China's Velvet Antler Value Chain Analysis: A Case Study in Jilin Province, China

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2023

Abstract

In China, the velvet antler industry not only provides a large number of employment opportunities but also becomes the pillar industry of the breeding area. Deer are precious and economically valuable livestock in China, and the velvet antler produced by male deer each year is considered an extremely high-quality medicinal material by traditional Chinese medicine and the major source of income for Chinese deer farmers. However, the velvet antler industry also experienced some challenges such as insufficient production capacity, unstable quality, and small breeding scale. For example, domestic deer were classified as wildlife in past policies and were managed by multiple departments. Therefore, the breeding of deer and the processing and sales of deer products like velvet antlers were under many restrictions due to policies. This has harmed the development of the entire industry. In a state where the overall development prospects of the industry were not optimistic, the attraction of investment, and the formulation of standards and policy had also been adversely affected.

However, the sudden outbreak of COVID-19 at the end of 2019 brought changes to China's velvet antler industry. Since domestic deer were classified as wildlife, the comprehensive ban on wildlife products introduced in the early stages of the epidemic was equally effective for the deer industry. Due to uncertainty about whether domestic deer farming would still be legal in the future, the entire industry was in a state of panic at that time, and the development of the whole industry suffered arrested development. To protect the domestic velvet antler industry and the rights of the practitioners, the new policy was introduced in the middle of 2020. By classifying the domestic deer as livestock, the velvet antler industry no longer needs to face the policy resection like before. This no doubt had brought opportunity to this industry. However, problems such as increasing breeding costs and transaction costs caused by the epidemic have inevitably harmed this industry.

Other than the challenges brought by the epidemic, the future of this industry also faces challenges from other aspects. Under the premise of long-term constraints in the past, what is the current status of China’s velvet antler value chain and how will it face the policy changes? What opportunities and challenges does it face? How should it seize the opportunities and respond to the challenges? These are the main objectives of this study.

A qualitative method was adopted in this study. Secondary data was collected through relevant journals, government publications, and other means. The primary data was collected via semi-structured face-to-face interviews with 19 different respondents from velvet antler value chain actors from the study area, Jilin province. Through these data, this study identified the current situation of the local velvet antler value chain and the opportunities and challenges it faces.

Based on information such as product quality, final price, target consumer groups, and economic strength of practitioners, four types of velvet antler value chains were found in the

research: low-income value chain, middle-income value chain, high-income value chain, and e-commerce value chain. For example, low-income value chains mostly exist in areas closer to the production area, the products in these value chains are mostly unprocessed primary agricultural products with low prices. Medium-income value chains are more common and offer a wider range of products, but due to the limited scale of most actors in the value chain, the prices they receive are not ideal. The high-income value chain is more profitable for value chain actors, but due to the high requirements for entering this value chain, most of the actors are unable to meet the standards.

In the research, many challenges faced by the industry were found. Financial challenges caused by insufficient funds, limited production capacity, and rising costs; Technical challenges caused by lack of professional knowledge and variety degradation; Market challenges brought by international competitors and domestic peers; And policy challenges caused by the previous policies. But there are also opportunities, such as the expansion of the market size of velvet antler products; the introduction of positive policies for the deer industry; The widespread application of advanced technology in the agricultural field; And the improvement of product standards and traceability systems.

Based on opportunities and challenges, if policymakers can introduce targeted assistance policies, such as increasing investment in the deer industry and improving loan mechanisms or formulating comprehensive standards, then, China's velvet antler industry will be able to seize the opportunity brought by the macroeconomic policy change, improve the shortcomings of the industry, achieve industry specialization, increase the profits, and further expand the market scale of China's velvet antler industry.

Acknowledgments

Being able to come this far, I have to express my greatest gratitude and appreciation to all those people who had been directly or indirectly involved in making this thesis journey possible.

First of all, I am deeply grateful to my primary supervisor and co-supervisor, Dr. Elena Garnevska and Prof. Nicola Shadbolt, for their guidance and feedback throughout the whole research process. Without your continuous support and encouragement, I wouldn't be able to finish this study.

Secondly, my sincere gratitude goes to the people of New Zealand and New Zealand's Ministry of Foreign Affairs and Trade for providing me the opportunity to study in this beautiful country. At the same time, my sincere gratitude also goes to Sharon Wright and all the other officers of the International Student Office for being always supportive and understanding throughout my stay in New Zealand.

Third, I would also like to acknowledge all the participants who spent their valuable time taking part in my interviews and answering my phone calls when I needed some further information. Without their help, this thesis wouldn't be possible.

Finally, I am deeply grateful to my family for their infinite love and support from home this whole time.

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Chapter 1 Introduction

1.1 Background

From a global perspective, the deer industry is relatively young. In the mid-19th century, New Zealand introduced deer species from other nations. The deer industry in Russia began in the 1840s, while the deer industry in Canada only experienced significant development after the 1990s. The common characteristic of the deer industry in these countries is that they focused on venison production and leather production in the early stages, and didn't pay much attention to velvet antler production until the emergence of the world velvet antler market (Zhang, 2008). China had a long history of raising deer, according to Lin (1986), as early as 457 BC, during the Zhou Dynasty, China had already begun to raise deer. But the modern deer industry in China was not found until the 1950s (Xu,2006). Unlike foreign countries, influenced by traditional Chinese medicine theory, the deer industry in China has been focusing on the production of velvet antlers, venison is a relatively unimportant product or side product for the deer industry of China (Shen, 2012).

In the early days, China's velvet antler products were mainly sold to South Korea and other international markets. However, due to the impact of the Asian financial crisis (1997), the purchasing desire of the international velvet antler market declined rapidly, which influenced China's velvet antler industry (Yu, 2005). At the same time, the deer industries in New Zealand, Russia, and other countries have successfully changed their business model from only focusing on producing venison to producing antler and venison at the same time and have gotten rid of the problems of insufficient production capacity and unstable quality problems that they have at the early stage (Li, 2010). The increasing competitive pressure from international peers and the shrinking down of the market share had a serious negative impact on China's velvet antler industry. The decrease in market demand for velvet antlers has led to a decrease in deer farmers' income and deer farmers found they are unable to balance income and expenditure, many farmers have to choose to slaughter their deer to reduce losses. The velvet antler industry of China had entered a low time at this stage. Except for external challenges, China's velvet antler industry also had many problems at that time, such as lack of production standards, unstable product quality, etc. Therefore, to improve the shortcomings, China's velvet antler industry has made many adjustments to solve these problems. By setting clear production standards, providing policy guides, and providing targeted assistance, China's velvet antler industry has gradually begun to recover from the crisis (Ding, 2012).

Nowadays, according to Fu (2020), the price of deer and velvet antler products in China remains stable and has a trend of steady growth for the last decade. Taking Jilin province, the largest velvet antler production province as an example, the population of domestic deer in Jilin reached 600 thousand by the end of 2020, accounting for 50% of the domestic deer population of China. However, for China's velvet antler industry, challenges still exist. Despite years of development, the total output of Chinese velvet antlers still cannot meet the

needs of the local market, and a large number of market share gaps need to be filled by the imported velvet antlers (Xing, 2021). Most agricultural producers are still small-scale farms operated by households, with issues such as insufficient funds, outdated equipment and unstable product quality (Liu, 2020). A large number of farms raise hybrid deer in pursuit of higher yield, resulting in a continuous decrease in the number of high-quality breeding deer. The long-distance between velvet antler provenance (Northern China) and the place of sale (Southern China) also brought challenges to the practitioners, they always need to pay more costs for product transportation and consumers also have to pay more fees (Wei, 2015).

In addition to challenges, opportunities also exist. The adjustment and improvement of deer breeding policies between 2020 and 2021 have brought about new changes to the industry. Domestic deer are no longer classified and managed as wildlife (Li, 2020). Due to the impact of COVID-19, people's concerns about health issues have increased, leading to an increase in the market demand for health products such as velvet antlers, which helps resist fatigue and improve immunity (Xing, 2021). The increase in per capita income and the decrease in Engel's coefficient have also led to a continuous expansion of the healthcare market. For the entire China’s velvet antler industry, the future of the industry is full of opportunities and challenges.

