

Small Scale Pig Farming in Northern Shanxi: An Environment, Health and Development Perspective

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Abstract

Over the past three years, under the combined impact of national policies and markets, the landscape of the pig farming industry in China is undergoing great changes, with a large number of medium and small farmers and scattered (*sanyang*) breeding households withdrawing from the market, and the market shares of large-scale pig breeding enterprises rising. Pressure from environmental protection and industrial transformation is placing the scattered breeding households, which were formerly the mainstay of the breeding industry, in a dilemma. Research and public opinion generally believe that sharp fluctuations in pig prices and environmental pollution from pig breeding are the primary negative effects of the sector and that both are due to the lack of macro control and the nonstandard practices of scattered households. But is this really the case? Drawing on qualitative fieldwork in northern Shanxi, this paper aims to provide a case study of scattered pig breeding and its interaction with environmental protection. Empirical research found that, in this region of Northern Shanxi, where animal husbandry and horticulture are equally important and complementary, pig breeding by scattered households does not put obvious pressure on the environment. Although there is still room for improvement in policy implementation and cooperation among government departments, and so on, pig farming is part of a sustainable agricultural system. Instead of discouraging scattered pig breeding everywhere, policy needs to take local environmental conditions and the relationship between horticulture and livestock rearing into account.

Keywords

Small Scale Pig Farming, Environmental Pollution from Pig Breeding, Sustainable Pig Farming

1. Background and Purpose of the Study

China is a large producer of pigs and a major pork consumer. Since reform and opening up in the late 1970s, it has seen stable development of pig production and continued progress in standardized large-scale pig breeding (Huang et al., 2020; Zhong et al., 2021). According to the No. 1 Central Document in 2021, China will “accelerate the construction of a modern breeding system, protect pig production capacity, and improve the long-term mechanism for the stable and orderly development of pig farming industry” (China Pigs Industry Editorial Board, 2021).

Over the past three years, under the combined impact of national policies and markets, the framework within which the pig breeding industry in China operates has been undergoing great changes, with a large number of medium and small farms and scattered (sanyang) breeding households withdrawing from the market and the market share of large-scale pig breeding enterprises rising (Liu et al., 2021a, 2021b; Zhang et al., 2021; Zheng et al., 2021). Pressure to improve environmental protection and industrial transformations is placing scattered breeders, which were formerly the mainstay of the industry, in a dilemma. Research and public opinion generally believe that sharp fluctuations in pig prices and environmental pollution from pig breeding are the main negative effects of the industry, and also that both are due to the lack of macro control, and non-standard breeding practices among scattered breeders. In contrast, large-scale breeding is thought to help reduce pollution (Yao, 2021; Li et al., 2021; Yang et al., 2021) and reduce price fluctuations in the pork market (Liu et al., 2021a, 2021b; Yan, 2019). It is true that medium- and small-scale pig breeding has some problems, including unplanned investment on breeding, an emphasis on short-term interests, the occupation of land resources, and delayed response to national policies. Certainly, the problems caused by pollution from pig breeding by scattered households cannot be underestimated in places such as Nanping in Fujian and other regions with dense pig farming and few agricultural crops. According to the China Oil & Foodstuffs Cooperation (COFCO), over 13,000 medium- and small-scale pig farms were closed down and reconstructed in Fujian Province in the second half of 2015, and around 70,000 medium- and small-scale pig farms were shut down in Zhejiang Province by the end of September 2014.

Other studies show that medium- and small-scale pig farms have caused serious pollution to the ecological environment, land resources and drinking water (Yao, 2021; Mungruaklang & Iwai, 2021). Therefore, more strict environmental regulations in animal breeding industry are necessarily. Yet, in making a choice between ensuring the pork supply and environmental governance, local governments are likely to be caught in a situation where only urgent needs are considered. For example, rather than attempting for more sustainable solutions, pig farms are often forced to shut down as a consequence of a strict pollution control. Based on such status quo, recent studies have indicated that in treating excrement in the animal husbandry, all regions should draw on the experience of

industrial pollution control, develop the environment-friendly animal husbandry featuring a combination of agriculture and animal husbandry. This will mark a new profit field to achieve common development of agriculture and pig breeding (Samarin et al., 2021).

In the social sciences, research on pig farming has been largely conducted used quantitative methods to explore relationships between environment, health and development. More focused research topics have included: studies of the influence of policies or government regulations on the environmental decision making and behavior of pig breeding households (e.g., Shao et al., 2021; Chen et al., 2021); studies of the environmental behavior, environmental risk perception and factors influencing pig breeding households (e.g., Chen et al., 2021; An & Sun, 2021). These studies examine the resource endowments (the quantity and quality of such factors as labor, funds, technologies and management) of pig breeding households, and simulate their decision making and production behavior in response to external policies, environment and market conditions. Like any human behavior, however, pig breeding is highly complicated and also has social dimensions. Qualitative case studies are therefore necessary to capture the complexity and diversity of the pig breeding industry and give a multi-dimensional picture of how the sector is actually developing. Such studies can also supplement macro-level analysis and provide information to support appropriate management measures appropriate to the different opportunities and conditions presented by diverse natural, economic and social environment in different regions.

This article presents an anthropological case study of a county in northern Shanxi province. It discusses several problems related to environment, health and development from the perspectives of those at the “top” (local government departments responsible for pig breeding) and at the “bottom” (large-, medium- and small-scale pig breeding households/farms) (Zhang et al., 2011). First, existing research has suggested that medium- and small-scale pig breeding households contribute disproportionately to negative environmental impacts. To what extent is this true, and how do medium- and small-scale pig breeding households understand and adopt environmental policies while pursuing economic profit? Second, from the standpoint of local governments, what functions do the various departments involved assume in “pig breeding”? How do these departments cooperate with each other, and how are policies implemented from the county to the village level? Lastly, the standpoint of pig breeding households, why do they continue to choose to raise pigs? What do they think of local government policies towards pig breeding and how do they respond? Beyond policy, how do they regard the economic and environmental risks associated with pig breeding, and what risk management strategies do they adopt?

