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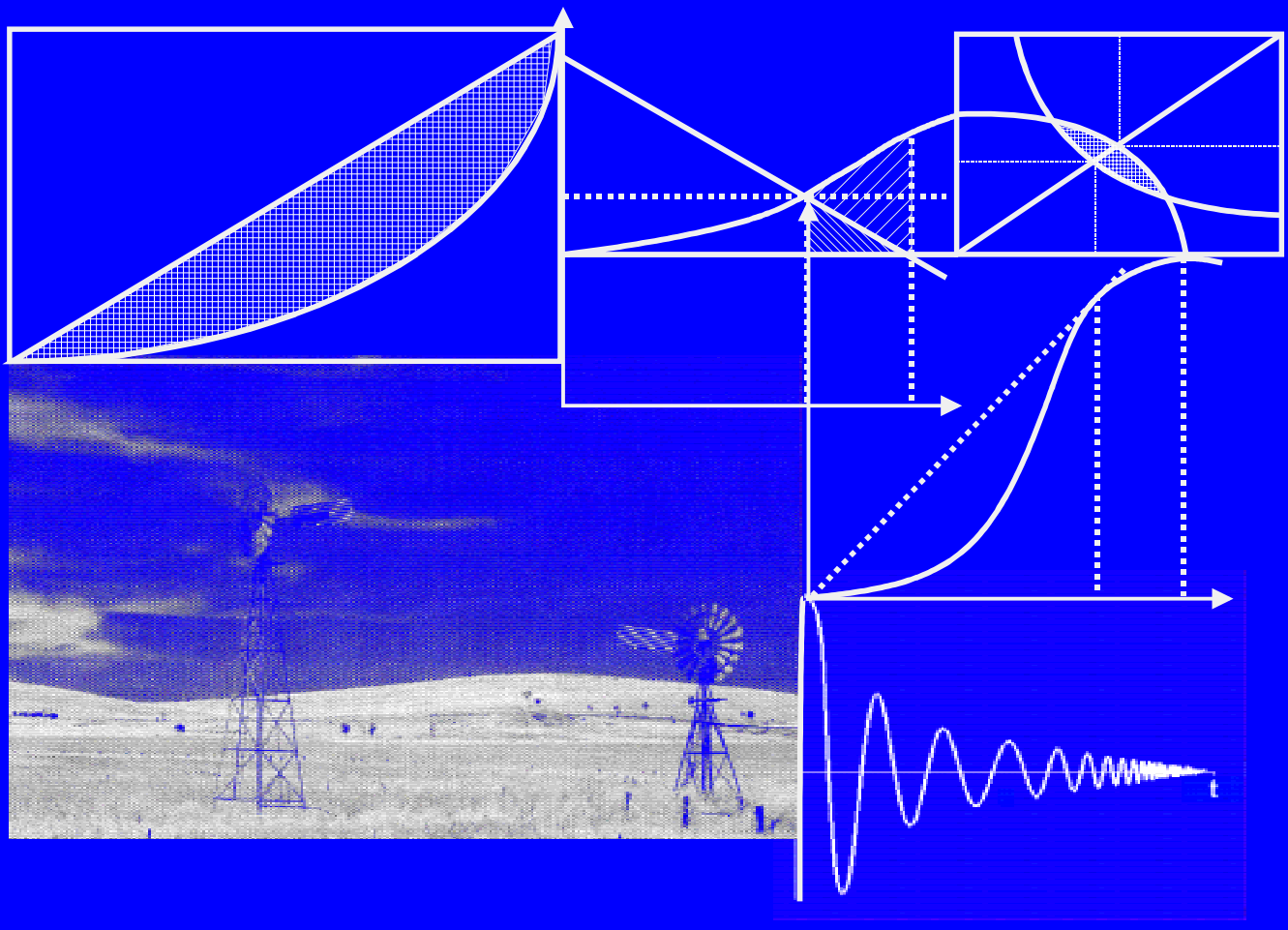

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Impact of Developing the Beef Industry in China on Farm Household Income and Farm Labour Utilization: A Case Study of Fuyang Prefecture[1]

Liu Yuman and Chen Jiyuan[2]

Abstract

Fuyang Prefecture in Anhui Province is one of the major areas for beef production in the Zhong-Yuan Beef Belt. It includes three counties designated as special counties under the "Straw for Beef" program targeted at making optimal use of crop residues in China. This paper will describe the general situation of the beef industry in Fuyang Prefecture and the "straw for beef" project and then analyse the impact of the project on the improvement of rural household income and on the utilisation of the rural labour force. The paper will also examine the "scale of economies" of beef cattle raising by smallholders and the broader development implications of the growth of the beef industry in areas such as Fuyang.