From the perspective of the value chain, the composition of participants of the velvet antler value chain is relatively complex. From deer farmers to retailers, their roles in the value chain are different, and the coordination relationships between participants in different sales channels are also different. As macro factors such as policies and markets change, the factors such as opportunities and challenges faced by practitioners and practitioners’ coordination relationships will also change. And these are also the directions that this study aims to study.

1.2 Problem Statement

Compared to other animal husbandry industries that focus on providing daily necessities like food and fiber, the deer industry which mainly aims to produce velvet antlers is not a mainstream breeding industry in China, therefore, there is relatively less research in this field and the data is not complete. However, for traditional advantageous deer raising areas such as Jilin, the deer industry has become a pillar industry, playing an important role in the income of local deer farmers and government finances (Zheng, 2016). Therefore, research on the velvet antler industry will be meaningful and helpful. However, the development of the industry had been restricted for a long time. Most deer farmers are small-scale farmers with poor production capacity, a lack of understanding of market changes and the ability to withstand risks (Zhang, 2021). The policy of classifying and managing domestic deer as wildlife limited the development of the entire industry, making it difficult for both producers and processors to expand their business effectively. Similarly, due to the classification of deer as wildlife, there have been no statistics about deer in the China Animal Husbandry Yearbook and relevant documents. The relevant associations and departments lack of sufficient human and material resources to conduct statistics on the information about domestic velvet antler industry nationwide. This results in a lack of data and information about the industry, making

it difficult for people to have a clear understanding of the overall status of this unique value chain (Xing, 2021). As the policies and markets continue to change, what is the current situation of China's velvet antler value chain, what are the opportunities and challenges it faces and how should this industry develop in the future, these are the questions that this study aims to identify.

1.3 Research Questions

What is the current situation of China's velvet antler industry? What opportunities and challenges does this industry face? How will the industry develop in the future?

1.4 Research Objectives

The primary objective of this research is to map the value chain of China’s velvet antler industry, identify the role of each value chain participators, analyze the opportunities and challenges that this value chain faces and provide recommendations for future development. To address the research goal, the objectives of this study are set:

1. Mapping the velvet antler value chain.
2. Developing a framework for analyzing the velvet antler value chain in the study area.
3. Analyzing the opportunities and challenges of China’s velvet antler value chain.
4. Providing recommendations for China’s velvet antler value chain.

1.5 Outline of the Thesis

This thesis is organized into 7 chapters Chapter 1 is an introduction, which introduces the background, problems research questions and objections of the study. Chapter 2 provides the background information about the study country of this thesis, China. The information concludes the geographical location, economic status, agriculture and the situation of the velvet antler industry. Also, this chapter will further introduce the background information of the study area, Jilin province, the largest velvet antler origin in China. Chapter 3 provides a literature review related to the content of this study such as the value chain theory and the application of the value chain theory in the agriculture fields and proposes a framework for this study based on the literature review. Chapter 4 provided the systematic method of analysis adopted by this study to achieve the research objectives. This chapter describes the research philosophy and approach, the research method. Introduce the study area and explain the reason why choosing this area. Describe the sampling approach for selecting the respondents for the interview. And describe the data analysis technique that has been used for analyzing the primary data collected from the respondents. Chapter 5 represents the results of the data collection. This chapter introduced the material flow of the velvet antler products, the role of different value chain actors, and the opportunities and challenges that the whole value chain faces based on the outcome of the analysis of the secondary and primary data analysis. Chapter 6 discussed the findings of the study and found the relation to the previous study.

Chapter 7 summarizes and concludes this thesis and provides suggestions for the future development of the velvet antler value chain.

Chapter 2 Background

This chapter provides the relevant background of this study. This chapter is divided into 4 sections. Section 1 introduces the general background of China. Section 2 introduces China's agriculture and relevant agriculture policies. Section 3 introduces the background information about China's velvet antler industry. The last section introduces the background information and velvet antler industry status of the study area, Jilin province.

2.1 China's General Background

This section outlines the basic background information of China, such as geography and, climate, population, GDP, per capita disposable income, etc.

2.1.1 Geographic Location and Climate

Located in Southeast Asia along the coastline of the Pacific Ocean, China is the world's third-largest country, after Russia and Canada. With an area of 9.6 million square kilometers and a coastline of 18,000 kilometers, its shape on the map is like a rooster. It reaches Mohe in Heilongjiang Province at its northern end, Zengmu Ansha to the south, Pamirs to the west, and expands to the eastern border at the conjunction of the Heilongjiang River and the Wusuli River, spanning about 50 degrees of latitude and 62 degrees of longitude. China is bordered by 14 countries at the same time and is adjacent to 8 countries by sea. China has 23 provinces, 5 autonomous regions, 4 municipalities directly under the central government, and two Special Administrative Regions (The State Council of the People's Republic of China. www.gov.cn, 2019).

With its vast territory, China's climate environment is very diverse. There is temperate monsoon climate, subtropical monsoon climate, tropical monsoon climate, temperate continental climate and plateau mountain climate. From south to north, it crosses the tropical, subtropical, warm temperate, middle temperate and cold temperate temperature zones. From the division of dry and wet areas, there are humid areas, semi-humid areas, semi-arid areas and arid areas (www.gov.cn/guoqing, 2022). The diverse natural environment also provides various animals with high-quality habitat choices, which is one reason why China is rich in different deer breeds.

Figure 2-1: Map of China (Baidu, 2022)

2.1.2 Population Composition and Urbanization

According to the data of the seventh national census conducted on November 1st, 2020, the total population of China is 1,443,497,378, of which the mainland population is 1,411.78 million, increase of nearly 72.06 million compared with 1,339.72 million in 2010, an increase of 5.38%; The annual average growth rate was 0.53%, 0.04% lower than the annual average growth rate of 0.57% from 2000 to 2010. The data show that China's population has maintained a low-speed growth trend in the past 10 years. The male population was 723,339,956, accounting for 51.24%; The female population was 688,438,768, accounting for 48.76%. The sex ratio of the total population was 105.07 (National Bureau of Statistics http://www.stats.gov.cn/, bulletin of the seventh national census [1] (No. 1), 2021).

According to the data, the population living in cities and towns is 901.99 million, accounting for 63.89%; The number of people living in rural areas was 509.79 million, accounting for 36.11%. Compared with 2010, the urban population increased by 236.42 million, the rural population decreased by 164.36 million, and the proportion of urban population increased by 14.21%.

2.1.3 GDP

China is the world's second-largest economy, the world's largest industrial country and the largest agricultural country. According to the statistics released by the National Bureau of Statistics, China's gross domestic product (GDP) in 2021 was 113,323.98 billion CNY (15,605.96 billion USD), and the GDP growth rate was 8.40%.