2. Research Methods

This research aims to explore small-scale pig farming in its natural setting in order to make sense of all stakeholders’ understanding, engagement and interac-

tions in the whole process. It doesn't involve any interventions of the local pig farming industry. The research team conducted fieldwork in five villages in two towns or T County, Shanxi Province, for three weeks in July-August 2016, using semi-structured interviews and participatory observation. We interviewed three types of respondents who represented the perspectives of "multiple interested parties": eight large-, medium- and small-scale pig breeding households, two heads and staff members of medium- and small-scale pig farms, three village cadres, two villagers who did not breed pigs, and seven leaders and staff of related government departments. The above interviews engaged with 5 female pig breeders. They were all married with pig breeding as family businesses. In-depth interview was conducted one-on-one between the female breeder Z and the researcher. All the other female participants were involved in household interviews with other family members. Participants from the government departments included the Bureau of Animal Husbandry, the Bureau of Environmental Protection, the Development and Reform Commission, the Bureau of Agriculture of T County, and the town veterinary station. Female government officials in these sectors were mostly men and we were not able to engage any female informants. Every interview lasted one or two hours. Some individuals were interviewed twice, for example, large-scale scattered pig breeding household Z, and director H of the T County Bureau of Agriculture. After obtaining the interviewees' consent researchers recorded the interview and also took notes. The in-depth interviews enabled us understand people's perspectives and experiences on pig farming practice and policy.

Participant observation was carried out throughout the interviews. We especially followed three breeders over four hours, in which we joined them as a participating member to get a first-hand perspective of all household members, their pig breeding practice and the dynamics within the households. Instead of observing as an outsider, we participated in the pig-feeding activities, which gave us the ability to experience events in the same way other group members experience them. Participant observation enabled the research team gain a close and intimate familiarity with breeders of different scales and their pig raising practices.

Interview transcriptions and observation notes were coded and analyzed in order to get a deep understanding of customers' perspectives on a specific issue. And the analysis in this paper is based on the above field data.

3. Presentation and Discussion of the Case

3.1. Overview: "Pigs are Raised on the Plains, And Cattle and Sheep Are Herded in the Mountains"

Under the jurisdiction of Datong, Shanxi, T County lies to the northeast of the city at the junction of the provinces of Shanxi, Hebei and Inner Mongolia. The county has the arid continental monsoon climate characteristic of China's north temperate zone. It has little rainfall all year round and a prevalent northwest

wind. The weather is dry and cold in spring, autumn and winter, with air temperatures averaging only 6.2°C. Listed as a key county in the national plan for poverty alleviation through development, it has a total land area of 1635 sq-km, including 0.72 million mu of cultivated land, and an agricultural population of 0.18 million. Its annual per capita income reached 10,000 yuan in 2015, and household income was around 40,000 - 45,000 yuan. T County is covered with mountains to the north and south, with plains in the east and west. A local saying describes a local tradition, that “pigs are raised on the plains, and cattle and sheep are herded in the mountains”. Sanshilipu, Nanhebao town and T urban area are the main towns where pigs are raised in this county.

T has no mineral resources, but arable land on the plains has fostered a relatively developed crop sector that includes mostly corn, millet, sorghum, proso millet, beans, and potatoes. As a result, for hundreds of years, horticulture and animal husbandry have always been equally emphasized in the villages and towns of the plains, creating an economic model in which the two activities complement and support each other (information of T county is from the official website of Datong, reference: <http://www.dt.gov.cn>).

3.2. Pig Breeding and Rural Livelihoods

According to interviews with local government officials, since the 1970s, T has become a major pig breeding county in Shanxi Province, and pig breeding is always one of the main livelihood sources of the county’s farmers. In the late 1970s, pig breeding was promoted by an administrative order, and the local government put forward the slogan “one pig per person” to encourage agricultural households to raise pigs. However, in more recent times, pig breeding in northern Shanxi has not been influenced by the government’s policies to support large-scale specialized breeding, and for the last few decades, local pigs have always mainly been raised by medium- and small-scale farms and smaller-scale scattered households. The reasons for this are one of the questions we explore below.

According to the Bureau of Animal Husbandry of T County, in early 2016, T County had around 400,000 pigs on hand, with more than 100,000 head for sale on average every year. Yet pig breeding is not the main activity on which locals rely to make a living. Even in those villages (each of which generally has a population of 1000 to 2000) on the plains, in which pig breeding is a tradition, there are usually only five to ten pig breeding households in a village, each with fewer than 100 head. There are not many large-scale pig farms with over 500 head; only two or three villages across the county had two farms with over 500 head each. As the data in the article by Chen and Gong in this special issue shows, Shanxi is one of China’s provinces that have the lowest density of pig breeding (less than 10% agricultural households have pigs). As they put it, “the fewer breeding agricultural households, the larger breeding scale”, and Shanxi, Shanghai and Zhejiang stand side by side as the provinces with a larger pig breeding

scale, ranking second only to Henan, Tianjin and Guangdong. According to their data, there are, on average, 49 head for sale per pig breeding household in Shanxi. These data are consistent with our survey results.

Chen and Gong also discuss the significance of pig breeding for the livelihoods of poor agricultural households. Their study found that 60% of poor households see their income from pig breeding exceed 50% of their net cash income, that government support for pig breeding is deemed an important means of poverty alleviation in many poverty-stricken areas, and that with a rise in income, small-scale breeding households will move faster to exit from the market. Yet our survey in northern Shanxi found that local pig breeding is stable and that pig breeding households generally neither give up rearing pigs, nor blindly expand the scale of their operations. Our research found that there are the following main reasons for this anomaly:

First, in this region, the volume of pigs for sale is accurately positioned in relation to the market and demand is stable market. There are two slaughter houses in the county town, and, pigs are generally locally butchered, and mainly sold within this locality and the surrounding county towns. According to custom and dietary habits in Shanxi, Inner Mongolia and the surrounding area, local pigs are slaughtered only after reaching 125 kg, because pig breeding households and locals believe, "Big pigs are rich in fat, and only their meat is delicious". Local pigs are not usually sold to Beijing and other regions further away on the grounds that people in those normally prefer smaller pigs. One interviewee remarked that, "Only pigs weighing 100 kg or so are allowed to enter Beijing". In T County, there is no market squeezing by large-scale farms, nor is there a custom by which farmers rear pigs specially for their own consumption during the Spring Festival, and there are few very small-scale scattered breeding households. As a result, even if prices fluctuate, local breeding households can more confidently wait for market recovery, for as the locals say, "people always need to eat meat".

