sounds unreasonably expensive – will attempt to confirm tomorrow. They don't manufacture walking tractors because they aren't selling anymore. This opinion was reconfirmed several times on the street – walking tractors are on the way out. One woman at a dealership told us she would call a walking tractor manufacturer to get us prices (she didn't ever sell them anymore.) So we'll get back to her tomorrow. She used to sell 6,8, and 9hp models.

Interesting questions: Why have w.t.'s gone out of fashion? My understanding is that they were at the core of China's early rural mechanization project, used to help a farmer become self-sufficient, ploughing, transport, water pumping, grain milling, etc. Perhaps "jack of all trades, master of none" has given way to increasing rural specialization?

Trip Notes #34 Through #41
Back in Beijing with a few days to kill before we can head off to Shandong. Very involved process to get letter of introduction. Decided to take a few days to talk to Beijing Municipality farmers and transporters. Headed out with Mr. Hu's student, Haiqing, as Zhenhong must prepare for his visa interview on the 22nd.

Haiqing's English is not as good as Zhenhong's, and she does not have the benefit of our past two weeks' experiences, but she does well despite these handicaps. We decided to head to Changping because we had heard the market mentioned very often at the Yanqing market – many transporters buy at Yanqing and sell at Changping. Also many had reported buying CRV's in Changping, so we tried to find dealerships.

34. Changping CRV Dealership

After much searching, we found an CRV dealership. Located off the highway, the sales lot was located in a complex of perhaps ten single story buildings and much storage space. The place has an oddly vacant, almost bombed-out feel. The lot is in front, four bored salesman standing in the middle of perhaps 20 4-w dumping CRVs with dualie rear axles. No customers. In a lot further down the entryway are another 40 minitrucks and CRV from 3 different manufacturers. We are told that none of the vehicles here are manufactured in the nearby Beijing Futian factory, but are shipped in from other provinces. Farther down from that lot is a large building that we are told is the warranty service center. Also little activity. The only three-wheel CRVs around are four or five low-end half-cab CRVs under a thick layer of dust stashed under an awning away from view. One has a flat tire. We are told that they are available for Rmb6500, but are not popular anymore, and they hardly ever sell any. Once the salesmen realize we are uninterested in buying an CRV, they quickly tire of our questions and suggest that we visit the nearby manufacturer. Since we are so close, we decide to take a quick look even though they don't make CRVs (Futian brand CRVs are manufactured by a subsidiary in Shandong.)

35. Changping Auto and Truck Mfg: Beijing Futian

Took a 2-stroke motorcycle-assist cycle rickshaw under the freeway to the Futian plant. Hand-start, loud and uncomfortable. Mostly there are motorcycle-taxis here, but the rickshaw was the only vehicle we could find from the dealership.

Arrive at Beijing Futian Automobile Co, ltd, across the street from Beijing Futian Environmental Engine Co (same company, different branches.) Enormous, modern buildings with elegant landscaping. Huge manufacturing complex, perhaps 20 3-4 story buildings, each about twice as large as Wellman. Complex appears to have been built on a cornfield perhaps 15 years ago. Wandered into the headquarters of the Engine Co unmolested and found the marketing headquarters. 12 cubicles in between 2 offices at either end of the room. They gave us brochures for the company, one in pretty good English. Very flashy.

Wandered back through the manufacturing facility (also unmolested) poking our heads into buildings as possible. Again very impressive – the opposite extreme from the 3-w motorcycle manufacturer we visited before. Stepped inside an assembly line for welding the bodies of vans. Very well organized, clean. Modern welding equipment counterbalanced for maneuverability. Factory produces vans, pickups, mini-trucks. Products look very modern, though I doubt the pickup could compete in the US. Was able to closely inspect the welds on a pile of mini-truck frames stacked outside. Welds were good, similar to those I've seen on US/Canada trucks. Not spectacular Honda quality, but certainly good. Not really qualified to comment beyond that.

36. Changping Wholesale Market 3wh CRV User

Gave up on chasing down more dealerships and went back to the wholesale market to talk with CRV users. The market is just massive, perhaps one quarter occupied by a lumberyard processing raw timber into boards. Another quarter is devoted to construction equipment, from power tools to concrete to flooring and detail items (faucets, water heaters, tile, roofing, etc.) The other half is a vegetable and fruit wholesale market. Noticed a pile of 3-w bicycles for sale (photo) cost: Rmb370. After wandering through the construction section, we find a group of men playing cards amid piles of fruit. Notably, there are almost no 3-w motorcycles, except for motorcycle-taxis.

Talk to a man who owns an CRV; goofy joker. Have to be careful of sarcastic answers and ask a few times to get the truth.

3-w full-cab CRV, bought new for Rmb8000 5yrs ago. Expects CRV to last another 7-8yrs, at which time he will sell for scrap metal, getting a little more than RMB1000. Uses to transport fruit from other provinces (Hubei, Shanxi, Yauning). Purchases fruit directly from farmers, and will travel up to 2-3 days

to buy. He also transports from closer fruit wholesale markets. This is exclusive use of CRV. Before owning the CRV, he did business with his 3-w bicycle. He hopes to someday replace his CRV with a Futian 4-w dualie vehicle. Only reported maintenance problem is tires.

37. Changping Wholesale Market 4wh CRV User
3 men and a woman sitting between an ancient truck and a 4-w dualie CRV. The old truck is "just a shelf" doesn't move – they just stack their vegetables on it for display. Use the CRV to transport watermelons. Bought new 2yrs ago at the market we visited for Rmb19,000. They hope to replace it next year with a Futian of larger size. Report no mechanical problems. This was their first vehicle. Before, they used 3-w bicycles. Report that most of the transporters in the market were using 3-w bicycles before, but have switched to motorcyclerized transport in the last 4-5 years. They buy watermelons from farmers about ½ hour away, both at small wholesale markets and from the farmer's field, depending on the price and quality. Mention that this type of CRV appeared on the market 3-4 years ago. They decided on it over the 3-w CRV because "the living standard is improving, and we have more money." Also mention that 10 years ago, a 3-w flat-bed bicycle cost Rmb1400, and now they only cost Rmb7-800.

38. Changping Wholesale Market 3wh CRV User
Dualie 3-w CRV owned by woman, accompanied by young son. Bought new 2 yrs ago for Rmb13,000. Bought in Shandong where woman is from. Use exclusively for transportation service. Buy veggies in Yanqing and transport here, and also transport fertilizer and crops locally. Want to replace with a 4-w vehicle. Before they owned this vehicle, they were farmers. Now in her village (in Shandong?), nearly every household has a 3-w CRV.

39. Changping Wholesale Market Minivan User
Off to the side of the vegetable market, there is a long line of minvans, gasoline mini-trucks (referred to in future as micro-trucks for lack of a proper term – similar size to minivan) and some other vehicles advertising their services. Most are sleeping. We talk to a conscious minivan user who is fixing his minivan (has removed steering wheel and is replacing turn-signal indicator assembly and wiring harness.) Bought used 3yrs ago for Rmb20,000. Uses to provide transport services and for personal use. His customers use it to transport various goods including construction materials. Vehicle made in Tianjin. Doesn't answer questions directly and rambles. Cut interview short.

40. Changping Wholesale Market Gasoline Micro-truck User
Woman in Changan micro-truck reading. Bought new 4yrs ago for Rmb26,000. Uses for personal use and provides transport services. From nearby village. Reports that vehicle ownership there is common. These types of vehicles became commonly available in '97 and '98. Before owning this vehicle, she was a worker.

41. Changping Wholesale Market Minitruck User
Bought 20 months ago for Rmb30,000 new. Transports cargo for others. Reports that he wants to replace his vehicle with something smaller – a minivan taxi perhaps. Asked to explain: His vehicle has a 1ton legal payload, but customers demand to overload with 3t of cargo. If he refuses, they take business elsewhere. If he accepts, he risks being caught and fined by policemen – clearly upset by this problem. Because minivans have low volume, overloading is impossible, so owning one can be more profitable.

Interesting differences between here and Luoyang. Very fast evolution from cycle to CRV, seems to move to mini-truck. No cycles, walking tractors.

Trip Notes #42 and #43
Decided that, as in Luoyang, we should spend a day going out to fields and speaking with farmers directly. Hired a cab for the day and headed to Changping. Amazingly, it proved very difficult to find a farmer still farming! The highway between Changping and Beijing is developing at a staggering pace, highrises littered in between cornfields, construction everywhere. Area is rapidly urbanizing, most farmers are becoming residents and no longer farm. We headed back towards Beijing in hopes of finding farmers between Changping and the city. Stopped at villages along the way asking questions. Many reported that they no longer grow crops on their land. Instead, they grow grass and trees to make their land more

appealing to investors! (Also, there is a government program to beautify the countryside by planting trees and grass on former farmland for environmental reasons and also for the 2008 games.) The farmers rent land to investors and developers. Must look into China property law – seems that land ownership is not allowed. All land is collective, village council rents it to villagers, who then rent it again to the developers. Interesting.