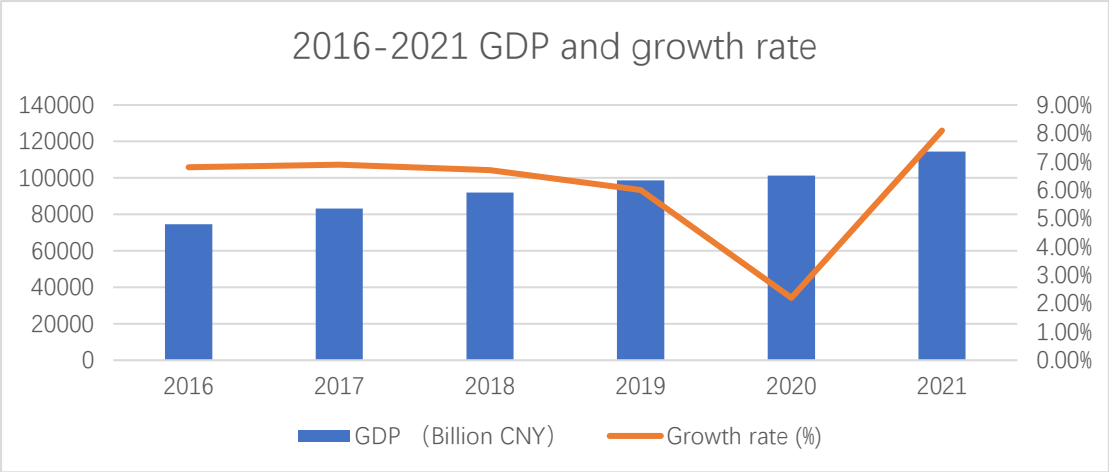

Figure 2-2: China’s national GDP and growth rate (National Bureau of Statistics, 2022)

In the three-sector model in economics, the economies will be divided into three sectors based on their activities: Extracting the raw materials (Primary Industry); Manufacturing (Secondary Industry); and Providing services (Tertiary Industry). In China, according to the division of the three industries proposed by the National Bureau of Statistics of China, the primary industry refers to the agriculture industry (including agriculture, forestry, animal husbandry, fisheries, etc.). The second industry includes mining, manufacturing, production and supply of electricity, gas, water and construction. The tertiary industry refers to industries other than the primary and secondary industries. Taking 2021 as an example, the output value of the primary industry is 83,085.5 billion CNY (11,441.79 billion USD), the secondary industry is 450,904.5 billion CNY (62,094.51 USD), and the tertiary industry is 609,679.7 billion CNY (83,959.6 billion USD). The primary industry accounts for 7.3% of the total GDP, the secondary industry accounts for 39.4% and the tertiary industry accounts for 53.3%.

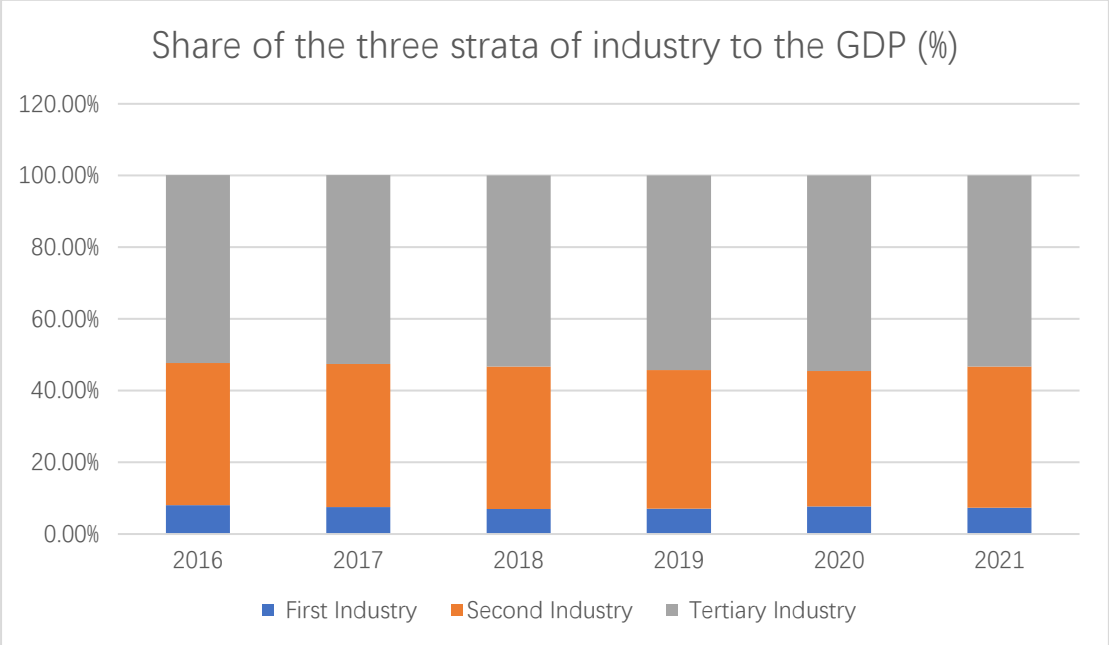

Figure 2-3: China's GDP contribution of three industries (National Bureau of Statistics, 2022)

2.1.4 Per Capita Disposable Income of China Residents

In 2021, the disposable income of Chinese residents was 35,128 CNY (4,837.51 USD), an increase of 9.1% over the previous year. After deducting the price factor, the actual increase was 8.1%. According to the permanent residence, the per capita disposable income of urban residents was 47,412 CNY, an increase of 8.2% over the previous year. After deducting the price factor, the actual increase was 7.1%. The per capita disposable income of rural residents was 18931 yuan, an increase of 10.5% over the previous year. After deducting the price factor, the actual increase was 9.7%.

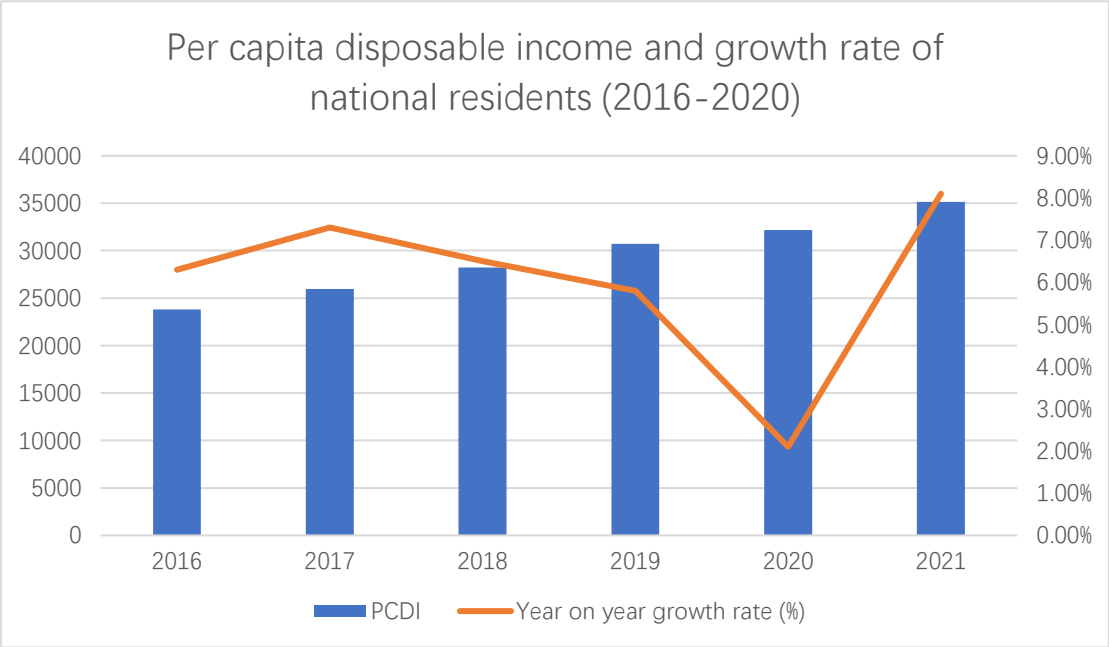

Figure 2-4: Per capita disposable income and growth rate of China's national residents

(National Bureau of Statistics, 2021)

2.2 China Agriculture and Agriculture Policies

This section provides a brief overview of the current situation of agriculture in China, introducing the total output value of the agricultural industry, the output proportion of the four major agricultural industries in China, the area of agricultural land in China, relevant laws and regulations, and important agricultural related policies newly released in recent years.

2.2.1 Agriculture Share in the Economy

The gross output value of agriculture refers to the total amount of all agricultural activities including agriculture, forestry, animal husbandry and fishery, it reflects the total scale and results of the agricultural production in a certain period. In 2021, the absolute value of China's annual total output value of agriculture, forestry, animal husbandry and fishery was 14,601.34 billion CNY (2.010.77 billion USD), an increase of 7.90% over the previous year, accounting for 7.30% of the total China’s GDP.