Next, although it was initially encouraged as a development strategy, pig breeding is not linked to poverty alleviation in this area. In T County, there are no very small-scale pig breeding households (with fewer than five head). All the pig breeders are agricultural households with fairly good incomes and they raise 10 or more head each. Furthermore, crop production and animal husbandry are equally stressed there. Net income from pig breeding occupies only 50% or so of total income from household businesses, except for medium- and large-scale pig farms with over 200 head each. Pig breeding households with a larger scale and more diverse income sources can better tolerate such shocks as price fluctuations, and pig diseases and deaths. Most locals keep pigs in their own yards and the relatively fixed number of breeding facilities means that the number of pigs on hand is also quite constant. A decrease in the number of pigs on hand would trigger a fall in both site utilization and per capita household income, while expansion of the scale of breeding is restricted by the size of the family's yard. The absence of other better employment opportunities makes it nearly impossible to replace pig farming with other occupations. These factors mean that local

households with over 10 years of pig breeding experience generally do not rashly expand the scale of their operations, nor give up raising pigs because of price fluctuations.

In addition to this, there are cultural differences between rural areas in northern Shanxi and those in southern China. One of these is with regard to migration. Local farmers in northern Shanxi are reluctant to work in a place too far away from their homes. Generally, those who migrate to work in other places are young men aged 17 - 35. But if a chance is available to find work in the county seat or adjacent areas, most people will still choose to stay in their home towns even if the salaries for such jobs are low. It has become increasingly difficult to find work in recent years and in this situation, many young people are willing to stay with their parents, raising pigs and farming. They will occasionally go to the county seat or other surrounding areas to do some odd jobs appear. But with development of modern techniques, pig breeding is not as labor intensive as it was a few decades ago. In particular, it is much easier to feed pigs and clean up hog houses than it was before.

In conclusion, in T County, the plains where pigs are reared are cold, dry, windy and rainless for three seasons of the year. The majority of pig farms are scattered but they are fewer in number than in many other provinces and somewhat larger in scale. Pig breeding is a stable and important but not the sole means of livelihood in this county, and it seems that more younger people are involved in the industry than in some other provinces.

1) Pig breeding as a purely economic activity

In the Yunnan-based case, Fang Jing points out that pig breeding is a “way of life” in LQ. For example, old locals rely on traditional feed to raise one pig or two every year in a “safer” way for family consumption, and this becomes a way in which older people provide care and spiritual support for their children living elsewhere.

In the survey in Shanxi, we found that despite being a traditional industry on the plains in T County, pig farming is not a “way of life”. Over half of local pig breeding households believe that pig breeding is still an important economic activity that creates income for households. This industry is deemed “too costly” and “unworthy”. As long as conditions permit, few farmers rear fewer than three head each, and most rear at least 10 or 20 head. Hearing about the Yunnan situation, local pig farmers attributed their breeding fewer than three head to “extreme poverty”. In one interview, for instance, a farmer named G said,

“Are there any people raising only one or two pigs in your places (the countryside in Huizhou and Yunnan)? How poor they are! No one does that here...It's rare to raise three or five head because so few pigs don't bring in much money. So it's common to rear 10 or 20 head.”

From G's description we can see that pig breeding in Shanxi is an important economic activity and is less related to “culture” or the local “way of life”. In discussing pig breeding, farmers tend to focus on the economic motives and sig-

nificance of the business, which mainly consist of the following three aspects:

2) “Raising pigs is not tiring”

The 10 pig breeding households we interviewed all had at least 10 years of experience. A pig farmer for over 20 years, 54-year-old L lives in the north of Wangjinbao Village and has the largest pig farm in his village, with over 50 sows. According to the local custom, the scale of a pig farm is judged by the number of sows rather than the total number of pigs. Between these sows and over 400 pork pigs, L actually has around 500 head, putting his farm in between the range of medium-scale and large-scale farms. He raises pigs in two places, one of which is his courtyard with over 200 head; the other is a slightly larger facility on a mountain slope near his doorway. Those sows and piglets requiring more care live in the courtyard together with L’s family.

L has two sons: The younger one worked elsewhere for a while after graduating from university; and the elder one began to raise pigs with L after finishing his junior middle school education. The elder son has been married for nearly 10 years, and moved his family to the county seat for his children’s education. However, this young man has his own pig farm, and continues to remain in the village most of the time. Although his pig farm is not very large, it is enough to support his whole family because of the high price for pork over the past two years. With the help of his father, he feels that pig breeding is more stable and easier than working outside. This young man said,

“I did work outside. I was young and ignorant, and I thought pig breeding was a dirty, dishonorable job. So I went out to do odd jobs. But after over 10 years of doing all kinds of jobs outside, I hadn’t learned anything and I hadn’t saved any money, and I got a lot of diseases. Later, persuaded by my father, I came back to rear pigs. Now, I am married, so I must consider my wife and children. Compared with plastering work at the construction site, pig breeding is really not tiring at all.”

Compared with manual labor at the construction site, pig breeding is not “tiring”, mainly because unlike in the past it is no longer necessary to spend a lot of time preparing pig feed, for example, cutting pigweed in summer and preparing grain in winter. Now, farmers rely mostly on ready-made feed. All they need to do is call the feed factory and it is delivered. What’s more, feed is divided into different types, which are used for sows, and for fattening pigs and piglets respectively. All the breeder does is to mix the feed with maize meal and stir the mixture and put it in the trough. Little manpower is needed for the whole process.