42. Hui Longquan Village Resident
Small village a few miles off the highway. At the juncture between the village and fields, badly paved roads turn to dirt. Meet a 67-year old man in tattered clothes. Talks with us for a long time. A little bitter, but very warm and friendly. Land is collectively owned, and village committee rents it to outsiders since ten years ago, before which the land was farmed by local farmers (*this appears to be untrue*). Says now all land is farmed by outsiders, who never speak with the villagers (bitterness creeps in). He used to be a factory assembly worker, but is now unemployed and does nothing but ride his bicycle around all day looking for work. Expressed anger at outsiders and fact that he has no land. When asked for details about the "outsiders" he gestured toward the fields and said we should find one and try and talk with them, if we could. Pantomimed a scared animal withdrawing, saying again that they don't like to talk.

43. Hui Longquan Farmers
Walked down the road one plot and immediately found a farmer in front of his brick shack. Tall, shirtless, friendly. Got his neighbor to come talk with us as well. Spoke for a long time, very warm and funny. They are actually from the village, the last two villagers still farming the land. They rent the land from the village just like the outsiders, paying Rmb100/acre for their 10 acre plots ("a fair price"). Also pay an agricultural tax. They sell their products directly at a small local retail market using their 3-w bicycles. The neighbor's younger brother and wife were also working on his plot. Say it is difficult to make a good living, but they make enough to pay their childrens' educational fees. Income depends on soil conditions, harvest quality, and market prices.

The land is very efficiently organized, with a highly diverse set of crops. Identifiable products included corn (used to feed their pigs and chickens), sunflower, onions, chives, peas, squash, melons, and probably five or six others I didn't recognize. The first man even grew tobacco, and was drying it on a line hung from his house. Also used greenhouses occasionally. None of the villagers farm this land anymore. The village is full of old unemployed people, as all the young employed find work elsewhere.

They began farming like this 6-7 years ago. Before, they had worked in a factory, but had lost their jobs and begun farming. Both in their 50's, they said they were too old to get factory work anymore. Asked about CRVs – they said they need a multi-purpose CRV that's good for plowing as well as transport. Asked about walking tractors, said they were too difficult to handle for plowing.

The outsiders also grow corn and vegetables, and use 3-w vehicles to sell at the wholesale market in Changping. They move here from elsewhere because the land in their home villages is poor and dry. Farmers here have always rented land from the village council, but now the farmers re-rent it out to the outsiders (conflict with previous – I believe these guys.)

As we leave, I notice that a huge 12-story office building is being constructed about 500 yards from these farmers' brick shacks.

Trip Note #44
Headed further towards Beijing to try and find more farmers. More and more development, office buildings According to driver, this has all happened in last 10 years. We take a side road away from the development as best we can, but the scale of construction is just immense. Finally found a corn field in the shadow of a massive project (photo: 13 boom cranes!). Very muddy dirt road, so we got out of the taxi and walked. Garbage everywhere.

44. Zi Erqi Village Residents
2 old men, 1 middle-aged woman sitting in shade on muddy road. Reported that the cornfields we see around us are all administered by a large agriculture company. Farmers are paid to plant corn, and get paid

for their work according to the quality of the harvest. This year, they have been planting trees according to the government's reforestation plan, but they ran out of trees so they still planted a lot of corn. As they speak, a empty 3-w CRV and an empty 3-w bicycle slog slowly through the mud. Driver reports that they are on lunch break, and are probably transporting materials for customers. The residents report that there are no private farms in the village, and the closest fruit farms are 2hrs away by taxi. Wanted to visit fruit farms because higher value crops may be more likely to support CRVs, and CRV owning farmers often grew fruit. Decided to bag it and head back home, will visit more farmers on the 23-24th in Hebei province with Haifeng.

Trip Notes #45 Through #54
Arrived in Baoding in the morning after a 1.5hr train ride from Beijing. Another large city, Baoding used to be the capital of Hebei province. Area seems wealthier than Luoyang. We checked into a hotel and found a taxi driver willing to take us around villages for the day. He turned out to be a very nice young man, and he took us to his village to have lunch with his family, who own an CRV. Village roads are very poor, rutted dirt. However, houses seem to be nicer than before -- brick construction as usual, but a larger percentage of the construction work seems to have been completed. Before we left the city, our driver took us to an CRV market. Vehicles in the Baoding area: outside city roads are filled with rural vehicles! Many many 3-w CRVs. Motorcycle-taxis also common. Saw dozens of old, slow, 1-cyl tractors hauling trailers piled with improbable quantities of building materials. Often traveled in convoys. A few horse-drawn carts, but not many. Didn't see a single walking tractor. CRVs seem to be more heavily loaded here – some amazingly so. Perhaps enforcement of weight restrictions is more lax here.

English: more of a problem now. Haifeng is not as good as Zhenhong, and he also seems like a less skillful interviewer. I have less confidence in the answers I get to my questions because of the distortions possible in 2-way translation. Some responses don't make sense, and it often becomes impossibly awkward to try and straighten things out while interviewing. Still, I think we've gotten good info, and the communications seem to be improving.

45. Baoding CRV Dealers
Off the highway leading out of town, a large lot (several acres) with perhaps 100AV's and mini-trucks, 90% 3-w. At least five brands are represented (Heibao, Qingqi, Kama, Juli, Yiqi, Jinbei). Each brand has a separate section of the market, and separate salesmen. Turns out that CRV manufacturers in China almost always run their dealerships directly – dealers are not independent, but employees of the company. One notable exception to this is Shifeng (we visited later) whose dealers are independent agents.

We spoke briefly with several dealers to confirm this. All reported the same warranty – one year free parts and labor, and free labor after one year. Warranty can be honored at any dealership of the brand of CRV you buy (note: possible incentive for consolidation?)

46. Xuzhuang Village, taxi driver's family (3-w CRV)
Taxi driver invited us to have lunch with his family. We drove into the village, scattering chickens and geese on the dirt roads, maneuvering around haystacks and piles of bricks blocking our path. Houses mostly have tall brick walls around them, so at times it seems like we're driving through a maze. Few people around, few vehicles except a couple of old small 3-w CRVs and some ancient looking tractors with trailers behind (type of interview #10).

Family house: dirt front yard with a makeshift lumbermill – belt driven table saw used to make wooden boxes that are sold to people who use them to transport electrical equipment. Boxes are transported using the family's CRV. Naked kids running around, wood cookstove outside. Concrete poured floors, tiled exterior. Bare electrical wires hanging from the ceiling. We were taken into the dining room, and all the women cleared out, leaving just the men to eat first. 3 generations, seven people. Served at least 10 courses, 5 types of vegetables. Father proudly told us that the vegetables were grown without pesticides. I asked why: it is common for farmers to grow a small plot of their own vegetables without using pesticides for their own consumption. They believe that the pesticides are dangerous to eat, so they only sell them to others! Just like the USA!

CRV is of the cheaper, 2-seat open-cab handlebar type. Bought at an CRV dealership 11km away. Reported that a close CRV dealer was an important factor. Did not want a dealer in the city, because they wanted to be able to drive it home themselves (??) Also said that small dealers have better service than large dealers, and that often the warranty is not well served by the dealer. They have had a good experience. Jinwa brand, bought new for Rmb5000 one year ago. If they ever have problems, they drive to the dealer to get it serviced.

Father: first CRVs appeared in the village 10 years ago. Since then, CRV regulations have become more strict. They claim their CRV has a capacity of 2t, and the largest Jinwa can hold 3t. They use the vehicle for farming (transporting fertilizer, hauling their crop, etc.) They plan to replace the vehicle with a 4-w in three years. Before this vehicle they had another 3-w CRV, and before that they had a horse and cart.

Other popular brands in the village are Shifung, and Juli. Other popular vehicle types are Futian mini-trucks, which are used for transportation, not farming. Motorcycles are used for passenger transport and farming. Family also has a couple of bicycles, which they report they do not use very often. Report that they sell their vegetables at a Baoding periodic vegetable market. Sell both directly to consumers (retail) and to resellers (wholesale).

47. Xuzhuang Village 3-W CRV user
Father hops in the taxicab with us after a cup of tea and takes us to all his friends in the village with vehicles ("which type of vehicle would you like to see next?") This method likely biases an already highly unscientific sampling method!

Visited another similar house, gate opening up onto a dirt yard, pigs and chickens also being raised. Another small 3-w Jinwa CRV. Bought 4yrs ago at the same market the father used, 2.5 ton capacity reported. No serious maintenance troubles "Jinwa is very good quality." Report the biggest problem with 3-w CRVs is safety. Used mainly for farming, transport fertilizer and harvest. This is their first CRV, before they had a horse and cart. Plan to keep vehicle for a long time ("Jinwa has a good reputation.").

48. Xuzhuang Village, 3-w CRV user
Similar small 3-w CRV filled with dirt, parked inside another similar house. CRV has dumping capacity. Owner also farms sheep (in a pen next to the CRV). Nice new 4str motorcycle in front of the house. Rmb5000 new – "not a famous brand, so cheaper than others." Uses for farming mainly (note: as I ask the owner questions, the father begins to answer for the owner.) Before this, they had a walking tractor. Report no maintenance troubles.

49. Lizhuang Village, 3-w CRV user
Drove across the fields to the neighboring village. I immediately notice lots of rough-cut lumber boards sawn from logs (bark still on) drying leaned up against the brick walls. Father wants to show us a minitruck, but the owner was out. Went to another house instead. A 3-w CRV heavily loaded with rough-cut lumber. Owner also does some rough carpentry. Dirt yard has much woodworking equipment – 3 table saws and some kind of a side-mounted drill (jointer?) Reports that his CRV is 7yr old Jinwa ("very common in this area") and he has had no maintenance trouble at all. Cost was Rmb6700 new, bought at the same market as before. Owner also farms pigs. Uses CRV for farming and other things. "Now Shifeng and Juli are better than Jinwa, but before, Jinwa was the best." Reports that his model of CRV is no longer made. "Very few 4-w CRVs in village".Why? "4-w is used mainly for transportation, and they have a much higher cost."