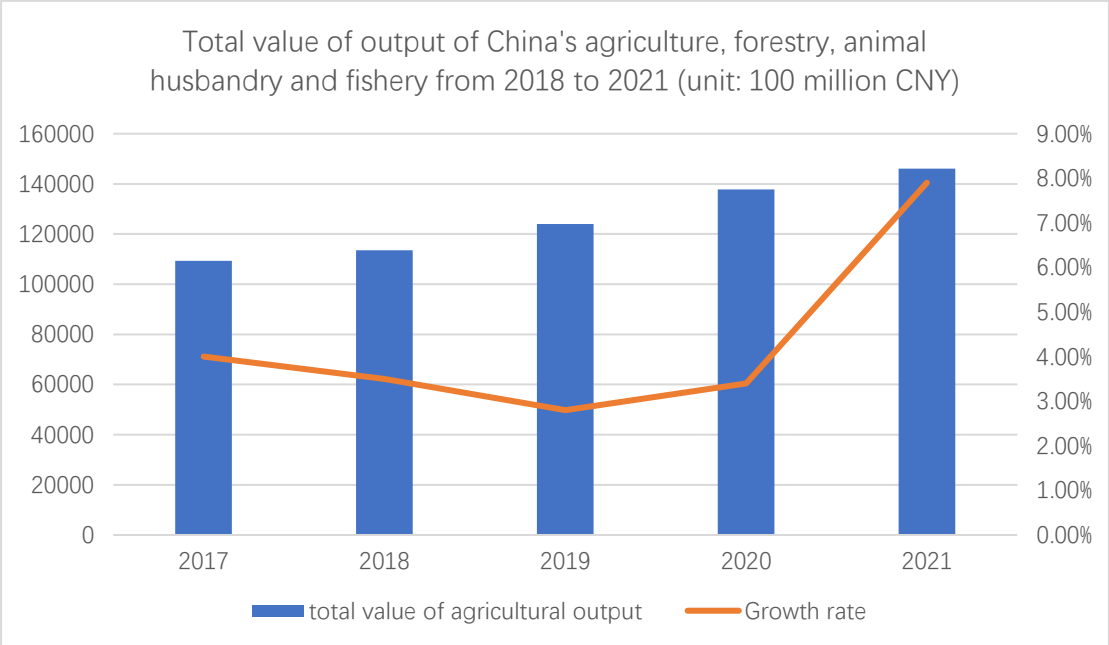

Figure 2-5: Total value of output of China's agriculture industries (National Bureau of Statistics, 2021)

In the total output value of China's agriculture, forestry, animal husbandry and fishery in 2021, the agricultural output value was 7,833.95 billion CNY (1,078.82 billion USD), accounting for 53.3% of the total output value; The forestry output value was 650.77 billion CNY (89.62 billion USD), accounting for 4.4% of the total output value; The output value of animal husbandry was 3,991.08 billion CNY (549.62 billion USD), accounting for 27.1%; The fishery output value was 1,450.73 billion CNY (199.78 billion USD), accounting for 9.9% of the total output value.

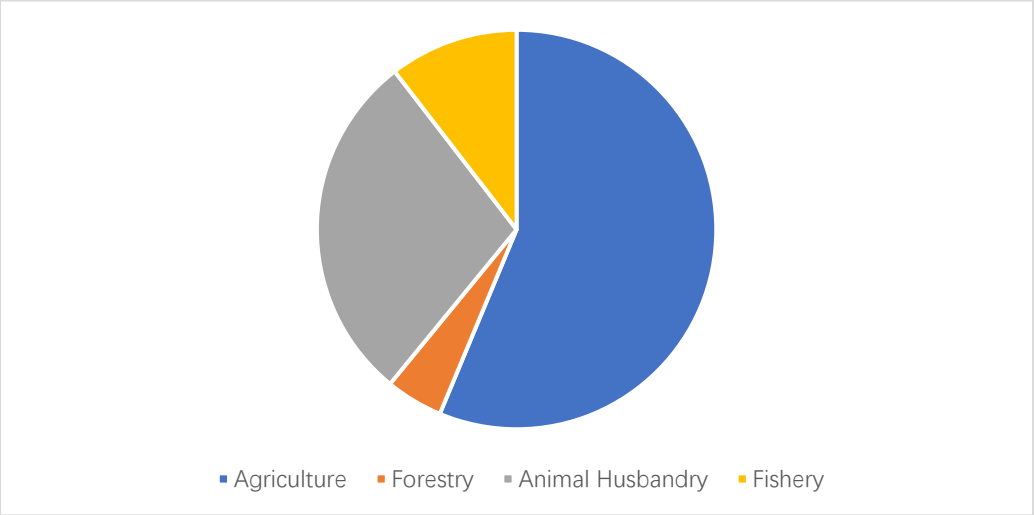

Figure 2-6: Output proportion of China's agriculture industries (agriculture, forestry, animal husbandry and fishery) in 2020 (National Bureau of Statistics, 2021)

According to the statistics data of China's National Bureau of Statistics, the number of large livestock in China by the end of 2021 was 104,868,000, including 98,172,000 cattle, 3,725,000 horses, 1,967,000 donkeys, 542,000 mules and 462,000 camels. The number of slaughtered fattened hogs was 671.28 million, and the number of hogs on hand by the end of the year was 449.22 million. The number of sheep by the end of the year was 319.69 million. Deer were under the management of multiple departments for a long time in the past and were regarded as wild animals, therefore, there is no clear statistical data about the deer industry.

2.2.2 Agricultural Land and Rights

Agricultural land mainly refers to land directly used for agricultural production, including cultivated land for planting, garden land for producing tea, fruits, or other products, forest land and grassland for grazing. According to the results of 'The Third National Land Survey' in 2019, China's cultivated land was 1,279,000 square kilometers, garden land was 202,000 square kilometers, forest land was 2,841,000 square kilometers, and grassland was 2,645,000 square kilometers. The rights of agricultural land are divided into land ownership, land contract rights and land management rights according to the law. Land ownership belongs to the country and rural collectives, land contract rights belong to farmers and land management rights belong to farmers. However, the management rights can be transferred to other individuals, enterprises, or institutions through contracts, land trusteeships and other management methods. However, it should be noted that the use of agricultural land is regulated by the state. According to the 'Rural Land Contract Law of the People's Republic of China', the use of agricultural land must still be used for agricultural purposes even after the transfer of management rights and the agricultural land cannot be changed to other use.

2.2.3 Agriculture Policies

China is a big agricultural country, agriculture is the foundation of national economic development and social stability (Yan, 2002), it can provide employment opportunities and essential goods for society. Therefore, the Chinese government has paid high attention to the agricultural field. 'The Five-Year Plan' is an important part of China's national economic plan, it mainly involves in making plans for major national construction projects, productivity allocation and setting long-term goals. In the 11th Five-Year Plan, China proposed to promote the construction of agricultural modernization and sustainable development in China. In the 13th Five-Year Plan, it is proposed that with technological advancements, the development direction of China's agriculture industry should also focus on achieving modernization and informatization, that is, to promote the model of 'Internet + agriculture' in rural areas. In the 14th Five-Year Plan, it further proposed to promote rural vitalization and achieve agricultural modernization.

The current agricultural policies at the national level in China mainly focus on encouraging agricultural development. Specifically, it includes pushing forward rural vitalization, accelerating the modernization of agriculture and rural areas, optimizing the agricultural industrial structure and encouraging investment in the agricultural industry. Other than providing sufficient guarantees for the development of the agriculture industry through policies, the government also provides economic support for agriculture. There are many specific agricultural policies with complex content, so this section only briefly describes a few agricultural policies that have been introduced in recent years and are of great significance for China's agricultural development. The "Digital Agriculture and Rural Development Plan" released in 2020 proposed promoting the application of digital technology in the agricultural field, improving agricultural management level and improving information communication. At the end of 2020, the Ministry of Agriculture and Rural Affairs of China also issued the "Guiding Opinions on Promoting the Deceleration and Efficiency Enhancement of Agricultural Product Processing", which specifically proposed strengthening the infrastructure construction in rural areas and promoting the development of advantageous and characteristic industries in rural areas. In 2021, the "14th Five-Year Plan for National Informatization" proposed by the Informatization Committee further proposed to promote the popularization and application of 4G and 5G technologies in rural areas, encourage agricultural producers and enterprises to carry out e-commerce business and further improve the logistics system and distribution network in rural areas. The "14th Five-Year Plan to Promote Agricultural and Rural Modernization" launched by the State Council of China in 2022, proposed to promote agricultural informatization reform and digital reform, attach importance to livestock breeding, protect high-quality local germplasm resources, improve the mechanization of agricultural production and promote the application of emerging technologies such as Internet of Things, blockchain and big data in the agricultural field. All these policies have pointed out the direction and provided assistance for the future development of Chinese agriculture from different perspectives.