Besides rearing pigs, L and his wife do farm work on their seven or eight mu of land, mainly growing corn as pig feed. “This is just part of the feed, and our whole pig farm consumes several tons of feed in one day,” said L. Besides growing corn himself, L has to buy some corn. He employs one worker for his large pig farm, mainly to serve the feed and clean up the hog house. It seems L is right, that for him, “raising pigs is not tiring”.

Even for people who do the work themselves, it is not very tiring. A

48-year-old villager Z in Nanhebao Village had a slightly smaller pig farm. Her husband works outside throughout the year. The couple has three daughters and one son. Their eldest daughter has started worked after graduating from university, and the remaining children are still at school. Before Z got married, she had already started to raise pigs and she has been doing this job for 30 years. Now, she raises five or six sows, over 30 pork pigs and more than 30 piglets by herself. Thanks to the small scale, Z runs the pig farm in her yard, without a feed blender. According to Z, “raising pigs is not tiring”:

“Without a blender, we cannot produce corn feed. Our children are at school. (This explains why we cannot afford to buy this equipment). We buy feed at the full price, which does not have to have added corn. A small pig farm has its own advantages, one of which is to save more trouble.”

It is more convenient to feed pigs now. Moreover, the pig sties of breeding households generally have automatic drinking water devices installed and excrement troughs are more easily cleaned. With these modern breeding technologies, breeding households have greatly reduced labour inputs, regardless of whether they are small-, middle- or large-scale.

3) You don't make a loss raising pigs

According to the universal experience of pig breeding households, they do not make a loss even when pig prices are low. Large-scale pig breeding households were more motivated to persist in their work since it is not easy to change industries, but even small-scale breeding households held this view:

“In the case of high pig prices, both of us (I and my husband) can earn a good income. But when pig prices fall or in other cases, for example, when a lot of our pigs died from cold weather due to snow last year, our family depended only on my husband's income from part-time work. However, we neither lose money nor make money when pig prices are low.” (Zhao, female villager, 48-year-old).

In the opinion of pig breeding households, the reason why they did not suffer a loss is mainly due to the fact that “we can still recover our costs even if pig prices are very low”. With a fall in prices, feed costs and other costs also decrease and since local farms mainly serve the local market and surrounding markets, demand is relatively stable. For example, Nanhebao Village in T County, where the township government is located, has about 1000 permanent villagers, and consumes about four pigs every day. Some meat shops actively contact Zhao to ask for pig supply.

Another reason why pig farmers do not make a loss is that some of them also do business in feed and the combination of pig breeding and feed sales can effectively reduce the risk incurred by price fluctuations. Zhao gave an example, saying:

“We (pig-breeders) are not as smart as those feed sales people. For instance, I need five tons of feed a year, while a feed salesman has to sell 10 tons in order to achieve his target. As he cannot end up selling as much, he has to run a pig farm as well in order to consume the feed. As such, he earns salary as a formal employee of the feed factory; in the meanwhile, he gets profits from raising pigs

with cheap feed. He makes far more profits than us.

Apart from the above two reasons, pig farmers engage in this activity because it frees them from migrating for work, and there are fewer restrictions on age, gender and educational background. Because of this it has become the safest livelihood choice for local agricultural households.

In T, a national poverty county, agriculture is the pillar, and the industrial sector barely exists. Farmers attach great importance to education, because they know that education can help them gain access to employment, and well-connected or capable people also leave to seek work. But farmers with a low level of education can only remain in the countryside. Men help their families financially mainly by doing odd jobs at construction sites. But in recent years, the real estate market in the county town has basically been saturated, so while some farmers purchase housing there, others still choose to grow old in their original homes. At the same time, fewer new houses are being built in the countryside. As a result, farmers have lost important sources of livelihoods, and have to make a living by farming. Some years ago, people led a relatively good life as men went to work in construction and women stayed at home, doing farm work. Nowadays, however, all men can do is farm at home, and they are unemployed during slack season in farm work.

Path dependence means that once one chooses a path, regardless of whether it is “good” or “bad”, one becomes dependent on it. When locals of T County want to increase the family income, they therefore choose a familiar route. Pig breeding is a long-standing tradition in the County, and they have experience, so it is the obvious choice. Relatively speaking, pig breeding is a low tech occupation and requires little financial investment. Even very poor people can afford to buy a piglet for just over 1000 yuan (at most) and let it reproduce itself. The other inputs are small, too. Pigs can be fed leftovers and home-grown corn, and people with more energy and funds can raise more pigs if they have a big enough property, increasing their earnings.

4) Gender and the intergenerational division of labor in pig breeding

Fang Jing’s study in Yunnan showed that pig breeding by scattered households in southwestern China shows an obvious gender and intergenerational division of labor, with women and older people more likely to work in the sector. In our survey in northern Shanxi, we found that there was a gender disparity that was significantly correlated with the scale of pig breeding. Among middle- and large-scale farms with more than 200 head on hand, pig breeding was the “main business” of the household is and the operation was run jointly by a couple. However, the man of the household dominated and made the big decisions, for example, decisions regarding the scale of the farm, and in particular the number of reproductive sows and pigs for sale, immunizations, and the purchase of feed and veterinary drugs. Men were also responsible for external liaisons, acquiring information, and efforts to obtain policy support. A pig farm with about 500 head generally employs one or two workers, who are usually also managed by the husband. Women rarely make decisions or assume management

functions; their main responsibilities are to maintain the daily operations of the farm, take care of sows and piglets, feed pigs, and clean pig sties. For example, the wife of farmer G plays these roles: she gets up at 5:00 a.m. every day, cleans up the pig stie and prepares feed. She spends most of her day on the farm, but she nonetheless considers her work unimportant. “He (my husband) makes decisions and knows everything; I as a woman am uneducated and just act as a helper.”