50. Lizhuang Village, 3-W CRV user
Large full-cab Feicai brand CRV parked next to an old small 3-w handlebar CRV. Household looks like it is doing well. Chickens and ducks farmed as well. Bought large vehicle 2 years ago for Rmb7100, uses for transportation. Reports that there are very few large 3-w CRVs in the village, and consequently no nearby dealer. If something goes wrong with it, they fix it themselves. Bought at a dealer 60km away. Asked what they transport in the CRV, the owner won't say exactly – "we do business with the CRV" and transport all sorts of things. Refused to provide more details.

Report that CRV costs Rmb1000/yr in road fees, 1000/yr in registration and license fees, 200/yr for insurance. Buy fuel for 2.6/l and use 10l/100km. Travel 5000km/month. Owner says he anticipates that there will soon be a very large market for larger 3-w CRVs. Asked about 4-w CRVs, "very few people in the village own them." Asked if he would like to, "perhaps in the future if business is good." Usually carries 3 tons, sometimes 4. Bought the small CRV 10 years ago, before that they had another CRV, bought in 1984! They mainly use their older CRV for farming.

As we leave, a Changan minivan passes. I ask about it – "mainly used for passenger transportation, and by wealthy villagers. Not many in village."

51. Xuzhuang Village, 3-w motorcyclercycle user

Drove back to first village, met a couple selling vegetables in the back of a shiny new 3-w motorcycle (4str). Turns out they bought it yesterday! 125cc, electric start. Rmb3700 plus 700 license fee. Bought vegetables at the wholesale market in city, and will sell them in the villages – about a 20km trip. They owned a 3-w bicycle before this. Bought over an CRV because they did not need the large capacity, and the 3-w motorcycles are allowed in the city. Reports that the poor roads are a hindrance to 3-w CRVs.

52. Xuzhuang Village, taxi driver's father

Had another cup of tea the driver's home and chatted more with the father about CRV regulations. CRVs are only allowed in the city from 9pm to 6am. The law was passed in 1995 to reduce pollution. Man predicts that villagers will buy 4-w CRVs in the future because of this law. He also predicts that 3-w motorcycles will become more popular, as gasoline engines are allowed in the city. Reports that only 3-w CRVs are banned from the city. They can enter if they buy an expensive license, but this is rare, so 3-w CRVs are only used for farming.

I asked about the tractors: very common here. Not used for farming (!), but to transport heavy loads (dirt, bricks, coal, gravel, building materials). Confirms what I have seen.

53. Xuzhuang Village, 4-w CRV user

We continue our quest to find a 4-w CRV. Find one owned by a man living in a house by the main road. Front yard is piled high with bricks, corrugated roofing material, raw coal. Driveway holds a nice looking 4-w Futian with a blue license plate. Signs advertise materials for sale. Owner sells materials and uses truck to deliver them to his customers. Report that there are some 4-w trucks in the village owned by people living right by the highway who use them for transport. 3 kids begin to play in the bed.

Bought new in Sept 1999 for Rmb25,000 plus a one-time fixed cost of Rmb7000 for the license! Uses to transport for others and for his own use. Charges Rmb2/km. Travels 2800km/month. Uses 7l/100km, pays 2.7/l diesel fuel. Rmb900/yr for insurance.

In 1994 they bought a 3-w CRV, which they still use for farming. Bought the 4-w over a 3-w because the 3-ws are not allowed in the city, and 4-w CRVs are much faster. Has no immediate plans for another vehicle purchase. Warranty: 1yr for big parts, 3months for small parts. Has had some mechanical problems (Chinese) including bearing failure. Report that Futian's warranty service is very good, and the CRV is of good quality "very rare that it has problems." Earns Rmb10,000/yr from his transportation business, and has other sources of income as well.

54. Xuzhuang Village, 3-w motorcycle and 4-w tractor user

Next we tried to find a tractor, as I'd been seeing so many on the roads. Didn't want to stop one that was transporting, but we saw one parked and pulled over to talk. Owner has a store selling beer, soda and cigarettes. Has a tractor and a 2stroke motorcyclercycle that he uses to transport the goods he sells. Motorcycle is loaded with empty beer bottles.

Bought tractor new in 1991 for Rmb9000. Now you can get an even more powerful tractor for Rmb7000 new. Motorcycle bought in 1999 (registration sticker: 60km/hr; 200kg (infer payload); 7.43kw; 190kg)

Neither vehicle is allowed in city. He may buy a 4-w vehicle if economics permit. He originally bought the tractor for harvesting, and still uses it some for farming now. Reports that tractors are being used less and less in his village, and are being replaced by CRVs. Now they are mainly being used for hauling building materials. He occasionally uses his tractor to transport building materials.

55. Baoding Shifeng CRV Dealers
Shifeng employs only independent sales agents to sell their CRVs. Warranty information above confirmed. Lot filled with mostly 3-w CRVs. All used ZS1100 engine, rated at 11.3kW. None that I saw featured the low-range gear lever – perhaps because terrain here is flatter than around Luoyang. Prices are cheaper – Rmb4000 for a half-cab steering wheel model. Rmb3600 for the same model with motorcyclercycle-style handlebars. (photos of lineup)

This dealership has only been open for 2 months. Also sell tractors – have sold 12 so far for over Rmb5000 (photo). "open-cab CRVs are for farming, larger full-cab CRVs are used for transportation" confirming prior reports.

A second dealer down the road sold similar products, including an even more stripped-down version, with just one seat over an engine (same ZS1100) with a side-mounted shift lever and no low gear for the remarkable price of Rmb3000 – "among the cheapest CRVs in China." (photo) Also said that Shifeng CRVs are inexpensive. Vehicles were partially assembled at the dealership.

Note: behind the dealership, an extreme example of Chinese environmental degradation: an entire mountain half-eaten by mining, crumbling into the plain below. Factory belching out thick black smoke. (photos)

56. Baoding retail market vendor (mini-truck user)
Went to a large retail market. Indoors, incredible variety of formerly and presently living critters from bugs to squid to eels to pigs. Also vegetables and poultry. Parking lot outside full of minivans, mini-pickups, 3-w motorcycle-taxis. Inside are 3-w bicycles, scooters, 3-w motorcycles. Many are 2str. We talked to a woman selling veggies (it smelled nicer there) and quickly others joined in.

She buys veggies at the wholesale market (will visit next) and transports them here with a Futian mini-truck. 1.5t capacity, and 1 trip/day. 10km/trip. Reports that 3 and 4-w CRVs are common at this market. They enter the city at night, deliver their goods, and leave before 6am. Others concur.

57. Baoding retail market 3-w motorcycle-taxi owner
Leave market and talk to motorcycle-taxi owner outside. 100cc 4-str Honda motorcycle. Allowed to enter city, as he has the appropriate license plate. Not allowed on some roads. Transports people from the market, avg. trip is 5km. Earns Rmb30/day on average. Paid Rmb4000 for the motorcycle, Rmb1000 for the license more than 4 years ago. Before 1995, used a 3-w bicycle, then bought his first 3-w motorcycle. This is his second. Has no plans to buy another, as he does not have enough money. Registration sticker: 190kg; 180kg; 60km/h; 7.43kW.

58. Baoding retail market mini-truck owner
4-w gasoline mini-truck with blue plate. Used to transport vegetables, fish, meat, etc. from wholesale market in another county to this retail market. Travels 50km/day. Truck is allowed in city, but not on some roads. Owner only buys and sells goods himself, no transport for others. Has owned truck for 5yrs. Bought for Rmb78,000. Before, owned 3-w bicycle. No future plans for purchase – hopes that truck will last another 10 years. Individual owner.

Leave retail market. Note that parking lot is full of 60% minivans, 30% mini-pickups, 5% full-cab CRV, 5%motorcycle. Most vehicles empty (infer owners inside.)

59. Baoding wholesale market 3-w CRV user
Took a taxi to the largest CRV market in Hebei province. Mostly vacant (we hear that 4-5am is its busiest time), except for HD trucks and some 3-w CRVs. Probably the most garlic I have ever seen in one place (photos)

3-w full-cab Shifeng CRV. Owners are a couple who use it to transport squash they grow on their own farm 200km away. Woman speaks while husband sleeps under vehicle. Their CRV has a license to enter the city (mkt is outside of city, but they must pass through city to enter the market.) They mostly sell their crop wholesale, little retail. Will stay here until 6am the next morning – the main time for business. They come once every 3 days, and only transport veggies they grow themselves. This seems curious to me. Ask about payload: 1.5tons/trip. Acreage of farm: 4acres. Doesn't seem to add up to me. They admit that occasionally they transport crops for others, but mostly for themselves. Also, they only transport during the growing season, and rest during the winter. Still, amazing productivity!

In their village, almost all HHs own this type of vehicle. They purchased for Rmb8000 this year. Before, they had a horse and cart, and sold locally. This is their first year at the market. Report that the price here is much better – too many vegetables are grown in their village for local consumption. Before CRVs, there were no buyers for their crops and farmers were in poverty.