2.3 Velvet Antler Industry in China

This section introduces some background of China's velvet antler industry, including development history, industry status, main deer breeds, market prices, import and export trade, etc.

2.3.1 History of the Velvet Antler Industry in China

China has a long history of raising deer, mainly because of its abundant natural deer resources. There are 15 known deer species in China, including Sika deer and Wapiti deer. Unlike the foreign deer industry that focuses on producing venison or deerskin, velvet antler is the main product of China's deer industry. According to the Chinese Pharmacopoeia, velvet antler generally refers to the newborn antler of the Sika deer and Wapiti deer (Chinese Pharmacopoeia, 2020). From the establishment of the first state-owned deer farm in Shuangyang County, Jilin Province in 1949 to the 'reform and opening up' (1978), deer have been listed as a special economic animal (Zheng, 2016). However, the development process of China's velvet antler industry was full of challenges. Ding (2012) divided the velvet antler industry of modern China into five stages, namely, the Development stage (1959-1979); High speed development stage (1980-1996); Low ebb stage (1997-2003); Adjustment stage (2004-2006); Stable stage (2007-2009).

Before the development stage, there were little deer farms in China. Therefore, at that time, most of the velvet antlers on the market were harvested by capturing wild deer. The yield of velvet antlers was very low. To solve this problem, China began promoting the development of deer farming in the 1950s and began building state-owned deer farms in Heilongjiang Province, Jilin Province, Liaoning Province and Xinjiang Province. By the 1970s, the scale of China's deer industry had significantly expanded, and the deer farming areas had also expanded from the three northeast provinces and Xinjiang province to the Yellow River basins and Yangtze River basins.

In the 1980s, due to the increasing demand for velvet antlers in the international and domestic markets, the prices of velvet antler products increased (Zhao, 1990). Driven by interests, more people had participated in the velvet antler industry. At this stage, according to Ding's (2008) summary, the scale of deer farming in China continues to expand. However, many practitioners do not have a deep understanding of the industry and are just blindly following the trend.

During the low ebb stage, affected by the 1997 Asian financial crisis and problems such as low product quality and lack of a systematic standard system, the sales of Chinese velvet antler products faced significant challenges (Yu, 2005). The scale of the velvet antler industry and the price of velvet antler products continued to decline during this stage. The decrease in income had also forced many practitioners to abandon their velvet antler business. Many deer farmer have to slaughter their deer to reduce losses. Meanwhile, the velvet antler industry in

countries such as Russia and New Zealand had achieved commercialization. Their product quality and production capacity had been stabilized. A large number of imported velvet antlers had replaced the market share of domestic products, posing challenges to China's domestic velvet antler industry (Li, 2010).

During the adjustment stage, due to the continuous decline in the scale of China's velvet antler industry, the government's attention to this industry has also increased. A series of policies have been launched to reduce the number of low-quality products in the market. At the same time, the government has also introduced many relevant policies and regulations, making the Chinese velvet antler industry become more standardized. The subsequent stable stage is to further improve the industry status, absorb new technologies and enhance product quality.

Year	Estimated domestic deer population (ten thousand)	Estimated velvet antler output (t)
1955-1959	0.04-0.04	1-1.5
1960-1970	0.8-1	10-20
1971-1979	7-9	30-40
1980-1989	10-15	80-100
1990-1993	20-30	170-200
1994-1996	33-35	250-300
1997-2003	50-55	400-500
2004-2006	40-45	400
2007-2009	35-40	300-350

Table 2-1: Scale of deer farming in China from 1995 to 2009 (Ding, 2012)

2.3.2 The Current Situation and Important Policy Adjustments of China's Velvet Antler Industry

Nowadays, China's velvet antler industry has stabilized, and the main deer breeding areas and velvet antler production areas are still the three Northeast provinces (Heilongjiang Province, Jilin Province, Liaoning Province) and Xinjiang Province. In addition to these traditional advantageous production areas, deer farming has also been promoted as a poverty alleviation industry in many rural areas that is suitable for raising deer. According to the summary, the output value of velvet antlers in China has reached nearly 30 billion CNY (4.1 billion USD), providing employment opportunities for over 800000 people (Xing, 2021).

But for the entire industry, the biggest change in recent years was the policy changes. Before 2020, the deer breeding industry was under the dual management of the Ministry of Agriculture and Rural Affairs of China and the National Forestry and Grassland Administration of China. Firstly, in China's “Catalog of Wildlife under Key State Protection”, the Sika deer and Wapiti deer all belong to national protected animals (National Forest and Grassland Administration, 2018). Therefore, raising deer and selling deer products will require more certificates and paper than other ordinary livestock. Breeding and raising Sika deer and Wapiti deer requires official licenses, and trading deer products requires transaction

identification. The issuance of licenses and management of transaction identification are under the management of the National Forest and Grassland Administration. This strict management policy has indeed played a very good and positive role in protecting wild deer, but it does not distinguish between domestic deer and wild deer. On the other hand, as domestic deer also belong to livestock, issues such as breed evaluation and epidemic prevention management are all under the management of the Ministry of Agriculture and Rural Affairs (Xin, 2021). This cross-organizational management had brought significant obstacles to the development of China's velvet antler industry. The wildlife characteristics of Sika deer and Wapiti deer might bring uncertain factors to the industry. The unclear prospects make the deer industry only attract 0.008-0.012% of husbandry investment from 2010-2020 (Xing, 2021). Since the whole industry was under the multiple management of different departments, the formulation of policies and industrial standards was affected (Fu, 2021). This cross-organizational management has also caused the Bureau of Statistics unable to collect accurate data on the number of deer in stock in China. These problems had brought negative impacts on the development of China's velvet antler industry. With the new “National Catalogue of Livestock and Poultry Genetic Resources” issued by the Ministry of Agriculture and Rural Affairs in 2020, domestic Sika deer and Wapiti deer were first time classified as domestic livestock, clarifying that the Ministry of Agriculture and Rural Affairs is the main management department of China's deer industry. Many previously imperfect regulations had been gradually resolved after the policy adjustments, and the government's policy support in this field had begun to increase. This brought a clear opportunity for the future development of China's velvet antler industry (Fu,2021).

2.3.3 Main Deer Breeds in China

Three types of deer have been widely raised as velvet antler deer in China, the Sika deer, the Wapiti deer and the Hybrid deer.

a) Sika deer（Cervus nippon Temminck）

Wild Sika deer are widely distributed in China, but due to human activities and environmental changes, the population of Wild Sika deer is really rare nowadays (Wang, 2013). It is a highly endangered animal in China and belongs to China's national first-class protected animal. Therefore, all China's deer products are produced from domestic deer, any deer products from the wild deer are illegal and buying or selling will be a crime. Sika deer is a medium-sized deer, the general body length is 140-170cm, the shoulder height is 85-100cm, the adult body weight is 100-150kg, the female deer is smaller than the male deer. Sika deer's sexual maturity is 16-18 months old, and can participate in breeding at 28 months old. Male Sika deer can form stable velvet antler production at the age of 2-3. The general harvest season is from May to August of the year. Farmers will adjust the harvest time according to the age of the sika deer and the growth of velvet antlers. in general, a male deer can harvest velvet antlers twice a year.