Women play a more important role in medium- and small-scale pig farms with fewer than 200 head on hand. About half of small pig farms are managed by young women, whose husbands often do a relatively formal, paid job elsewhere. This is mainly because a small pig farm does not need two workers and pig breeding is traditionally deemed housework or a part of women’s reproductive role. For example, Z raises scores of pigs at home, and her husband works at the construction site in the neighboring Yanggao county and comes back once every two weeks. Besides raising pigs, Z does almost all the housework and raises their three children. She and her husband can earn two basically equal incomes a year, but even when pig prices are low, income from her husband’s odd jobs is enough to raise the family.

It follows that the gendered division of labor in pig breeding by scattered households in northern Shanxi replicates the gendered division of labor for housework, in which women take on heavy work, but their labor is considered to have lower value than men’s. Unlike the Yunnan case, however, pig breeding by scattered households in northern Shanxi does not show an ageing trend. This is because pig breeding is mainly an economic activity rather than a “way of life”, and small-scale farming is not regarded as a daily activity by older locals.

4. Management and Support from Local Government

Section 3 provides an ethnographic account of pig breeders’ perceptions and experiences of T County. However, the pig farming and pork industry are strongly regulated and managed by the government. Various government departments seek to regulate how breeders across the county operate and breeders are on track to comply. This section seeks to explore how government departments work together or separately to enforce the policy.

4.1. Cooperation or “Performing Only One’s Own Function”

In T County, the major government departments involved in pig breeding include the Bureau of Animal Husbandry, the Bureau of Environmental Protection, and the Bureau of Agriculture. The Bureau of Animal Husbandry is responsible for implementing policies and activities specifically related to pig-breeding, the Bureau of Agriculture is responsible for projects to support facilities such as hog houses and biogas digesters, and the Bureau of Environmental Protection is responsible for environmental protection work. Cooperation and linkages across departments are a requirement of the county government, so leaders of the above entities claimed that they would communicate and cooperate with one another.

However, in further interviews, we found that cooperation was almost an empty promise, and that the best they could do was to “perform their own functions”.

The Bureau of Animal Husbandry of T County is the department that takes the lead in developing the pig breeding industry. Under this bureau are the office, the breeding and improvement station, the grassland station, the animal inspection station, and the epidemic prevention station. This bureau has also set up a veterinary station for each town to carry out animal vaccinations, health care and epidemic disease treatment. Yet unless otherwise required (for example, for animal vaccinations once a year), pig farmers will not usually go to the veterinary station to seek help. According to their years of experience, these breeders generally have some veterinary drugs on hand and can treat common pig diseases. Pig farmer L said, “The personnel of the veterinary station do not know more than we do. I usually do not go there because it is a trouble to reach this place by motorcycle.” National and provincial subsidy programs for pig farmers are implemented by the Bureau of Animal Husbandry, for example, the subsidy program for reproductive sows, and the “reward and subsidy program for major pig production counties”. These programs generally reach breeding households through the township government.

The Bureau of Environmental Protection is in charge of managing pollution from animal husbandry, and it primarily monitors and regulates environmental pollution resulting from large-scale breeding. This is defined as households with 500 head or more on hand. But the deputy director of this bureau repeatedly indicated that this standard was dynamic and changeable since the number of pigs on hand always changed. In his view, any pig farm with 300 to 400 head is likely to be under the management of this department. Specifically, the Bureau of Environmental Protection checks whether manure composting tanks and urine tanks constructed by large-scale farms meet environmental protection requirements. A business license is required for large-scale farms and if the construction of such two types of tanks does not meet the standards, the EPB will have the power to veto the issuance of the business license. Furthermore, it will regularly inspect the environmental protection condition of large-scale farms. Because they do not need a business license, scattered pig breeding households are not confronted with environmental protection requirements from the government. The head of the Bureau of Environmental Protection said, “We mainly manage sewage treatment for large-scale farms and make no requirements for scattered household breeding.” Since scattered household breeding is the main model in T County, fewer than 10 large-scale farms should be covered by environmental protection requirements, or only about 10% of all farms. Therefore, in the scattered household breeding model, the government has a very limited role in regulating and controlling environmental pollution.

The Bureau of Agriculture mainly participates in the biogas digester program for pig farms. The biogas program was demonstrated and tried out as early as 2006, and began to be officially implemented in 2007. In 2007, biogas construction was particularly valued in Shanxi, and ranked as a “project of the provincial

governor”. For this, Agriculture Department and Finance Department of Shanxi Province jointly issued the “Circular on Printing and Distributing ‘Administrative Measures for Rural Biogas Construction Projects and Funds in Shanxi Province’ (trial implementation)”. According to the guidelines of this circular, the Datong Municipal People’s Government released a government document, “Implementation Opinions of Datong Municipal People’s Government about Accelerating Rural Biogas Construction”. This document pointed out that CPC Shanxi Provincial Committee and Shanxi Provincial People’s Government had placed accelerating rural biogas construction among the 12 practical projects which they promised to people of the whole province in 2007. According to this document, the state and the province would subsidize 1000 yuan per household for biogas digester construction, Datong city would provide not less than 250 yuan of supporting funds per household, counties and districts would actively raise funds to offer cooperation, and the remaining fund gap would be filled by agricultural households’ own funds. In the project implementation, national, provincial and municipal supporting funds were used to collectively purchase pipes, purifiers, gas stoves and other equipment, and biogas digesters were constructed by villagers. In this process, government at the provincial level provided more than 90% of the total investment, while villagers provided free labor and covered the costs of construction. However, in 2009, this project ended in failure after being implemented for three years. The main reasons for its failure are that first, the temperature in northern Shanxi is low and excrement does not ferment for about 120 days during early spring, late autumn and the whole winter every year, so no biogas is generated. Second, locals are used to using the kang, a heated brick bed that is connected to the stove. The kang is convenient because it utilizes the heat generated by cooking but this means that agricultural households do not actually have much demand for biogas. Lastly, because T is a national poverty county, electricity prices for agricultural use are much lower than the market price and using electricity to heat up water and cook is clean, convenient and easy. As a result, hundreds of biogas digesters paid for mostly by the state have been discarded, except for a few in some households in Fanjiazhuang Village, Sanshili Town. Those biogas digesters are located in the green houses, where vegetables are grown above pigs are reared below. In that way biogas can be recycled. According to the head of Bureau of Agriculture, large-scale development and liquefied gas sales are the only possible hope for the biogas program in this county.