Keywords: China, beef, straw, economic development, household incomes, labour utilisation.

Introduction

Fuyang Prefecture is located in the northwest of Anhui Province. Fuyang Prefecture is a large agricultural prefecture in Anhui province. The total land area of the Prefecture is about 1.82 million hectares, of which the arable land area is 1.1 million hectares. The total population of the prefecture in 1996 was 13.08 million, of which 12.06 million was classified as agricultural population. The arable land area per capita is only 0.08 hectare. There are three districts, two cities (county level), and 7 counties under its jurisdiction. The agricultural activities in the prefecture are heavily focused on crop production(including wheat, maize, sweet potato, soybean, paddy-rice and cotton) and animal husbandry. In recent years, the beef industry in the prefecture has been developing very rapidly. Many changes have taken place as a result of these changes in the beef industry. In this paper, the focus is on analyzing the impacts on farm household income and farm labor utilization in Fuyang Prefecture.

The Development of the Beef Industry In Fuyang Prefecture

Fuyang is an important prefecture in the development of the beef industry in China. It has experienced the most rapid growth in beef cattle development of any prefecture in China since the

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[2] Rural Development Institute, Chinese Academy of Social Sciences.

early 1980s. It is also one of the demonstration prefectures for the "Straw For Beef" Project selected and approved in 1993 by the Ministry of Agriculture in China. The beef cattle inventory in Fuyang increased from 1.23 million head in 1984 to 3.52 million head in 1996. Over the same period, the number of cattle turned-off increased from 102 thousand head to 1.369 million head while beef production grew from 8kt to 177.4kt. Beef production in 1996 made up 41 % of total meat production, while the income generated from beef cattle farming represented 24% of the total net income per capita. Fuyang accounts for 2.6% of China's beef cattle inventory, 3.9% of its turn-off number and 3.6% of its beef production. The meat yield of individual cattle is 125 kg on average.

Farmers in Fuyang Prefecture have long had the tradition to raise cattle. For instance, the cattle inventory was up to one million head in the early 1950's and most of the cattle belonged to individual farmers. However, the cattle inventory dropped dramatically in the 1960's and 1970's owing to the introduction of rural collectivization and agricultural mechanization. During that period, individual farmers were not allowed to keep cattle of their own. Therefore, all the cattle previously owned by private households were collectivized. Furthermore, most of the cattle were used as draught animals in that period. A large proportion of the draught animals was replaced by agricultural machinery as a result of agricultural mechanization launched by the central Government. By 1978, the cattle inventory had dropped to 400 thousand.

The situation has changed greatly since the rural reforms of the early 1980s. The Rural Household Responsibility System for agricultural production was introduced and agricultural land previously managed by the collectives was contracted out to individual farmers. Individual farmers were again permitted and encouraged to keep cattle of their own. A lot of farmers began to purchase cattle from outside Fuyang Prefecture. Therefore, the annual growth rate of the cattle inventory increased by more than 100 thousand from 1979 to 1984. Most of the cattle used by farmers in that period were for draught. Commercial beef production did not begin in earnest until 1985 after the requirements for draught animals were met. The annual growth rate of turn-off number for commercial beef cattle increased by as many as 200 thousand head from 1985 to 1996.