The first CRVs came to their village 2 years ago. Before that, the village grew only wheat and soybeans, as they were the only products they could sell – but the price was very low. Now, with CRVs they can grow vegetables instead, and sell them here at a high price. (a crowd gathers and comments issue forth)

They mostly sell their veggies to long-distance HD trucks who transport their crops to southern China. In the wintertime, veggies arrive from south China to here, and are distributed for sale. (3-w bicycle arrives at truck and buys a load for retail sale.)

60. Baoding wholesale market HDD truck user
Truck loaded with potatos. Comes from Shanxi province 500km away. They buy direct from farmers in Shanxi and sell here. Their costs are Rmb1000 per trip for fuel and road fees. They make 1trip/4days on average. If market is good, they can earn Rmb50,000 per year, but now the market is bad due to excess production and low prices, so they make little money.

3 people bought truck collectively for Rmb200,000 in 1998. Vehicle too expensive for one person, so this arrangement is common in China. Farmers he buys from have 3-w CRVs to transport produce to his truck. He drives into a village and farmers arrive to sell to him.

61. Baoding wholesale market 3-w CRV user
Shifeng full-cab 3-w CRV w/ dualie axle loaded with cabbage. Owner from 250km away in Shanxi province, and 8hr trip. Comes here every 2 days. Exclusively buys from farmers and transports here. Carries 3t of vegetables per trip, reports his capacity is officially 1t. "CRV quality is very good, and Shifeng is very good." Bought 1yr ago for Rmb10,400 new. Before, he farmed in the village and owned a 3-w motorcyclercycle. "This is better than farming." Income is Rmb200/trip. Very common to have an CRV in his village – almost every hh has one. Since last year, the larger CRVs have become common. Smaller CRVs have been common for about 10 years..

62. Baoding wholesale market minivan user
Nice clothing, flashy minivan. Hotel owns vehicle, driver mostly buys from retail market, about 100kg/trip. Vehicle cost Rmb30,000.

Trip Notes #63 and #64
Arrived in Liao Cheng after a 6hr train ride. Were met at the station by two government representatives who whisked us to our marble-plated 3-star skyscraper hotel ($30/night) in a black Volkswagon with tinted windows. City looks similar to but smaller than the others we have visited. Lots of new construction, but clearly a developing economy. Haifeng reports that the city is among the poorest in the region. The rep's take us up to our room and leave us to shower. Haifeng informs us that many of our original plans have been changed because of difficulties communicating between government branches. We are associated with the ministry of agriculture, but CRV classification is unclear (ag equipment? Transport?) So (I think) different governments classify them differently. Here, some of the places we want to see are associated with other bureaus, and it is difficult to make plans with them. All of this is very unclear, as the language

barrier is pretty intense. Furthermore, the changed plans involve people whose jobs I don't understand, so in order to begin to formulate questions for them, I must go through a painful process of charades with Haifeng, often in front of our ever-growing entourage (up to eight people and two big black cars with tinted windows, plus the usual 6-10 hangers on at one point.)

63. Liao Cheng CRV maintenance professionals (government accompaniment)
After waiting around in our hotel room for a while, the reps return with two other men. After much difficulty, I determined that they are from a government agency in charge of post-warranty CRV repair. Seems as though the pre-reform government took pains to ensure that the newly developing CRV technology was able to be properly maintained. They made the mandatory warranty rule we have encountered before (1yr free parts and labor), and then set up a government department for post-warranty CRV maintenance. Each town has an CRV maintenance department, which operates essentially like a gov't owned repair shop. They charge for service like any other repair shop, and employees range from 5-20 depending on the size of the area.

The men report that over 90% of farmers get their post-warranty repair work done at these shops. I ask what their competitive advantage is: they are widely distributed throughout the villages, and farmers are used to going there. They expect that they will be privatized soon, and expect that their prices will be lower once they are.

I get some CRV history: Shifeng produced CRVs for 10yrs. Liao Cheng city manufactures 900,000 CRVs/yr (note: 1/3 of Chinese total!) and Shifeng produces 600,000/yr. Shandong province produces 60% of total CRVs. Now 500,000 CRVs in use by farmers in Shandong, 40,000 in Liao Cheng city.

The men have been working at this job since 1982. Most common CRV maintenance problems are engine-related (CHINESE). To qualify to be a CRV repair man, you must be trained by the government. Occasionally, CRV manufacturers/dealers will train technicians in CRV repair if they release a new technology.

64. Liao Cheng CRV market (gov't accompaniment)
Arrive en masse at the largest CRV market in Liao Cheng. Also sell other ag equip. Meet manager of the market. He shows us some large 65hp tractors made by Luoyang First Tractor (RMB54,000), and says he can't keep them in stock. His market sells 130/yr. There are 50 salesmen and managers in the market. Market is basically a large dirt lot with some shade cover. Some shoddy brick walls demarcate maintenance areas. Very little equipment in maintenance areas – each brand has its own shop. Manual chain engine lift is being used by two workers to replace an engine in a 3-w CRV.

Speak with the market's Shifeng agent. 40,000 units sold by Shifeng in Liao Cheng city last year (all sold here at the market), out of 80,000 CRVs total. Product value is Rmb400,000 (avg. price = Rmb5000.)

See a small tractor with a different type of 1cyl engine – circulating water cooled with a side-mount radiator. Rated at 16.2kW (more powerful than most I've seen of its size.) Engine model J128, tractor costs Rmb5500. Manager predicts that in the future 4-w CRVs will be more common. Predicts that higher-tech, higher-power CRVs will dominate. Now he sells mostly 3-w vehicles.

I see a floor full of single-cyl engines (perhaps 100) similar to those I saw in other CRV markets – this time I look closer and notice that the engines are all used. I ask about them: when a farmer has engine trouble, it is easier to take the engine out of the CRV and leave it in the village. Engines are repaired here and then returned to the farmer (note: this must take lots of time – many engines sitting, some with dust; poor service?) Cost of a new engine is Rmb1400. Manager says that these companies export very few vehicles. Furthermore, those that are exported are built to very different specifications than Chinese vehicles.

Government car drove us back to our hotel room. Woman went home, man stayed with us for dinner. Very tired, wanted something quick, but we had to entertain him because we can't offend the government. As a consequence, we sat in the hotel room while he smoked for a while, then walked across town to his favorite restaurant. The meal lasted for hours, we drank too much (offensive if you don't drink when they

toast you) and ate too much. We got home and he stuck around and had a couple more of our cigarettes (used for icebreakers with farmers.)

Trip Note #65
Visited the Shifeng Group manufacturer. Picked up at hotel at 9am by another tinted-window Volkswagon inhabited by our rep and our driver. After an hour wait in the parking lot of a government building we were on our way. (Apparently our rep was smoothing out some problems – Haifeng said that it is becoming difficult for government to dictate terms to large companies, and Shifeng may not want to give up personnel for the day.) Anyway, we drove for an hour and a half through the flat fields to the headquarters. Along the way, saw many CRVs, and fields intercropped between corn and fruit (?) trees. Many small CRVs in the fields, outfitted with an extra belt pulley mounted on the flywheel. They use the extra pulley to drive a belt that powers a water pump – similar to walking tractor use. First time I've seen this. Irrigation ditches everywhere here – perhaps only a 2m lift to get the water up onto the fields.

65. Shandong Shifeng CRV manufacturers (gov't accompaniment)
Arrived at the headquarters. Enormous! Have stats from flyer they distributed (factory covers 1500mu = 250 acres!) Our car was joined by four other tinted-window vehicles filled with our future entourage, and we drove slowly through the manufacturing buildings to let me see the facilities. The tour ended in the showroom, where all Shifeng's products were displayed – rows of 1cyl motorcycles, and every type of CRV they manufacture, from walking tractor to large 4-w dumping CRV/mini-truck

Once the cars emptied out, our entourage consisted of perhaps 15 people including plant managers, our government representative, and local government officials. Later, we also spoke with one of the first Shifeng sales agents in China, a service manager, and a CRV customer (all provided by Shifeng.) To make this busy day understandable, I will condense the information we learned from many interviews into appropriate sections at the end of my summary of the day's events.

We spoke at some length with members of our entourage while strolling through the showrooms. Next, we were driven to the company's hotel for a meal with our entourage in a private room. Probably 30 courses (each maybe half eaten), four waitresses, 2 hours. Drinking was unbelievable – Haifeng saved me by telling the Chinese that I didn't drink liquor, but they still managed to force about two liters of beer down my throat – they say endless toasts and make you show the bottom of your glass to prove that you drank the whole thing. I was the soberest person there by the end, though. Probably the most bloated as well.

After the meal, we were given a room in the hotel to take a break (i.e. sober up.) Within five minutes, the head of the local government was at our door. He stayed for 45 strange minutes, trying to get me to help get his brother a job in the United States! His brother is a doctor in Toronto. I told him to have his brother send me an e-mail.

Next, we spoke with CRV sales and service people, as well as a consumer. These conversations evolved into almost 100% Chinese. Haifeng translated during the evening. Good method, as he is becoming familiar with my goals and has interviewed over 300 companies in the past. We got fantastic information this way (see below).