The departments above have seldom cooperated on programs related to pig farming, and in fact their main leaders are mostly engaged in public administration and decision making and have little knowledge or experience of the pig farming sector. For example, the director of the Bureau of Animal Husbandry just took office last year. For more than 10 years after he served as deputy secretary of the Commission for Discipline Inspection of T County and he is a party and government leading cadre with little experience or knowledge of animal husbandry. This lack of relevant experience obviously weakens the department’s

capacity to make decisions about a specialized sector.

4.2. Policy Implementation

To increase the domestic pig supply, since 1992 the Chinese government has introduced a series of policies to support the sector. In July 2007, for example, the State Council distributed the “Opinions of the State Council on Promoting the Production and Development of Live Pigs and Stabilizing the Market Supply” and the “Circular of the General Office of the State Council on Further Supporting the Production and Development of Live Pigs and Stabilizing the Market Supply”. It required that all regions should establish a subsidy system for reproductive sows, promote insurance for these sows, and support standardized large-scale pig breeding. The state would subsidize breeding households (farms) of reproductive sows at the standard rate of 50 yuan per head, and set up a breeding sow insurance system, with 80% of the premium borne by the government and 20% by breeding households (farms). In August 2012, the General Office of the Ministry of Agriculture (MOA) and the General Office of the Ministry of Finance (MOF) jointly unveiled the “Guiding Opinions on Implementing Reproductive Sow Subsidies in 2012”. According to this document, all sows in national reproductive sow farms (including large-scale farms, breeding households, boar farms and scattered breeding households) would be subsidized at the rate of 100 yuan. The subsidy would be paid by the state (in eastern regions the costs are borne by local government, and in central and western regions 60% of the subsidy is paid by the central government and the other 40% by local government).

Implementing these subsidies is mainly the responsibility of the Bureau of Animal Husbandry of T County. In 2013, due to a dramatic fall in pig prices, farmers slaughtered a massive number of sows. To encourage breeders to start up again, in addition to subsidies and insurance, the Shanxi Provincial People’s Government selected over 30 “major pig production counties for rewards and subsidies” across this province, among which T County was included. Support mainly included: 1) government subsidies to agricultural households to purchase breeding sows. As a result, a year after this project started, the number of pigs for sale in the province rapidly rose. Then, purchase of reproductive sows was not be subsidized by the government any longer. 2) Government subsidies for the construction of large-scale farms. Seven to eight farms in T applied for this project, and six out of them were eventually funded by the government. Each of these six farmers owned 300 to more than 1000 pigs. Breeding household Y in Huangjiazhuang Village was the only license holder to get 0.85 million yuan in financial support. The other five farms got only an average of round 0.12 million yuan each.

4.3. Villagers’ Opinions about Policies

Opinions and assessments of policies are always made by two types of people: those who benefit from the policies and those who don’t, and the two groups of-

ten hold opposing views. The views pig breeding households have of government policy are largely determined by their own experience of how those policies were implemented, but their general level of trust in the government and experience of other policies are also factors.

H is the Party Secretary of Huangjiazhuang Village and the largest pig breeding household in the north of T County. His farm has more than 1000 pigs, including over 150 sows. As the only holder of a business license for livestock breeding in the county, H obtained 0.85 million yuan in financial support under the “reward and subsidy program for major pig production counties” which began to be implemented in 2013. As noted above, other farms received much less. In H’s view, national and provincial support for pig breeding was very important, and he used the funds mainly to build safer hog houses and expand the breeding scale.

In contrast, farmer J, who obtained only 0.10 million yuan of financial support, believed that these limited funds did not substantially help him expand the scale of his operation. Another farmer, L, who was raising around 500 pigs, was eligible for the program but did not obtain any support. According to L, his failure to get funded was due to his lack of “connections” or “social connections”:

“We haven’t got access to any preferential policy from the Bureau of Animal Husbandry although we are a regular individual enterprise registered with the administration for industry and commerce. The government has launched subsidies for pigs and farm construction. But we have never enjoyed such subsidies because we don’t find potential backers. These subsidies are primarily given to well-connected individuals or enterprises, and secondarily to old acquaintances to get a commission. Breeding households like us with no source of assistance are not contacted by the Bureau of Animal Husbandry about this matter. T county is poor and has few mineral resources, so officials are eager to get a share of these benefits. They can manage to grab some money no matter how strictly the process is supervised.”

More medium- and small-scale breeding households held the view that although the market economy provides them with more choices and opportunities, government stipend for pig-breeding is never allocated equally. Villagers heard of government subsidies for pig breeding, but never received such subsidies. For example, Zhao said:

“Subsidies for (reproductive) sows are provided by the government but are unattainable for us. A few years ago, someone came to (our home) to take statistics, but those statistics did not help us get access to those subsidies. Similarly, several other pig breeding households with sows were investigated but received no money. Who goes to report (this matter to the government at a higher level)? No one does so.”

As mentioned above, in the course of our research we collected complaints from agricultural households, who voiced their doubts about the fairness of policies and the legitimacy of policy implementation. However we were not in a position to investigate and confirm whether these reports that subsidies for repro-

ductive sows were not implemented at the household level and what the actual situation is. If the information reported by pig breeding households is true, then, how many eligible pig breeding households have yet to receive subsidies and how exactly is this policy implemented from the county to the town to the village level by level? Given that our qualitative study could not unpack the whole complex issue of local policy implementation and rural governance, it was hard to get accurate, objective answers to these questions.