Figure 2-7: Sika deer（Cervus nippon Temminck) (Shoot on the farm)

b) Wapiti deer （Cervus elaphus Linnaeus）

Wapiti deer belong to Mammalia, Artiodactyla, Cervidae, and Cervus. Wapiti lives in alpine forests or grasslands, widely distributed in China, Mongolia, Russia, Canada, the United States and other countries, and has also been introduced to Italy, New Zealand and other countries. Wild Wapiti deer is the second-class protected animal in China so the laws about wildlife production are also applicable to them. Wapiti is a large deer, with a body length of about 180cm and a shoulder height of 110-130cm. The adult male deer weighs about 200kg and the female deer weighs about 150kg. The antler harvest period is similar to the Sika deer, but the output of velvet antlers of Wapiti deer is higher than Sika deer.

Figure 2-8: Wapiti deer (Cervus elaphus Linnaeus)(shoot on the farm)

c) Hybrid deer

Except for these two main purebred deer, China’s deer industry also has a lot of hybrid deer. The male and female parents of these hybrid deer are mostly Sika deer, Wapiti deer and

subspecies of these two deer. Due to the large geographical span, purebred deer sometimes cannot well adapt to the breeding conditions of some regions. Therefore, these hybrid deer breeds that can adapt to different breeding environments have become more popular in some areas (Mi, 2014).

2.3.4 Velvet Antler Products

According to the summary of the Chinese Pharmacopoeia, deer antlers are mainly the young horns of the male deer of *Cervus nippon Temminck* (Sika deer) or *Cervus elaphus Linnaeus* (Wapiti deer). Its main functions are tonifying the kidney and 'Yang Qi', enriching the blood, strengthening muscles and bones, etc. Chinese patent medicine or health products containing velvet antlers also have similar effects. Therefore, velvet antler has high Yang tonifying value and concern as one value treatment for male diseases in Chinese culture. All these advantages make velvet become the most important product in China's deer industry. There are many ways for consumers to use velvet antler products, they can be used as raw materials for medicine, added to food, or soaked in wine to make medicinal wine. The velvet antler products that consumers can buy on the market are mostly fresh velvet antler, dry velvet antler, velvet antler slices and health products or drugs containing velvet antler ingredients. However, since the proportion of velvet antlers in drugs and health products is uncertain, they will not be included in the discussion scope. In addition, according to relevant laws (such as 'the Food Safety Law of the People's Republic of China' and 'the Measures for the Supervision and Administration of Quality and Safety in the Marketing of Edible Agricultural Products'), velvet antler, dry velvet antler and velvet antler slices are classified as primary agricultural products. In addition to requiring relevant certificates such as 'animal quarantine certificates', no further qualification certification is required, making these products the most widely circulated products on the market. Therefore, the velvet antler products mainly discussed in this thesis only include fresh velvet antlers, dry velvet antlers and velvet antler slices products.

2.3.5 China's Domestic Velvet Antler Market

China's velvet antler can be divided into two main categories, Sika deer velvet antler and Wapiti deer velvet antler. Sika deer velvet antler will also be divided into two specifications, two-branches and three-branches. The 'two-branches' refers to the velvet antler with one side branch, while the 'three-branches' refers to the antler with two side branches. According to Song (2012), the two-branches are more expensive than the three-branches and the three-branches are more expensive than the Wapiti deer velvet antler. Except the locally produced velvet antler, the red deer velvet antler from New Zealand and reindeer antler from Russia also occupy a certain market share in China's velvet antler product market (Wei, 2015). However according to Fu (2021), most of the Russian reindeer antlers were flowing into China's market through smuggling, and the reindeer antlers were not recognized by most consumers. As shown in the following figure, in 2020, the average price of all three types of velvet antlers had declined. This is because of the sudden outbreak of COVID-19. According

to Xing (2020), since all the domestic deer used to be managed as wild animals in the past, and the government strengthened the control over wild animal products after the epidemic outbreak, the sudden change of the policy seriously influenced China's velvet antler industry.

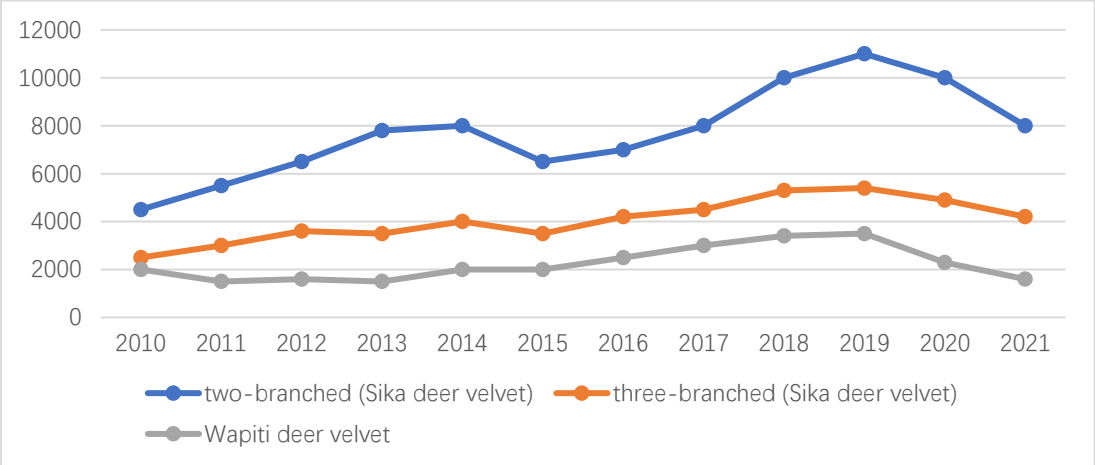

Figure 2-9: Price changes of velvet antlers in China (Animal Agricultural, 2021) & (www.kmzyw.com.cn)

2.3.6 The Price Change of Live Deer in China

The price of live deer has a significant impact on deer farmers, especially small-scale deer farmers. Before 2019, the price of live deer in China had maintained stable growth. By the end of 2019, the price of Sika deer fawn reached 7,000 CNY (963.98 USD) for males and 6,000 CNY (826.27) for females. The price of Wapiti fawn reached 9,000 CNY (1,239.40 USD) for males and 7,000 CNY (963.98 USD) for females. The price of adult sika deer was 15,000 CNY (2,065.67 USD) for males and 8,000 CNY (1,101.69 USD) for females. The price of adult wapiti was 25,000 CNY (3,442.78 USD) for male deer and 15,000 CNY (2,065.67 USD) for females. Affected by the outbreak of the epidemic, the price of the deer by the year of 2020 declined. The price of Wapiti deer declined a lot, but it is mainly because of the market strategy instead of the epidemic. According to Xing (2021), as the main producing area of Wapiti deer, Xinjiang has had few live Wapiti deer transactions in the past few years, resulting in a high price in the market. But after 2020, the business strategy changed and the price of the Wapiti deer fell back to the normal level.

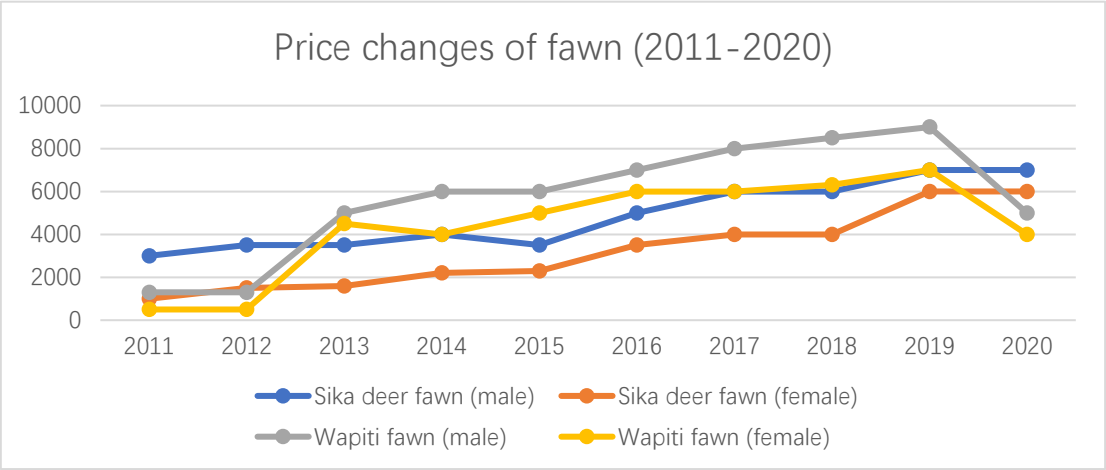

Figure 2-10: Price changes of fawn (2011-2020) (animal agricultural, 2021)