The Fuyang prefecture government has taken active measures to develop the beef industry. First, the government mobilized the capital needed for the development of beef industry. Since the early 1990's, a total of 216 million yuan (RMB) has been invested in the beef industry. Among the total capital invested, 8 million yuan came from the "Straw For Beef" Project of the Ministry of Agriculture; 158 million yuan was organized by the prefecture government from its own budget; and 50 million yuan came from farmers themselves. Second, the government made great efforts to implement a scientific and technological extension system. A network of animal improvement centers has been established. There is a beef cattle improvement center at the prefectural level and animal improvement centers in each county. Animal improvement stations have also been established in more than 80% of the townships. In 1996, a total of 486 thousand female cattle were artificially inseminated. At the same time, the crop straw development system and the disease prevention system were established. In 1996, the total silage and ammoniated straw amounted to 3.2 million tons that accounted for about 38% of the total straw production. The disease prevention system consists of three levels, i.e. there is animal husbandry and veterinary stations at both county level and township level. There are also one or two veterinarians at the village level.

There are three fundamental features about the beef industry in Fuyang Prefecture. First, most of the cattle are raised by individual farm households (individual production pattern). Very few large-sized feedlots can be found in Fuyang. Farm households that keep cattle for beef production amount to roughly about 95% of the total farm households. The advantage of the individual production pattern is that it ensures full use of both agricultural by-products for ruminant animals and the surplus labor force of the household, and it maximizes the net income of the household by producing beef or marketable live cattle. Second, crop straw (including wheat straw, paddy rice straw, maize straw, soybean straw and sweet potato vines) which were previously used for cooking firewood is now made

into either silage or ammoniated roughage to feed to cattle or to "exchange straw for beef". This is the so-called "Straw For Beef Project". Silage making began in the prefecture in 1983 and, two years later, ammoniated straw making started and was extended throughout the prefecture. Thus the "Straw For Beef Project" in Fuyang Prefecture really commenced in the middle of the 1980's, which was well before other parts of China, even though it was not an official project at that time. Third, almost all the cattle-keeping farm households produce calves from their own cows. Very few farm households buy calves for fattening from live cattle markets.

Fundamental changes in the rural economy have taken place in Fuyang Prefecture since the development of the beef industry. First, the rural industrial structure has changed. For instance, the composition of meat production has changed. The percentage of pork declined from 83% in 1984 to 61.9% in 1996, while the percentage of beef increased from 5.5% to 26.4%. The percentage of animal husbandry gross product to agricultural gross product increased from 16.8% to 30.4%. Feed grains and maize have also increased because of the high demand of feedstuffs required by the beef industry. The sown area of maize grew from 50 thousand hectares in 1984 to 260 thousand hectares in 1996, while total maize production increased from 149kt to 631kt. Second, a large proportion of crop straw is consumed by beef cattle and the cattle produce a lot of manure. The manure is then applied back to the cropland. Therefore, the quality of soil has been improved. Organic matter in the soil increased from 1.2% in 1984 to 1.4% in 1996. In places where the animal husbandry is more developed, the percentage of organic matter in the soil is as high as 1.8%. This is part of the explanation for an increase in grain production from 5.03 million tons in 1990 to 7.83 million tons in 1996. Third, because of the rapid growth in cattle numbers, the demand for cattle feed was also strong. Therefore, the production of silage and ammoniated straw has significantly increased. In fact, the annual growth rate of silage and ammoniated straw production was 31.9% from 1991 to 1995. Currently, there are about 300 thousand silage pits and 5,300 ammoniated straw cutting machines in Fuyang. In 1996, silage and ammoniated straw production totaled 3.6 million tons that accounted for about 43% of the total amount of straw produced in Fuyang.

The "Straw For Beef "Project at the Household Level

In 1993, Mengcheng County, Lixin County and Guoyang County were selected and approved by the Ministry of Agriculture as demonstration counties for the "Straw For Beef Project" because of their "excellence" in exchanging straw for beef. They are the three largest counties for the beef industry in Fuyang Prefecture. The three counties together are known as the "Golden Triangle" of the beef industry in China. In 1995, the beef cattle inventories in the three counties were 608 thousand head in Mengcheng, 512 thousand head in Lixin and 417 thousand head in Guoyang, while cattle turn-off numbers were 215 thousand head, 205 thousand head and 133 thousand head respectively. Beef productions in these three counties were 26 thousand tons, 27 thousand tons and 16 thousand tons. In total, there were 1.54 million head of cattle in the three counties in 1995 with 0.55million head turned off and 69 thousand tons of beef produced, accounting for 44%, 46% and 46% of the prefecture's totals respectively. Thus the three counties reflect a general picture of the current situations of the beef industry. The analysis also focuses on the farm household level since almost all the beef cattle are raised by individual farm households. In this section, beef cattle production patterns and how straw is used at the farm household level is described.