4.4. Environmental Pollution, Risk Perception and Management

From the above analysis, we can see that the responsibilities of county-level government departments are limited mostly to subsidizing pig breeding households and supervising pig breeding pollution. But another interesting finding of our research was that unlike in the cases of Fujian and Yunnan reported in this special issue, pig breeding in T County is not causing serious environmental pollution. The fundamental reasons for this are that the natural and geographical conditions, and the breeding density in T County minimize environmental pollution from pig breeding. Pig breeding is distributed across the plains, where the climate is dry and rainless most of the year. In this situation, pig excrement and urine are not washed by rainwater from low to high ground as their often are in mountainous parts of southwestern China. The cold, dry climate, with annual average temperatures of only 6.2°C, means that pig excrement and urine also cannot quickly ferment; And the strong northwest wind promotes the diffusion of pollutants in the atmosphere, so unlike the hot, often humid climate of southern China, there is little odor. More importantly, pig breeding is not the main livelihood of locals. Even in those villages on the plains (with populations of 1000 to 2000), in which pig breeding is a tradition, there are usually only five to ten pig breeding households in a village, each with fewer than 100 head. In accordance with the data presented by Chen and Gong in this special issue, few villages in Shanxi have large-scale pig farms with over 500 head; and in T County only two villages or three across the whole county had two pig farms with over 500 head (Information and data were taken from the interview with director of Bureau of Animal Husbandry of T county, which was conducted in July 2016).

Of course, just because pig breeding does not result in serious environmental pollution, does not mean that it has no impact on environment and health. Our research found that pig breeding households and local villagers can, to varying degrees, perceive environmental and health risks from pig breeding. In the existing literature, quantitative studies on the risk perception of pig breeding households have showed that the environmental risk perception of pig breeding households is related not only to their age and educational background, but also to the state of their business, cooperation with surrounding agricultural households, and the supporting policies for the pig breeding industry. Also that the environmental risk perception of large-scale pig breeding households has a significantly positive influence on environmental behavior (Li et al., 2021). Yet the existing studies do not take the specific conditions of different regions into ac-

count. The following section discusses risk perception from the perspectives of feed/antibiotics and environmental risks, and again shows that it is important to take the regional characteristics affecting the pig breeding sector into consideration.

1) Perception of risks from feed additives and antibiotics

Fang's Jing's qualitative study in L County in Yunnan found that farmers had a strong awareness of health risks associated with pig feed and that they fed pigs for sale and pigs they planned to eat themselves differently. Even if they were not raising pigs for sale, most farmers still rear one or two pigs in a traditional mode to prepare for their own consumption during the Spring Festival or to send to their children working in the city.

Our Shanxi-based study had very different findings. Almost all the breeding households we interviewed believed that feed additives and veterinary drugs are safe. Their trust is mainly due to their faith in "science", and "authority" and governmental regulation. For example, pig farmer L said:

"Properly prepared in the veterinary medicine factory, medicine in feed is a kind of traditional Chinese medicine (TCM), which doesn't harm the livers or lungs, and [helps the animals] resist viruses and pathogenic bacteria. Pigs will not be fed these medicines a month before being sold in the market and during this time these things (the drugs) are removed through excrement and urine, otherwise, they will damage human bodies. The pig buyer will inspect for this, and reject any unqualified pigs. Feed contains a few antibiotics, too. Pigs are not fed antibiotics some days before being sold. But antibiotics are harmless for health since the feed we use meets the national standard."

According to these pig breeding households, with strict regulation by the government, risks from pork intake become smaller and smaller. Now, it is prohibited to add clenbuterol hydrochloride (used to promote lean muscle growth) to feed because its ingredients harm human health. The disuse of this drug led directly to an extension of the period pigs are on hand, but some pig breeding households believed that this proves that pork is safer. For example, L said:

"It's safe to eat pork. But it's unsafe to eat food available for sale in small shops and pesticide residue in vegetables. Vegetables are certainly sprayed with pesticide. Feed is strictly controlled by the state and must be not sold unless it is produced by regular factories. The reason why the state prohibited feed is that as fattening agent, clenbuterol hydrochloride contained in feed is harmful to health. It took five months to raise pigs for sale in the past, while this period must extend to seven months now."

Pig breeding households' trust in the safety of feed additives and antibiotics is reflected in their actions. They raise pigs for sale and those for their own consumption in the same way, and all the breeding households we spoke to said that they felt safe eating the pigs they raise themselves. Z said,

"We eat our own pigs, which are fed in the same way as those pigs for sale. We don't feed medicine to pigs more than 20 days before they are sold. They (the

pigs) should be safe. The pigs we raise to eat ourselves are also slaughtered at the slaughter house. When the Spring Festival or any other festivals come, we will carry a pig to the slaughter house to be slaughtered for our own consumption.”

2) Perception of environmental pollution

In the villages of T County, pigs are just one kind of livestock that is raised. Residents also raise chickens, cattle, sheep and goats in their yards and these and other animals share their yards with them. This long-established way of life is acceptable to locals.

In the countryside, people can now conveniently buy what they need from shops or markets. But the idea of self-sufficiency is still deeply rooted, particularly for poor households and they try not to buy what they can produce at home. For example, people grow some vegetables in their yards in summer, and keep some chickens to provide eggs for themselves. Raising sheep is mainly based on economic considerations, while rearing cattle is not only economically feasible, but also helpful to farm work. Livestock raising is closely linked to the economic circumstances of rural households, regardless of whether the purpose is to save household expenses or increase income. It is seen a matter of course and so even some smells or the presence of excrement from livestock does not prevent people from raising animals.

Although not everyone raises pigs, and so some households must experience pollution from others, they mostly do not complain. This is because the countryside is a “society of acquaintances” (shurenshehui) (see Zhang, 2022; Li, 2016; He, 2011), where everyone has lived in the same village generation after generation. So, even if some families are disturbed by others’ breeding, they can only express their dissatisfaction secretly, and will not complain to the breeder face to face. For example, one villager raised pigs in his yard and in the summer, some maggots appeared in his septic-tank, crossed the wall, and reached his neighbor’s home. But all the neighbor did was to complain privately, without telling this to the breeder face to face. More generally, as we discuss in the next section, in T County, livestock excrement is not a pollutant but a “useful” substance.