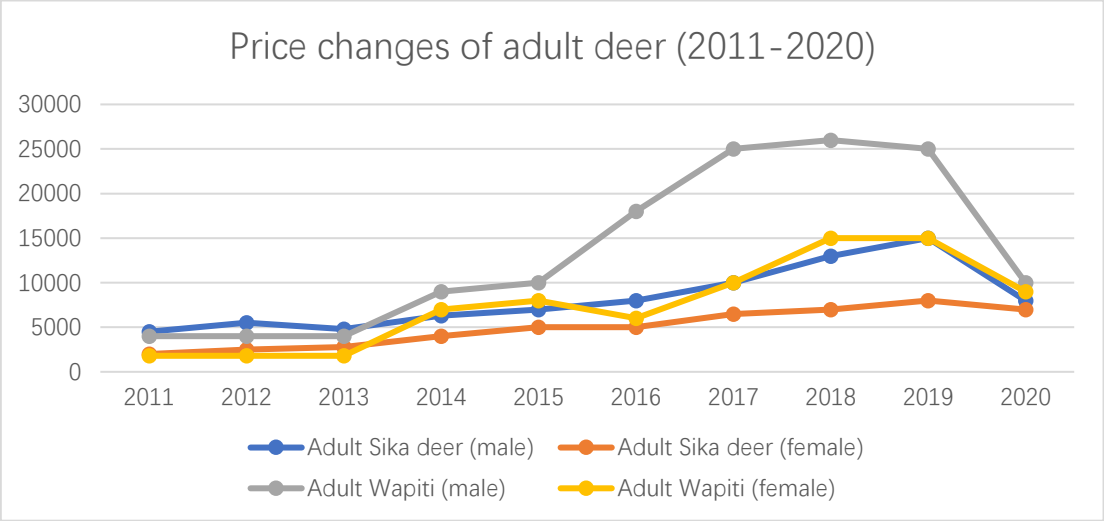

Figure 2-11: Price changes of adult deer (2011-2020) (animal agricultural, 2021)

2.3.7 China's Velvet Antler Import and Export Trade

China’s local markets’ demand for velvet antlers is quite high and since the output of the local deer industry is unable to meet the requirements of the market, which makes China become one of the biggest velvet antler importers in the world. There is no detailed classification of velvet antlers in the fourth edition of SITC (Standard International Trade Classification). In the HS (Harmonized System) code, velvet antler is coded as 0507902000 (Pilose antlers and powder thereof), which includes fresh velvet antler, dry velvet antler, velvet antler powder and antler. In China's import and export management, these four categories will be uniformly classified as 05079020 for customs declaration and export. According to the statistics of the customs data platform, China's import volume of antlers is much higher than the export volume. China's import volume of antlers has continued to rise steadily since 2018. By 2021, China's annual import volume of pilose antlers has reached 859,245 kg, which reflects the strong demand for velvet antler products in the Chinese market and the shortage of antler production capacity of the domestic deer industry.

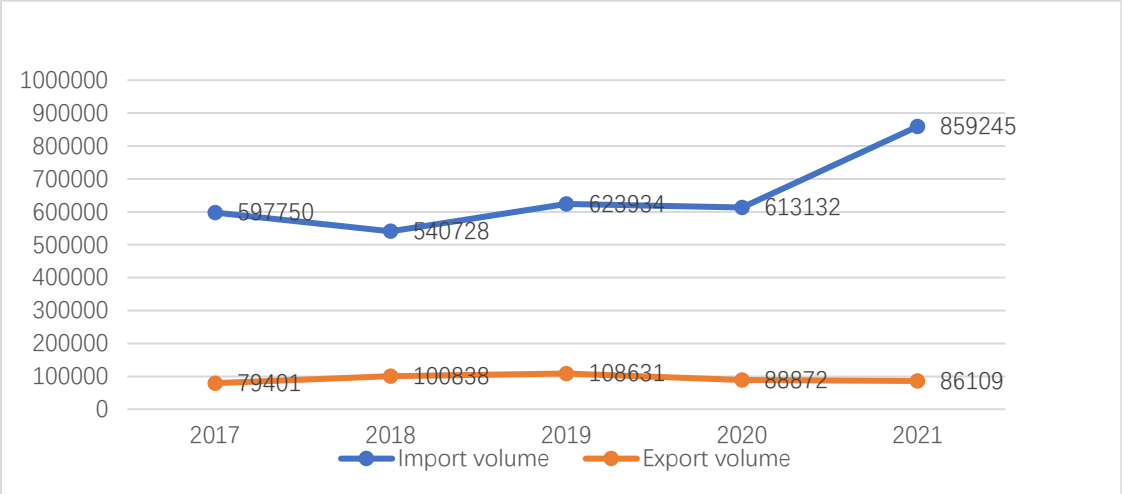

Figure 2-12: Total Import and Export volume of Pilose Antler (kg) (China Customs Data, 2022)

By analyzing the import data of pilose antlers and the by-products in China from 2017 to 2021, it is found that the imported velvet antlers in China mainly come from New Zealand and Australia, New Zealand is the main source. Taking the import data of 2021 as an example, the pilose antlers imported from New Zealand were 833,620 kg, accounting for 97% of the total import volume of that year, the total import price of pilose antlers reached 351,717,753 CNY (48,435,403 USD) and the import price of pilose antlers from New Zealand reached 344,983,556 CNY (47,508,030 USD), accounting for 98% of the total price.

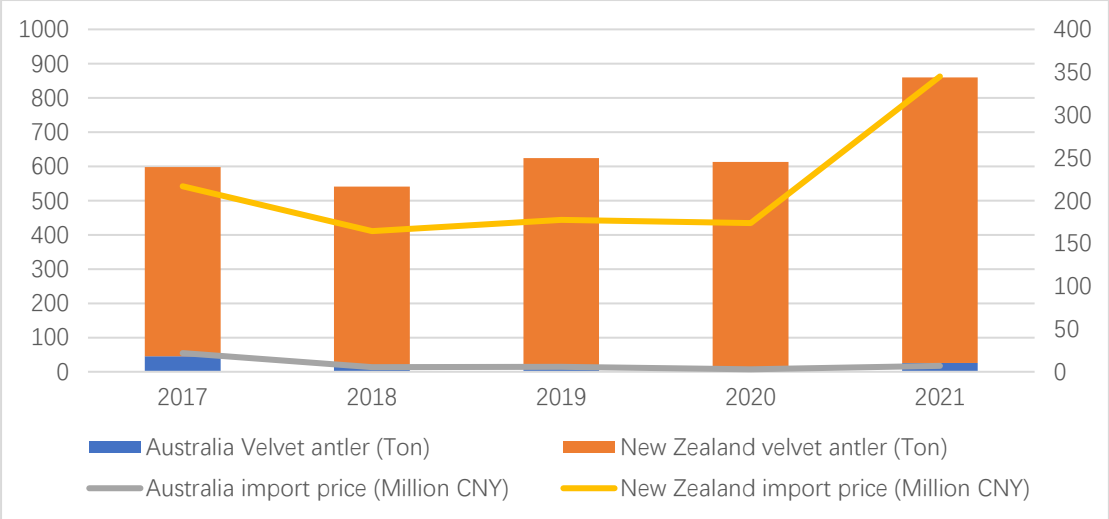

Figure 2-13: Detail data of China’s velvet antler import (China Customs Data, 2022)

The main export countries and regions of Chinese pilose antlers are Hong Kong, China; Japan; Korea, Rep.; America. Among them, Korea, Rep is the one that has the highest import volume. Taking the data of 2021 as an example, in that year, South Korea imported 73,450 kg of Chinese velvet antlers, accounting for 85.3% of the total export volume of Chinese pilose antlers of that year. In 2021, the total export price of China's pilose antlers reached 145,003,482 CNY (19,968,574 USD), while the import price of South Korea reached 95,336,281 CNY (13,128,855 USD), accounting for 65.7% of the total export income of that

year.