On average, each farm household keeps three or four cattle. However, there is a variation from one to more than ten cattle per household depending on the economic conditions and the available resources such as labor force and feed and straw for beef cattle production of each household. Table 1 reveals the general situation of farms and beef cattle production at the household level in Fuyang Prefecture. The average size of arable land area per family is only about 0.6 hectares which is not large enough to generate the income needed to support a family. Furthermore, there are few industrial employment opportunities for local farmers in Fuyang. Conversely, there is a lot of crop straw and agricultural by-products which can be used for ruminant animals. Thus it is wise for households to raise a few cattle

by feeding them a certain proportion of the straw.

In general, there are three main characteristics of the household production system for beef cattle.

First, many of the households who keep cattle rely on the resources available to their family as much as possible. They do not purchase calves or young cattle for fattening. Instead, they raise calves from their own cows. Cattle are fed with feed and straw they produce from their own land. They normally do not buy feed and straw. The concentrate feed they use include maize, barley, sweet potato, soybean meal, cotton seed meal and wheat bran. The roughage they use includes green grass, sweet potato vines, soybean straw, wheat straw, paddy rice straw and maize straw. From early June to late September, cattle are either grazed outside or given green grass which is collected by the spouse or children. During this period, very little concentrate feed is given to the animals. The roughage and concentrate feed are given to the cattle from early October to late May. In fact, this is cheapest way for farmers to do business and reduce market risks. If they buy calves or young cattle and straw for fattening, the cost of production will be significantly increased. In addition, they need cash to purchase the cattle, but credit is not easy to organise in the poor areas.

Table 1 Beef Cattle Production at the Household Level in Fuyang Prefecture

Item	Unit	Mengcheng	Lixin	Guoyang
No. of households		39	40	40
Average family size	People	5	5.2	6
Labourers per family	People	3	2.8	3.1
Land area per family	Hectares	0.66	0.53	0.77
Grain production per family	Kg	5,148	4,562	6,164
No. of cattle per family	Head	4.2	3.3	3.3
Grain concentrates per family	Kg	1,562	1,195	895
Non-grain concentrates per family	Kg	1,369	1,036	1,484
Untreated straw per family	Kg	2,697	2,423	4,755
Silage per family	Kg	4,036	1,121	1,335
Ammoniated straw per family	Kg	2,069	2,961	418
Green grass per family	Kg	3,237	1,149	2,554

Source: The data in Table 1 and following tables were collected by Ms. Wen Pingli in a survey in 1996. In the survey, she interviewed 119 farm households. The survey covered five villages in four townships of Mengcheng County, four villages in four townships of Lixin County and four villages in three townships of Guoyang County. The villages were selected according to the economic conditions and cattle production conditions in each area. However, the households surveyed in each area were selected at random. For more details see Wen Pingli (1997) “An Evaluation of the Economic Benefits of Straw for Beef Production in Fuyang Prefecture, Anhui Province”, Master’s degree thesis, IAE/CAAS, May,1997.

Second, to feed cattle with straw is labor intensive. One beast consumes at least 2500kg of roughage a year. It takes a lot of time to prepare the roughage, feed and water and to supply it to the cattle. For a household that keeps 3 or 4 cattle, it takes about three hours a day to look after the cattle. This work can be done by the housewife and her children since it is not heavy physical work. Clearly, the household production system for beef cattle will not significantly affect the labor force mobility in the family if the scale of production is small.

Third, farm households can achieve multiple economic benefits from the new beef cattle production system. It generates supplementary income for the family by producing marketable live cattle and beef. It makes full use of the crop straw that was previously used as firewood. It makes more cattle available for draught purposes and saves physical work in the fields. It produces cattle manure that can be applied to agricultural land as base fertilizers to replace chemical fertilizers and to save on production costs. These and other benefits explain why most farm households raise cattle.