Besides environmental and health risks, pig price fluctuations and pig deaths are ranked as the greatest risks by pig farming households. In the opinion of some pig farmers, pig prices follow a three-year cycle. Yet most pig breeding households argued that pig prices are unpredictable and uncontrollable; and that all they could do is to raise pigs well and refuse to leave the industry when prices are low. As for pig deaths, in addition to regular use of drugs, some medium- and small-scale pig breeding households choose to take in piglets with a weight of 35 to 40 kg, and sell them at a good price several months later. This can reduce the mortality rate of big pigs considerably, and larger piglets are easier to raise. Raising small piglets can be more lucrative and requires less investment, but the risks are higher.

“We must work extremely hard in order to make more profit by raising up very small piglets rather than directly purchasing the bigger ones. The bigger piglets have already been immunized before they are sold, therefore they are

much less vulnerable than the little ones. But we only buy little ones. They are much cheaper so we can make more money in the end.”

When pigs die they are usually buried in a deep grave. The pig breeding households held that no one is willing to eat pigs that died from disease as they were before, and that farmers do not sell dead pigs, either. They can decide themselves whether to insure pigs, for example, the premium for a sow is 60 yuan, and the state subsidizes this at the rate of 48 yuan, so the farmer only needs to pay 12 yuan. If the insured pig dies accidentally, the breeding household can get 1000 yuan in compensation. Therefore, most pig breeding households insure their sows, and some of their pork pigs. Insurance subsidies provided by the state effectively reduce the risks of pig breeding.

4.5. Common Development of Pig Breeding and Planting Industry

About 90% of T County’s pig farming households are defined as “medium- and small-scale pig breeding households” by the environmental protection department, and are not subject to the constraint and supervision of environmental protection policies. In some circumstances, this could cause problems, but in this county, there is a weak correlation between pig breeding and environmental pollution.

One important reason for this is that in the locally developed agricultural crop sector, pig excrement and urine are never deemed “waste”, but act as a useful bio-fertilizer resource. An agricultural product trading market has been constructed to purchase vegetables grown in local greenhouses and the greenhouses have a high demand for manure to increase fertility. Besides greenhouses, individual farmers can buy manure and spread it on their fields. Manure and chemical fertilizer are priced at the basically same level, but manure is better than chemical fertilizer at raising yields.

Because of this demand, even if the environmental protection department makes no requirements, most medium- and small-scale pig breeding households will construct a special excrement pit and the urine storage tank in their hog houses. Because the hog houses are scientifically built and easily cleaned, we did not experience any particularly unbearable smell even when we conducted interviews in these yards in the summer. The urine storage tanks are often constructed with pipes controlled by valves so that stored urine can directly flow into the irrigation canal. In the season of spring ploughing, pig excrement is snapped up by nearby villagers to be used for agricultural production. Pig urine is not wasted, either. After being mixed with irrigation water according to the proportion of 1 to 10, pig urine can irrigate the surrounding farmland. Such urine is used free of charge, so it is often given as a gift to show “human feeling” (renqing). Pig farmer H said:

“Whoever wants to irrigate his fields, can come to our doorway and ask me to give him some pig urine. Then, I will open the faucet of the urine storage tank. Crops in the fields irrigated by pig urine grow well, without any need for chemical fertilizer. People like this substance. I also feel I do them a favor. So, they are

very happy.”

Soil pollution and crop safety problems caused by excessive heavy metals in biofertilizer have become a growing focus of attention by the media, scholars and NGOs in recent years. In T county, we did not find any scientific data to prove that the heavy metal content in local pig excrement violates the standard. According to an estimate by the Department of Agriculture, however, the total quantity of local biofertilizer (mainly including human and livestock excrement) is still small. So long as excrement is not concentrated on a small area of land, it should not be a problem, and excessive application generally does not occur because local biofertilizer is quite highly priced. Hence, the department of agriculture did not believe that biofertilizer application would usually result in soil pollution.

5. Conclusion

As this case study of pig breeding by scattered households in northern Shanxi showed, pig breeding is not an irreplaceable “way of life” or the sole livelihood mode in this region, but pig breeding by scattered households presents a trend of steady, positive development due to such factors as the long tradition of combining crop growing with animal husbandry, the low breeding density, stable market demand, and a lack of squeezing from large-scale modern pig farms. This study therefore suggests that we should question the common assumptions that small-scale pig farming is responsible for price fluctuations and environmental pollution. At the same time, these are not traditional operations in which families raise only a few pigs. They are a kind of medium scale operation, with quite modern facilities.

County-level government departments support pig breeding households mainly by implementing policies from above. But the specific implementation of policies (particularly those relating to subsidies) is neither encouraging nor transparent. And households assess these policies differently depending on whether they have benefitted or not. The objective situation regarding policy implementation remains to be further studied and discussed. While government departments involved in pig breeding claim that “cooperation” is needed to comprehensively solve the problem of environmental pollution and development brought about by pig breeding, such cooperation has not become a reality because of mutual constraints and the independent operation of these departments.

However, despite this lack of environmental supervision and regulation, medium- and small-scale pig breeding by scattered households in this county is not causing serious environmental pressure. This is fundamentally because of the area’s large environmental capacity, “a vast land with sparse pigs”, as well as other natural conditions such as climate and geographical conditions. These factors mean that pig excrement and urine do not cause soil or water pollution, and air pollution is easily diffused. In combination with the tradition of integrating agricultural crop production with animal husbandry, this favorable en-

vironment is conducive to the formation of a positively circular development model.

In sum, environmental health risks associated with medium- and small-scale pig breeding vary in different contexts, which are shaped by geographical, cultural and economic factors. It is therefore hard to calculate risks merely through economic estimates. This case study has suggested that medium- and small-scale pig breeding may not always cause price fluctuations in pigs' market, irrational decisions over pig breeding, or environmental health risks. In some areas of China, if supply and demand are well balanced, the whole industrial structure is well-designed, and land resources are not over-exploited, medium- and small-scale pig breeding can contribute to local economic development with the support from local policy supervision.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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