Finally got back to our hotel, exhausted at 6:00. Learned to my horror that we would be having dinner with our friend from last night again (on us, of course.) This time, he brought a couple of friends of his along as well. Haifeng ordered the cheapest dishes in the restaurant, and we left early while they continued eating our food. "Good evening," he said as we left. When the elevator door closed, Haifeng surprised me with a new English word: "That evening was xxx!" I laughed and he continued, "but we have little muscle to deal with situation." I'm learning a lot about Chinese corporate/government culture!

Basic Statistics:
Walking tractor costs Rmb2600 – I asked and they claim sales for w.t.'s are increasing. True? Only 6% of their production is 4-w, mostly 3-w ("great demand in rural areas.") They employ 28,000 workers, 70% in manufacturing, 12% sales, 5% engineers, 1.5% managers – claim their managerial efficiency is very high for China. 8% of employees have college degrees. Note: all of these workers get to work on motorcycles –

enormous parking lot full of them! Production value last year was Rmb5 billion. They currently have no partners, but a future joint venture is planned with US and Japanese companies. Their first CRV was produced in 1982, but they didn't really start to take off until 1992.

Their CRVs are driven 100,000km before scrappage. Claim 3-w CRVs get 4l/100km (note: way too low! Could reflect lack of contact with customer.) Their vehicles have 15, 18, 20, 22hp engines. They have over 1000 agents in China selling their vehicles. They use agents over direct distributors because the profit incentive encourages agents to sell many vehicles.

Company Structure:
According to Hiafeng, Shifeng is a very oddly structured company relative to the ever-changing Chinese norm, and their ownership situation is far and away the weirdest he's seen. The oddest thing about it was that nobody seemed to know who owned Shifeng, not even the upper management. Apparently, it is 40% owned by the local government, and the rest is owned "collectively." This latter segment is subdivided somehow, but nobody knew who "the collective" was, or what their ownership might entail. It seems that at the end of the day, Shifeng is a state-owned TVE. This was a surprise to me after reading Scott Rozelle's paper on rural privatizations. I asked if there were future plans for privatization, and got a variety of answers, along with wry smiles and insinuations I can't even begin to guess at. Haifeng, whose job it is to unravel this sort of thing, was almost as perplexed. The general manager of the company was chosen by the local government. In fact, the local government is run by his father (PNC congressman), who also happens to be chairman of the board at Shifeng! All on the front page of the company brochure! Anyway, here's Haifeng's best guess combined with my inferences – again, I'm very unsure of the accuracy of all this. Clearly, the situation is extremely complex.

Shandong is a relatively conservative province, and has been slower than southern provinces to privatize. One manager said that they haven't privatized because China is socialist (hmm?) unlike the capitalist US. They must first develop socially before privatizing (old-school rhetoric from what I gather.) That same manager later told us that the main thing holding back Shifeng is that the government ownership reduces their ability to respond quickly to changing market conditions. We also heard that the company is too large to be privately owned – perhaps in the future some small parts of it will be privatized, but not the whole thing.

The general manager receives Rmb500,000/yr. Vice-general manager gets Rmb200,000. Engineers paid Rmb40,000. Factory workers get Rmb12,000.

Consumer Interview:
Who knows if this is any use, but they hand-picked a farmer for us to talk to. Haifeng asked the usual battery of questions and got answers – all in Chinese, so no interaction from me. Bought his first Shifeng 3-w in 1990, an 8hp model for Rmb3,400. Bought a second in 1993 and sold the first – a 12hp for Rmb5000. In 2001 he bought his third (15hp for Rmb5000) and sold the second. Uses for farming and short distance transportation. He finds a 4-w CRV unnecessary for rural areas at present, but imagines that in the future they will be necessary. Says farmers don't care about pollution, just power and price. Says that the advantage of the Shifeng group is that it can quickly improve its CRVs, changing their power, size, and quality quickly to meet market demand. Its service after sale is the best in the Chinese CRV industry.

Manufacturing Model:
Wasn't able to get a detailed tour of the facilities, but I can make some comments based on the driving tour. First, the facility is HUGE! It took us 10 minutes to drive around it. Second, this is an old-school Henry Ford style factory. They make almost everything themselves, including the engines. Saw trucks loaded with steel rolls entering the factory, complete vehicles leaving. Huge piles of coal everywhere. Was not able to get a good idea what it's for, but saw a bed of it burning through a window – some kind of metal forming process I guess, but it could be more basic than that. Also many large piles of powders, unsure what they are for. They drove us through their sheet metal working area – massive dies stamping out body parts. Rows of CNC (?) equipment. In my presentation, I described the old and new auto manufacturing models in US industry – the old Henry Ford "make everything you need in one spot" model vs. the new

"outsource everything" model. Managers very interested in this part of the presentation, and said that the reason they are using the old model is because parts available from other manufacturers are high price and low quality, so they can do better making their own. (Note: CRV industry is so new, there is little competition. Perhaps as the industry matures, companies will sell off subsidiaries and there will be competition for parts.)

Sales, Warranty, and Marketing Network:
As discovered before, Shifeng has a unique distribution strategy, employing independent agents rather than direct manufacturer-owned dealerships. They have more than 1200 agents across China. To be an agent, one must have Rmb500,000. They buy CRVs direct from Shifeng with cash – manufacturing is based on dealer orders. Shifeng's warranty is six months, but 1 year for main parts including the engine. During warranty, free parts and labor, post-warranty free labor. Common problems are with the engine, gears, and transmission. Their goal is to be able to send mechanics out to service the vehicles at the farmer's house, but they are unable to do that now. Agents receive "very high" net profits for selling the CRVs – Rmb200-300 for a 3-w, Rmb1000 for a 4-wheel. Shifeng also gives awards to those who sell many vehicles. Agents must have a maintenance shop as well. Mechanics (avg 5 per shop) are trained and provided by Shifeng, who pays their salary. The agent collects and feeds back market information to Shifeng based on its interactions with customers. This is pretty much the extent of market research in CRV industry. My presentation had a section on the importance of marketing in the US auto industry, and the new methods of focus groups for discerning customer needs. Again, this prompted much interest. Managers noted that Chinese CRV countries pay much attention to production, but ignore marketing, and they agreed that this was a faulty model.

Exports:
In the past, Shifeng paid little attention to the export market. Since WTO, they are trying to increase their exports (note: posters were everywhere in the plant encouraging workers to think about the foreign market – or at least to convince the foreigners touring that Shifeng was thinking about the foreign market – signs were in English and Chinese!) They export tractors, 3 and 4-w CRVs to 22 countries, but only 3000 units/yr. Plan to export more in the future – say that first they must improve their technology and quality. WTO will have no negative effects on Chinese CRV manufacturers because their prices are the lowest in the world. Predict increase in exports to countries less developed than China. Will take a long time before they export large numbers of CRVs. Note: brochure says they have an office in Mexico!

Future Strategy:
They currently produce only diesel vehicles, but they have future plans to produce a gasoline 4-w vehicle to compete with Futian – say that diesel pollution is a serious problem, and they will respond to changes in market demand as regulations for city vehicle entry change. Future business plan is to increase their competitiveness by increasing quality, improving production technology, lowering price, and improving service after sale. They focus on diesels because "Diesels have more power than gasoline engines, even if their hp ratings are the same" (note: torque is the difference). For this reason diesel has a bigger market in rural areas, and that's what they produce.

Trip Note #66
Took a taxi from Liao Cheng to Weifeng – our friend from the last two dinners "recommended" that we take a ride from his friend, who (of course) overcharged us. Also learned on the drive that the other Liao Cheng government rep. had informed him at the end of the evening that we owed them Rmb700 for driving us around all day!

Anyway, a long flat 4-hr trip. Irrigated farmland everywhere. CRVs everywhere. Not much else to speak of. Weifeng is a larger city than Liao Cheng, "more advanced" according to Haifeng. Arrived and were met by more government reps. Met with the head of the regional agriculture department at another nice hotel with private dining room. As I am learning is customary, we didn't talk about anything work-related, instead we drank a lot of beer and ate too much. Luckily, it was pretty quick, the head guy went off to a meeting and we headed to Juli.

66. Weifeng: Shandong Juli CRV manufacturers (gov't accompaniment)

Much lower-key affair than yesterday's Shifeng visit. Drove into the factory with two young gov't reps, and basically only interacted with one man. Luckily, he was a very nice guy, and he even spoke some English. Song Ji Qiang (sdjlie@chinajuli.com) is a manager and senior engineer in the dept. of imports and exports. We exchanged questions for a couple of hours, and I gave my presentation. Next, we went on another short tour of the facilities, getting out to see the CRV final assembly line and the CRV shipping station where CRVs are loaded onto trucks and sent off to the market. Song seemed genuinely proud of "his vehicles" and excited about future prospects. Was concerned about the environment, and the livelihoods of rural farmers. Wanted me to go into business exporting to Mexico!

General impression of the factory: less flashy, smaller than Shifeng (though I guess everyone is!) Whereas Shifeng was out in the countryside, Juli is pretty close to the middle of Weifeng – incentive to keep their operation compact, I guess. Facilities in general looked a little older than Shifeng, but it's really not fair to compare, since I got such a quick look at each. Assembly line for CRVs was very simple – four automatic lines running the length of a warehouse (maybe 100m), making tractors, two types of small CRV, and a larger full-cab model. At one end of the warehouse are stacks of chassis, at the other end, brand new CRVs are sucking in their first breaths of oxygen, and sputtering out their first PM contamination. Lifts were used for the chassis, engine, and transmission. Everything else is just picked up and bolted on with air tools. Parts are delivered to assembly stations with push-carts. Nothing fancy. I would have liked to have seen the welding shop, but wasn't allowed. Chassis welds looked adequate, but nothing special. Lots of splatter. Also noticed that engines are rubber mounted – just rubber blocks as far as I could tell. Not enough time to get a good look.