The straw is used in three forms, namely plain (untreated), ammoniated and silage. Among the 119 households surveyed by Wen (1996) in Table 1, there were 21 households who fed the cattle with plain straw (17.6% of the total surveyed); 13 households who fed the cattle with silage straw (10.9% of total surveyed); 17 households who fed the cattle with ammoniated straw (14.3% of total surveyed); and 68 households who fed the cattle with silage plus ammoniated straw (57.2% of total households surveyed). Table 2 shows how the crop straw was utilized by the surveyed households.

The Impact on Farm Household Income and Labor Utilization

The development of the beef industry plays a significant role in the regional economic development of Fuyang Prefecture. This is because the development of the beef industry does not only generate income for farmers, but also creates employment opportunities for the local people either in the production sector or in other related sectors.

Table 2 Utilization of the Straw Per Surveyed Household

Item	Total available straw	Ammoniated	Silage	Untreated	Burned
		-- kilograms --			
Wheat straw	3848	1599	0	1797	452
Maize straw	1996	0	862	491	643
Rice straw	230	51	13	158	8
Soybean straw	322	2	0	159	161
Sweet potato vines	3062	0	1182	1854	26
TOTAL	9458	1652	2044	4459	1290

Source: As for Table 1.

In the context of beef cattle production, farmers in Fuyang have been self-employed and generated extra income to supplement their family income. In 1996, the net income per capita generated by the beef industry in Fuyang was about 380 yuan, which contributed to more than a quarter of the total net income per capita. However, the level of income generated by the beef industry is heavily dependent upon the size of cattle production at the household level and the way in which the crop straw are utilized (see Table 3 and Table 4).

Table 3 The Impact of Beef Cattle Production Size on Income

Size	Head	1-2	3-4	5-6	7-10
No. of Households		6	69	35	9
Average size	Head	1.25	3.4	5.6	7.8
Total working days	Days	80	137	171	225
Gross product of major products	Yuan	1834	3831	6333	10171
Gross product of by-products	Yuan	296	470	730	1004
Total gross product	Yuan	2130	4301	7063	11174
Concentrate feed cost	Yuan	727	1241	2311	3632
Roughage cost	Yuan	536	853	1240	2543
Depreciation	Yuan	85	95	90	117
Disease control and AI	Yuan	44	137	191	302
Total expenses	Yuan	1392	2326	3832	6594
Total net income	Yuan	738	1975	3231	4580
Net income per beast	Yuan	590	581	577	587
Net income per labour day	Yuan	9.23	11.83	14.99	20.36

Source: As for Table 1

Table 3 demonstrates that as the size of beef cattle production of farm households increases, total net income increases steadily, as does the net income per labor day. However, net income per head of cattle is almost constant. This suggests that if the household increases their production by one head of cattle, they can generate an extra income of about 585 yuan assuming that the market prices for feed and cattle or cattle products remains unchanged and that the cattle consume the same amount of feed. This is especially the case when farmers invest very little in fixed assets. Second, as the size of the beef cattle production increases, the labor input per cattle diminishes because size economies exist in labor input at the current stage of development of the beef industry. This explains why net income per labor day goes up as the size of beef cattle production increases. Third, as the size of beef cattle production at the farm household increases, the more laborers are needed to look after the cattle. When a farm household keeps only one or two cattle, the spouse and children who otherwise generated no income for the family can be heavily involved in the process of beef cattle production and generate income. However, there are limits to how much spouses and children can do.

Table 4 shows that as the treatment of straw changes from plain straw to ammoniated straw plus silage, the total net income, the net income per head of cattle and the net income per labor day are gradually improved. This suggests that all the treatments of straw are effective. To feed the cattle with ammoniated straw plus plain straw or silage plus plain straw is better than with plain straw only. However, it appears that it is best for farmers to feed the cattle with a combination of ammoniated straw and silage. This indicates that straw ammoniating and silage making improve the nutritional value of the straw significantly and make the straw more digestible so that the cattle can more easily gain body weight. Thereby, the market value of the cattle increases, as does the farmer's income assuming that other conditions remain unchanged.

Table 4 The Impact of Different Treatment of Straw on Income

Treatment	Unit	Plain	Ammoniated	Silage	Ammoniated plus silage
No. of households		21	17	13	68
Average size		3.1	3.2	3.6	3.9
Total working days	Days	152	144	152	147
Gross product of major products	Yuan	2944	3684	5103	5313
Gross product of by-products	Yuan	471	575	574	607
Total gross product	Yuan	3415	4259	5677	5920
Concentrate feed cost	Yuan	1087	1386	2420	1837
Roughage cost	Yuan	655	857	813	1449
Depreciation	Yuan	64	104	115	100
Disease control and AI	Yuan	116	163	170	173
Total expenses	Yuan	1922	2510	3537	3559
Total net income	Yuan	1493	1749	2140	2361
Net income per beast	Yuan	482	547	594	605
Net income per labour day	Yuan	9.8	12.1	14.1	16.1

Source: As for Table 1.

Farmers in Fuyang have obtained employment not only in the beef cattle production sector but also in other related sectors. For example, they have obtained employment in the processing sector and in mushroom farming. The rapid growth of beef cattle production has led to the development of the beef cattle processing industry since the mid-1980s. At present, there are 344 cattle slaughtering and beef processing enterprises which are respectively operated by the local governments, collectives and foreign joint ventures. There are 146 cattle leather processing factories and 243 cold storage warehouses located in different counties. In 1996, a total of 200 thousand rural surplus labor force obtained employment in the processing sector and they generated a total gross product of 6.4 billion yuan. In Lixin County, farmers are using cattle waste to grow mushrooms. In 1996, there were about 12 thousand farm households located in 26 townships involved in mushroom farming activities and 3.25 million kilogram of mushroom were produced. The gross product of mushroom farming was as much as 20 million yuan. The mushroom farming technology has been extended to Mengcheng County, Guoyang County and Yingdong County.

Conclusions

Fuyang Prefecture Government has attached great importance to developing the beef industry. The government has formulated a package of plans to develop further the beef industry, especially to improve the infrastructure required by the industry. For example, a beef cattle improvement center has been established at the prefectural level; a three-level (prefecture, county and township) beef cattle improvement network has been forged, the equipment for silage making and straw ammoniating has been increased and improved, and more than 800 markets for animal products trading have been established. Clearly, the Provincial Government considers that there is great potential for further development of the beef industry in Fuyang.

The general development trend of beef cattle production in Fuyang is that the household production system will continue to dominate over the next few years though the size of the production will increase gradually. In addition, there are some feed lots of different sizes already established and more are likely to be established in future. At present, there are four feedlots which can contain one thousand cattle each, one hundred and seventy-eight feedlots which can contain more than one

hundred cattle each, and two hundred and forty-three farm households who keep more than thirty cattle each. But under current market conditions, it is better for farmers to have a small size feedlot rather than a large size feedlot. When farmers have a small size feedlot, they can maintain the comparative advantage of household beef cattle production. For example, they can make full use of the economic resources of the family such as the labor force and the straw. They need invest little money in fixed assets for production. In addition, they have less market risks because of a more flexible production system. Under current costs and returns conditions, it would seem that the ideal size of the production for a household is around 10 cattle. If a family keeps more than ten cattle at any time, they may need to invest in the fixed assets, they may have to buy feed and straw, they may need to buy young cattle, and they need to hire extra labour. All of these inputs cost money and make the production more expensive (ignoring opportunity costs which are ordinarily very low for the family supplied inputs needed for beef production). Conversely, if the scale of production is too small, the economic resources of the family may not be fully utilised and the family can may not be maximising its level of income.

The demand for beef is a vital constraint to the further growth of the beef industry. If market demand does not keep pace with the rapid increase in production, then the price will fall and farmers will find that the economic benefits of raising beef cattle are reduced. But the market for beef is not static. There is room for further growth in the demand for beef. The market share of beef at the moment is relatively low in comparison with pork. This indicates that there is still a great deal of market potential for beef in the mass market for meat in China. Therefore, the households should aim to produce beef for the domestic mass market while the large-sized feedlots should be designed to produce beef for the top-end of the market or for overseas markets.

The processing industry for beef cattle products and other related industries are important to the development of the beef cattle production sector. They rely on each other. The processing industry creates market demand for the production sector. The production sector provides raw materials to the processing industry. Both the processing and production sectors offer farmers and others in the rural areas employment opportunities. Thus an efficient processing sector is also essential if the development of the beef industry is to achieve the maximum possible benefits for rural China.

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