Back to the hotel, government guys went home, and we can do as we please.

Basic Statistics:
Juli produced 400,000 CRVs last year (2,000 per day), all at this facility – a huge parking lot we saw at the end of the tour gets filled with CRVs and emptied by trucks every night. Juli employs only 8,000 workers – less than 1/3 of Shandong, despite 50% of their productivity. Manager says that this is due to higher production technology. 500 engineers, 1200 sales, 400 managers. Income last year was Rmb200M.

I ask about their CRV's fuel economy, and get what I think are government specs (2.8l/100km) that have nothing to do with market research. When I asked about CRV life span, he calculated 20,000km/yr times 5 years = 100,000 miles. Unsure where these numbers come from, but I will look into it further. He mentioned that the vehicles must be built well to last that long – government regulations say payload is 500kg, but their customers often load up to 3t.

They make about 90% 3-w CRVs. Of the 3-w, 2/3 are the small handlebar model. They used to produce 3-w motorcycles, but when the government banned them from cities, they ordered Juli to stop production to reduce China's excess capacity (note: not sure about this.)

Company Structure:
Juli is only 6% government-owned. The rest is owned by publicly traded stock. The group is very diverse, producing pharmaceuticals, nanotech, bearings, pipe, inkjet ink, and other seemingly unrelated products. General manager is paid Rmb100,000/yr, workers are paid 14,400/yr. Wages higher than Shifeng because workers are paid by part, so they have incentive to work harder.

Manufacturing Model:
Juli CRVs are somewhat more expensive than Shifeng. Song says this is because they are built more durably, using thicker steel. They try and produce the lowest-priced durable machine they can to meet the needs of Chinese farmers.

Song claimed that their company was more similar to my "new" mfg. model, outsourcing many parts. Claimed that only 30% of their parts are produced here. Further questioning revealed more similarities than differences between Juli and Shifeng, however. 1-cyl engines are manufactured on-site, though some multi's are outsourced. Pistons and castings for the engine are imported, but assembly is done here. Both gears and transmissions are manufactured and assembled on site. Obviously, chassis, bodywork, and

hydraulic cylinders (for dump trucks) are manufactured here. Wheels, lights, and other small parts are outsourced. I was surprised they hob their own gears: "very critical part, so we make it here."

Sales, Warranty, and Marketing Network:
Juli has 800 service locations, which serve as hubs for their dealer network. Each hub serves several independent sales agents, who operate like Shifeng's do. Juli employs 1300 mechanics to work at these hubs. Song mentions that the V-belts are the most common maintenance item, as the rubber in China is not good. But, he adds, they are available everywhere and easy to change (this is true.)

Exports:
Began exporting 3 years ago, exported 1080 units last year to 20 countries. Exports are expected to increase with the WTO. Song believes that the WTO will have no negative impacts on Chinese CRV industry, as vehicles are low-priced and competitive in the world market. Reports that the main problem with exports is providing adequate service after sale, and gathering appropriate information about foreign consumers.

Future Strategy:
Song mentioned that Chinese diesel engines have been improved greatly through cooperation with foreign firms. The group is currently discussion a joint venture for a CRV assembly plant in Indonesia, and have invested Rmb1M in a venture in South Africa. Song won't discuss any future vehicle plans. I mention gasoline vehicles, and he reports that the government will not allow them to produce them. I ask about using other mfg's engines, and he agrees that this is the route they would probably take if they decide to enter the market.

Says that as farmers become wealthier, they will be able to make vehicles that are more comfortable and quieter – possibly with heating and cooling systems. However, currently they must build the cheapest product possible.

Trip Notes #67 and #68
Last day of work. Tomorrow will travel back to Beijing, then home on the 31st. One interesting thing I learned is that the Chinese government mandates that farmers grow a certain amount of staple crops such as wheat, rice, and corn. No idea about details.

67. Shouguang vegetable market (gov't accompaniment)
The largest vegetable market in China, with Rmb300M of sales per year. From all indications, it functions the same as other vegetable markets we have visited in the past. The head of the Shouguang agriculture department accompanied us, along with four or five others. Would have thought that this is a very bad way to get good info, but people seemed to freely tell us about their activities, even illegal ones such as overloading. We spent little time there, as he had to leave. Info pretty much replicates earlier experiences. Farmers transport goods here with 3-w CRVs, some retailers pick up goods here with 3-w CRVs. Larger trucks for longer distances. As we left, I saw a 3-w CRV with a dualie axle that had (from the sound) a multi-cylinder diesel engine (couldn't tell if it was 3 or 4.) No chance to investigate further.

Mini-truck users:
Outside the market there are perhaps 25 mini-trucks sitting, waiting for business. We speak with one, and before long about 20 people crowd around our entourage. We get answers from the crowd. Minitrucks have 2t capacity, but are overloaded to 5t. They mainly transport between here and Beijing (500km) but some transport as long as 1000km. They like that the trucks travel fast and use little fuel (12l/100km). They say there are too many mini-trucks at this market, and many there have not had work for several days.

They are paid for transport services, typically Rmb1200 for the trip to Beijing. Use Rmb160 of diesel each way, and Rmb180 in road fees round-trip. Owners report 300,000km before scrappage, but some said 100,000. Their vehicles are allowed inside Beijing City only for vegetable transport (a special exception.) Cost about Rmb40,000 new – all of them bought their vehicles new. If they had more money, they would buy bigger trucks. For maintenance, they use some of the many independent maintenance offices around the city. Many owned 3-w CRVs before. One bought CRV 6 years ago, truck 2 years ago.

HDD truck owners:
Medium size HDD truck with a load of celery being sold off. Unloaded by handcart, moved to buyer's 3-w CRV elsewhere. Transported celery from Hebei (>1000km). 8t capacity, overloaded to 15t. Travel at 60kph, use 24l/100km. Paid Rmb3500 for the 3-day round trip. Road fees are Rmb800 each way. Co-owned by 2 men. Rmb170,000 + Rmb50,000 license fee. 1.5 years ago. Before, had another large truck – been transporting since they left school.

68. Qingzhou Futian CRV market (gov't accompaniment)
I wasn't looking forward to seeing another CRV market, but we lucked out on this one. A Futian dealer – the same company we had been hoping to see. Dealership was Futian's only direct distributor in China. Other dealerships are owned by agents, but this is a very large dealership in an important area, so Futian retained ownership. Also got good brochures on their products, as I have with other CRV manufacturers. Futian makes 30 types of CRV, 90% 4-wheel! They have left the 3-w market to the Shifengs of the world and are targeting what they hope to be a large future 4-w market. (note: they seem to be doing a good job. "Futian" seems synonymous with "truck," and their product is object of envy among rural 3-w owners.) They make upscale 3-ws, but no small handlebar-style CRV. Interestingly, they have been making a 3-w gasoline model for 3yrs. Not selling well, but dealer thinks in the future sales will increase because of pollution regulations (it is allowed in cities.) See details below.

The dealership sells 7000 4-ws/yr, 1500 3-ws/yr, and 700 tractors/yr. Futian exports small quantities to other countries in Asia, but mostly domestic. Rmb6B in sales last year. Many parts mfd by other companies – if the parts fail in service, Futian fines the manufacturer. They have maintenance offices at most 100km away from each customer (note: unclear about this.) My general impression was very favorable – this company seems to have their ducks in a row, and if China grows as planned, their products could turn their company into a world force to be reckoned with in the truck and auto industry. They make passenger vans (sold at dealership) and pickup trucks (not seen, but have brochure), and seem to have much

experience with gasoline engines. Note: Futian = Forland in their English translation. Trucks all say "Forland" on the grille.

Examples of prices:
Small 4-w CRV: Dualie, extended cab 2-door. Diesel 5-speed, about the size of a ½ ton pickup (photos) Rmb22,000

Minitruck: Slightly larger than 1-ton pickup, very similar to 4-w CRV but bigger (photos). Rmb29,800.

Gasoline 3-w CRV:Outwardly identical to closed cab 3-w. 4spd tranny, 75kph speed (photos). Engine (photo): 2-cyl 644cc, 8.4 c.ratio, 17kW. Rmb 13,900

B: Vehicle Specifications of CRVs Sold In Year 2000

Table B-1: 4-W CRV Sales by Type in Year 2000

Type			**Sales (in Unit)**	**Percentage**
1) Open Cargo Bed			**416605**	**83.9%**
	Payload	0.5t	243308	58.4%
		0.75t	27629	6.6%
		1.0t	84245	20.2%
		1.5t	61423	14.7%
	Cabin Design	Long[98]	79032	19.0%
		Flat[99]	337573	81.0%
	Cargo Bed Unloading	Automatic	116960	28.1%
		Not Automatic	299645	71.9%
	Seat Number	One Row	230891	55.4%
		1.5 Rows	112638	27.0%
		Two Rows	73076	17.5%
2) Close Cargo Bed			**11329**	**2.3%**
		0.5t	1208	10.7%
		1.75t	1563	13.8%
		1.0t	4071	35.9%
		1.5t	4487	39.6%
3) Transformed Tractors			**67879**	**13.7%**
4) Others			**901**	**0.2%**

Table B-2: 3-w CRV sales by type in year 2000

Type		**Sales (in Unit)**	**Percentage**
Payload	0.5t	2,249,373	91.2%
	0.75t	217,321	8.8%
Cabin	Close	1,645,181	66.7%
	Open	821513	33.3%
Cargo Bed Unloading	Automatic	291847	11.8%
	Not Automatic	2174847	88.2%
Driving Control	Control Bar	1181498	47.9%
	Steering Wheel	1285196	52.1%
Starting Method	Hand	2228684	90.4%
	Electric	238010	9.7%
Driveline Design	Belt/Chain	244634	9.9%
	Rear Axle Mounted With Transmission*	2197445	89.0%
	Axle*	24615	1.0%

[98] Conventional design with engine compartment in front of the driver's cabin
[99] The engine is located below the driver's cabin

C: Prices and Specifications of Some CRV Products

Figure C-1: Juli 7Y-950 Vehicle

Table C-1: Specifications of Juli 7Y-950

Specification	Unit	Value
Dimension (L×W×H)	(mm)	3960×1460×1530
Fuel Type		Diesel
Emission Test Standard		GB18322-2001
Power	(kW)	9.7
Steering Control		Bar
Cargo Bed Volume (L×W×H)	(mm)	2235×1352×36
Wheelbase	(mm)	2600
Tread	(mm)	1200
Max. Speed	(km/hr)	48
Payload	(kg)	500
GVW	(kg)	825
Cabin		None
Driveline Design		Belt
Engine Type		195
Price	US Dollar	454 (Jan. 2003)

Figure C-2: Juli 7YPJ-950A Vehicle

Table C-2: Attributes of Juli 7YPJ-950A

Specification	Unit	Value
Dimension (L×W×H)	(mm)	4220×1460×1900
Fuel Type		Diesel
Emission Test Standard		GB18322-2001
Power	(kW)	9.7
Steering Control		Steering Wheel
Cargo Bed Volume (L×W×H)	(mm)	2430×1352×360
Wheelbase	(mm)	2780
Tread	(mm)	1200
Max. Speed	(km/hr)	47.83
Payload	(kg)	500
GVW	(kg)	990
Cabin		Enclosed
Driveline Design		Belt
Engine Type		195
Price	US Dollar	907 (Jan. 2003)

Figure C-3: 7YPJ-1150 by Juli Cop

Table C-3: Attributes of Juli 7YPJ-1150

Specification	Unit	Value
Dimension (L×W×H)	(mm)	4500×1490×1900
Fuel Type		Diesel
Emission Test Standard		GB18322-2001
Power	(kW)	12.1
Steering Control		Steering Wheel
Cargo Bed Volume (L×W×H)	(mm)	2300×1352×360
Wheelbase	(mm)	2920
Tread	(mm)	1200
Max. Speed	(km/hr)	48.17
Payload	(kg)	500
GVW	(kg)	1040
Cabin		Yes; Enclosed
Driveline Design		Belt
Engine Type		1105
Price	US Dollar	926 (Jan. 2003)

Figure C-4: WJ2010D by Juli Cop

Table C-4: Attributes of Juli WJ2010D

Specification	Unit	Value
Dimension (L×W×H)	(mm)	4380×1795×1945
Fuel Type		Diesel
Emission Test Standard		GB18322-2001
Power	(kW)	20
Cargo Bed Volume (L×W×H)	(mm)	2715×1635×360
Wheelbase	(mm)	2400
Tire Number		6
Tread (Front/Rear)	(mm)	1300/1240
Payload		1000
GVW		1535
Max. Speed	(km/hr)	65.99
Engine Type		475
Price	US Dollar	NA

Figure C-5: ZB1605W3 by Qingqi Corp.

Table C-5: Specifications of Qingqi ZB1605W3

Specification	Unit	Value
Cabin Design		Two rows
Cargo Bed Volume (L×W×H)	(mm)	2410×1730×350
Wheelbase (Mm)	(mm)	2600
Engine Type		480
Tire Type		6.50-14
Transmission		Five-speed
Price	US Dollar	3,581 (Jan, 2003)

Figure C-6: 7Y-950 by Shifeng Corp. at $478 for Jan 2003[100] (specifications not available)

[100] Specification data are not available, but should be similar to the previous Juli 7Y-950

D: Attributes and Photographs of Single-Cylinder Engines for CRVs

Figure D-1: S1100 Made by Yuchai Corp.

Figure D-2: S195 Made by Yuchai Corp.

Table D-1: Specifications of Model 195 and Model 1100 Diesels by Fangtian Industryies CO., LTD

Model	195	1100
Type	Horizontal, Single-cylinder, Water-cooling, Four-stroke	
Bore X Stroke (mm X mm)	95 X 115	100 X 115
12-hour rated output/Rotational speed(kW/r/min)	8.8/2000	11.03/2200
Specific lube oil consumption(g/kW.h)	<=251.6	<=250.2
Specific lube oil consumption(g/kW.h)	<=2.04	<=2.04
Max.torque/Rotational speed(N.m/r/min)	>=47.2/<=1600	>=53.5/<=1760
Overall dimensions (L X W X H)mm X mm X mm	770 X 480 X 620	875 X 480 X 675
Net weight(kg)	145	155

E: Top 10 CRV Makers in 2002

Table E-1: Top 10 Manufacturers of 3-w CRVs, Sales between Jan and Oct 2002

Ranking	Company	Vehicle Sales
1	Shandong Shifeng	716800
2	Shangdong Juli	397615
3	Anhui Feicai	177520
4	Shandong Liaocheng Shuangli	154432
5	Shangdong Wuzheng	96580
6	Nanjing Jinwa	55933
7	Beiqi Futian	43763
8	Henan Benma	43857
9	Gansu Lantuo	30885
10	Shenyang Tianlin	29021

Source: China Economic Information Network

Table E-2: Top 10 Manufactuers of 4-W CRVs, Sale between Jan and Oct 2002

Ranking	Company	Vehicle Sales
1	Shandong Shifeng	47240
2	Anhui Feicai	28875
3	Shandong Huayuan Kaima	21550
4	Beiqi Futian	18052
5	Hangzhou Hanggua	16774
6	Zibo&Shandong Heibao	15271
7	Hebei Yukang	14955
8	Chengdu Wangpai	14108
9	Zhejiang Zhengyu	13798
10	Sichuan Road Machinery	13536

Source: China Economic Information Network

F: Examples of "Transformed Tractors"

Figure F-1: Zhongyuan ZYT1810 Transformed Tractor[101]

Figure F-2: Shifeng 130T Transformed Tractor

Figure F-3: Hangzhou Baoshi Dalishen Transformed Tractor

[101] The company's website, http://www.xxyt.com.cn/tljbian.htm, accessed on June 20, 2003

Table F-1: Baoshi Dalishen's Specifications[102]

Model		BS2510CD
Shape	Lenghth(mm)	5310
	Width(mm)	1990
	Height(mm)	2200
Wheelbase(mm)		3240
Tread	Front(mm)	1400
	Rear(mm)	1510
Cargo bed Interior Dimension	Length(mm)	2920
	Width(mm)	1820
	Height(mm)	500
	Tipping Control	Auto or Manual (Optional)
Engine		1115,2100,2105,3100 (Optional)
Rear Bridge		132, hydraulic
Transmission		JC524H
Clutch		130, hydraulic
Cabin/Seat Number		New Dongfeng Model/2
Minimum Ground Clearance(mm)		=180
Maximum Cargo bed Tipping Angle(degree)		=45
Minimum Turning Diameter(meter)		=13
Braking		Bi-loop, hydraulic
Frame		20#,bi-layer

Figure F-4: Hangzhou Baoshi Baoshihuang Transformed Tractor[103]

Table F-2: Baoshi Baoshihuang's Specifications

Model		BSP150DIIA
Shape	Lenghth(mm)	4850
	Width(mm)	1770
	Height(mm)	2200
Wheelbase(mm)		2700

[102] The dealer's website, http://www.ztjd.com/chanpinjieshao4.htm, accessed on June 24, 2003
[103] The dealer's website, http://www.ztjd.com/chanpinjieshao4.htm, accessed on June 24, 2003

Tread	Front(mm)	1480
	Rear(mm)	1380
Cargo bed Interior Dimension	Lenghth(mm)	2800
	Width(mm)	1580
	Height(mm)	400
	Tipping Control	Auto or Manual
Engine		1115,2100,2105,3100,490 (Optional)
Rear Bridge		132, 3t standard
Transmission		130 (vice transmission optional)
Clutch		130, hydraulic
Cabin/Seat Number		Qingling Model/2
Minimum Ground Clearance(mm)		=180
Maximum Cargo bed Tipping Angle(degree)		=45
Minimum Turning Diameter(meter)		=11
Braking		Bi-loop, hydraulic
Frame		16#
Memo		Cargo bed size and engine can be customized

Figure F-5: Kangdi Ping'anzhixing Transformed Tractor[104]

Panel, Engine, Tipping Equipment, Frame, Respectively




Table F-3: Kangdi Ping'anzhixing's Specifications

Model		KD1410-? -3 or KD1410-? A-3
Shape	Lenghth(mm)	5000
	Width(mm)	1700
	Height(mm)	2200

[104] The dealer's website, http://www.ztjd.com/chanpinjieshao4.htm, accessed on June 24, 2003

Cargo bed Interior Dimension	Lenghth(mm)	2620
	Width(mm)	1580
	Height(mm)	400
Payload (kg)		1000
Engine		S1110 or 2100
Rear Bridge		132, 3t standard
Transmission		4+1, mechanical
Minimum Ground Clearance(mm)		=180
Maximum Cargo bed Tipping Angle(degree)		45
Minimum Turning Diameter(meter)		=11
Braking		Bi-loop, hydraulic
Suspension		NJ31
Frame		16#

G: In-use Administration Policies and Industry Standards for CRV

Table G-1: Administration Policies and Laws

Year/Sector	Name
1987/MPS	Notification On The Issue Of Strengthening The CRV Road Transportation Administration
1988/MMBE	Temporary Administration Methods For CRV Products
1989/MMBE	Notification On The Task Of Inspecting The 3-W CRV Industry
1993/MPS	12th Command: Basic Standards For CRVs
1993/MPS	46th Doc: Rules On The Administration Of CRV Road Transportation
2000/SBMBI	Model Verification Test Rules For CRVs

MPS: Ministry of Public Security
MMBE: Ministry of Machine Building and Electronics
SBMBI: State Bureau of Machine-Building Industry

Table G-2: Industry Standards

Code	Name
GB 7258-1997	Safety Specifications For Motor Vehicles Operating On Roads
GB 18320-2001	Technical Requirements On Safety For CRVs
GB 18321-2001	Limits For Noise Emitted By CRVs
GB 18322-2002	Limits And Measurement Methods For Smoke At Free Acceleration From CRVs
GB/T 5373-1994	Measuring Method Of Dimensions And Masses Parameter For Motorcycles And Mopeds
GB/T 7031-1986	Vehicle Vibration--Describing Method For Road Surface Irregularity
GB 7454-1987	Technical Regulations For Operation And Beam Adjustment Of Motor Vehicle Head-Lamp
JB/T 5673-1991	General Technical Requirements On Lacquering For Tractors And Equipments Used For Agriculture And Woods
JB/T 5999-1992	Maximum Operation Force Of Operation System Of Agricultural Tractors
JB/T 6701-1993	Front Illuminating Lamps For Tractors And CRVs
JB/T 6702-1993	Rules For Product Drawing Sample And Document Coding
JB/T 6704-1993	Technical Requirements For Clutch Cover And Plate Set Of Tractors
JB/T 6712-1993	Quality Requirements For Appearance Design
JB/T 7234-2001	General Technical Requirements For 4-W CRVs
JB/T 7235-1994	Test Methods For 4-W CRVs
JB/T 7236-2001	Technical Requirements For 3-W CRVs
JB/T 7237-1994	Test Methods For 3-W CRVs
JB/T 7735-1995	Model Coding Rules For 4-W CRVs
JB/T 7736-1995	Test Methods For Reliability Of 4-W CRVs
JB/T 8405-2001	Model Verification Rules For CRVs

JB/T 8552-1997	Technical Requirements On Half-Axle Of 4-W CRVs
JB/T 8582.1-2001	Driving Bridges Of CRVs
JB/T 8582.2-2001	Dry Friction-Mode Clutch Of CRVs
JB/T 8582.3-2001	Mechanical Transmission Of CRVs
JB/T 8582.4-2001	Steering Device Of CRVs
JB/T 8582.5-2001	Dampener Of CRVs
JB/T 8582.6-2001	Generator Of CRVs
JB/T 8657-1997	General Technical Requirements For Walking Transformed Tractors
JB/T 9868.1-1999	Model And Parameter Of Unpackaged Feed Transporters
JB/T 9868.2-1999	Technical Requirements For Unpackaged Feed Transporters
JB/T 9868.3-1999	Test Methods For Unpackaged Feed Transporters
JB/T 50096-1997	Test And Evaluation Methods Of Reliability For 3-W CRVs
JB/T 50106-1998	Test Standards On Reliability For Plate Springs Used For CRVs
JB/T 50109-1998	Test Standards On Reliability For Front Axles For CRVs
JB/T 50110-1998	Test Standards On Reliability For Drive Shaft Set Of CRVs
QC/T 456-1999	Technical Requirements For Unpackaged Granular Grain Transporters
QC/T 518-1999	Standards On Tightening Torque For Vehicle Screw Threaded Parts
QC/T 533-1999	Bench Test Methods For Vehicle Driving Axles
QC/T 545-1999	Bench Test Methods For Vehicle Tin-Style Dampeners
QC/T 568-1999	Bench Test Methods For Vehicle Mechanical Transmissions
JB/T 10132-1999	General Technical Requirements For Passenger CRVs
JB/T10133-1999	Test Methods For Passenger CRVs
JB/T10195-2000	Composition Rules On User's Guide For CRVs
JB/T10196.1-2000	Driving Brake Of CRVs
JB/T10197-2000	Model Coding Rules For 3-W CRVs
JB/T10198-2000	Connection Dimension Of Front Axles For 4-W CRVs
JB/T10199-2000	Connection Dimension Of Driving Axles For 4-W CRVs
JB/T6000-1992	Static Test Methods On Working Adaptability For Agricultural Tractors
GB/T3730.1-1998	Motor Vehicle And Semi-Trailer-Type-Terms And Definitions
GB/T3037.2-1996	Road Vehicle--Masses--Vocabulary And Codes
GB/T3871.10-1993	Test Methods For Agricultural Wheeled And Tracklaying Tractors--Part 10: Low Temperature Starting Tests
GB/T13053-1991	Drive Area Dimension For Passenger Vehicles
GB/T13056-1991	Glossary For Dimension Of Passenger Area Of Passenger Vehicles
GB/T15089-1994	Motor Vehicles—Classification
GB/T16955-1997	Simple Method For Testing Noise Of Operator's Area For Tractors And Equipments Used For Agriculture And Woods
GB 4785-1998	Installing Rules For Outside Illustrating And Signal Equipments Of Vehicles And Trailers
GB5763-1998	Brake Pads For Vehicles
GB9656-1996	Safe Glass For Vehicles
GB9969.1-1998	General Rules For User's Guide Of Industrial Products

QC/T239-1997	Performance Requirements For Brakes Of Trucks And Passenger Cars
QC/T77-1993	Technical Requirements For Hydraulic Brake Wheels Of Vehicles
QC/T479-1999	Bench Test Methods For Brakes Of Trucks And Passenger Cars
QC/T556-1999	Thermocouple Installing Method And Temperature Testing Method For Vehicle Brakes

H: Prediction Oil Products Consumption for Transportation Sector[105]

Table H-1: Civil Vehicle Volume and Distribution (Ten Thousand Units)

Civil Vehicle	1997		2000(predicted)		2005(predicted)	
	In-use	Ratio,%	In-use Units	Ratio,%	In-use Units	Ratio,%
Total Motor Vehicle	1,219	100	1,620	100	2,355	100
Mini Car	151	12	210	13	250	11
Automobile	304	25	470	29	910	39
Light-duty	392	32	500	31	680	29
Mid-duty	350	29	380	23	430	18
Heavy-duty	22	2	60	4	85	4
Total CRV	1,240	100	1,800	100	2,450	100
3-w	1,080	87	1,550	86	2,040	83
4-w	160	13	250	14	410	17
Total Motorcycle	2,022	100	3,500	100	6,000	100
Sum	4,481		6,920		10,805	

Table H-2: Civil Vehicle Oil Products Consumption (kilo-ton)

Civil Vehicle	1997	2000(predicted)	2005(predicted)
Total Gasoline Consumption	30,930	33,890	38,560
By Gasoline Car	27,410	28,460	29,860
By Motorcycle	3,520	5,430	8,700
Total Diesel Consumption	19,380	26,600	36,250
By Diesel Car	8,900	12,320	17,030
By CRV	10,480	14,280	19,220
Alternative Fuels(LPG and CNG)	70	480	1,800
Ratio of Diesel to Gasoline	0.63:1	0.78:1	0.94:1

[105] Excerpted from X. Ke, C. Sh, Development Trend of Domestic Civil Vehicles and Its Influences on Supply of Oil Products, China Petrochemical Consulting Corporation, http://www.spc.com.cn/spcspc/Chinese/tep/2000_04/7.html, accessed on June 29, 2003

I: Sale Distribution by Province from Jan through Oct 2002

Table I-1: 3-W CRV Sale Distribution by Province between Jan and Oct 2002

Province	Market share (%)
Hebei	22.96
Shandong	21.27
Henan	17.27
Anhui	6.68
Shan1xi1	5.67
Gansu	5.47
Liaoning	4.57
Jiangsu	3.95
Shan3xi1	3.45
Inner Mongolia	2.86
Other	5.85

Source: China Economic Information Network

Table I-2: 4-W CRV Sale Distribution by Province between Jan And Oct 2002

Province	Market share (%)
Shandong	11.73
Sichuang	8.79
Zhejiang	8.11
Hebei	7.52
Henan	6.14
Shanxi	6.07
Heilongjiang	5.53
Jiangxi	5.05
Jiangsu	5.02
Guangxi	3.58
Other	32.46

Source: China Economic Information Network