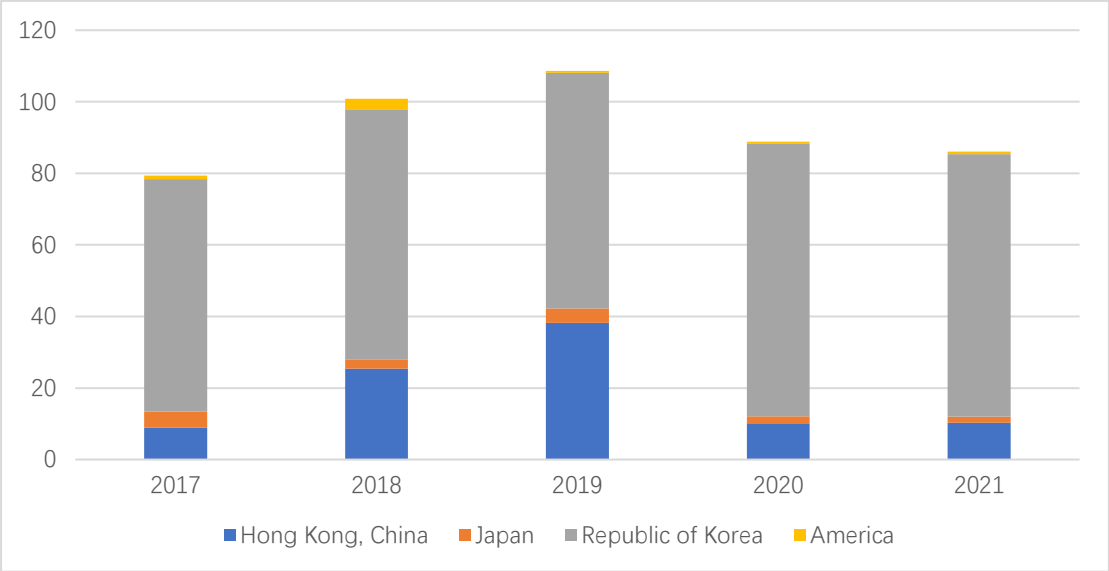

Figure 2-14: Export volume of pilose antlers of China (China Customs Data, 2022)

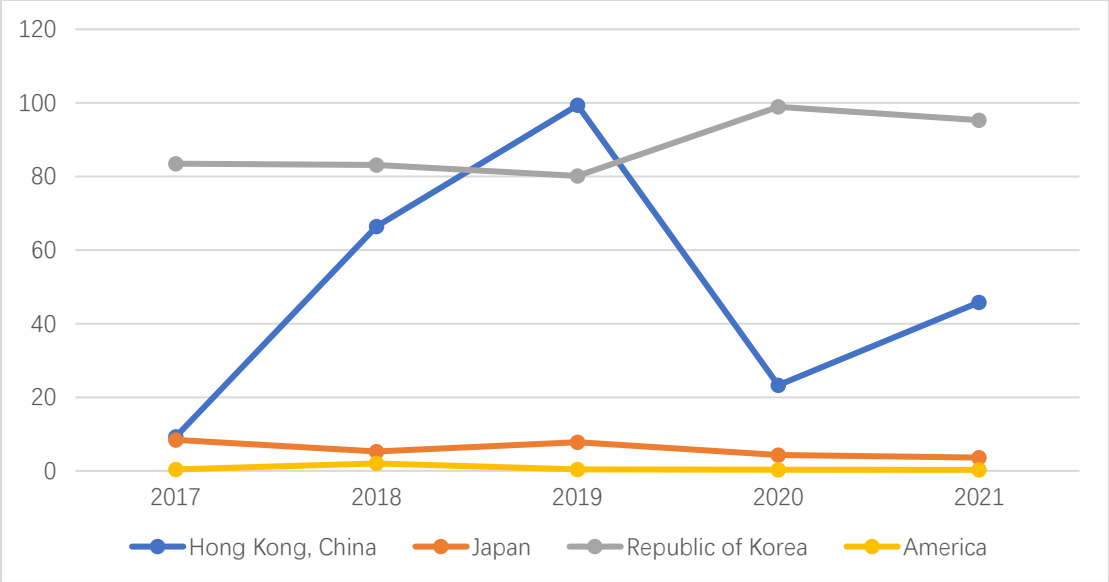

Figure 2-15: Export price of the pilose antler of China (China Customs Data, 2022)

2.3.8 Main Business Model of China's Deer Farms

In the early days, Chinese deer farms were all state-owned farms. But after years of development, the ownership of deer farms in China now is very diverse. According to the summary, there are six types of business models in China.

a. State-owned: The deer farm is invested by government departments, the farm workers are formal workers of the state or normal contract workers and the profits and losses of the enterprise are owned by the state.

b. Collective management: Collective management can be divided into two

types. The first type of collective management can be considered as the traditional one. It is invested by the collective and the employees of the farm are collective workers and the profits and losses of the farm belong to the collective. The other type is that the deer belonging to multiple self-employed households are gathered together and under the unified management of the collective, the management cost is apportioned according to the size of the deer herd of the self-employed households.

c. Self-employment: Farms are managed and operated by individuals. This model is common among Chinese deer farmers, and the scale of this model is generally small. Although the operation is flexible due to its small size, its poor anti-risk ability makes this type of farm very vulnerable to market changes.

d. Shareholding management: This business model manages the farm with shares, which helps to improve the profits of the farm, reduce the operating costs and reduce the obstacles that enterprises may encounter in financial issues.

e. Cooperative management: This mode is also common in China. A cooperative is formed by multiple individual farms. The members of the cooperative cooperate and help each other in technology, market operation, production technology and other aspects, unified management, improved members' anti-risk ability and improved profits.

f. Private enterprise: The deer farm belongs and is under the control of the private enterprise. These private enterprises are often engaged in other industries besides the deer industry. Therefore, the financial strength of these farms is often stronger, the breeding scale may be larger than other models and their capability to resist risks will be stronger (Li, 2011).

2.4 Reagon of Study: Jilin Province

This section introduces the background information of Jilin province and the deer industry in Jilin province.

2.4.1 General Background

Jilin Province is located in the central part of Northeast China, adjacent to Liaoning Province, Heilongjiang Province and Inner Mongolia Autonomous Region. The provincial capital city is Changchun City. The climate of Jilin province is the temperate continental monsoon climate. The province has 8 prefecture-level cities and one autonomous prefecture, with a total area of 187,400 square kilometers. By the end of 2021, the total population of

Jilin Province was 25.596 million, of which 12.574 million are urban permanent residents (Jilin Statistical Yearbook, 2022).

Figure 2-16: The map of Jilin Province (http://www.onegreen.net/, 2019)

2.4.2 Economy and Per Capita Disposable Income

By the end of 2021, the total GDP of Jilin Province is 1,323.552 billion CNY (1812.724 billion USD), ranking 14th in China. The GDP of the primary industry (agriculture) is 155.384 billion CNY (21.281 billion USD), accounting for 12% of the total GDP of Jilin province. The GDP of the secondary industry (manufacturing) is 476.828 billion CNY (65.306 billion USD), accounting for 36% of the total GDP. The tertiary industry (service industry) is 691.34 billion CNY (94.685 billion USD), accounting for 52% of the total GDP.

As for the per capita disposable income, by the end of 2021, the per capita disposable income of urban residents was 35,645 CNY (4,882 USD), the living consumption expense of urban residents was 24,420 CNY (3,345 USD) and the Engel's coefficient of urban households was 27.1%. The disposable income of rural residents was 17,641 CNY (2,416 USD), the living consumption expense was 13,411 CNY (1,837 USD) and the Engel coefficient of rural households was 30.2%.

2.4.3 Agriculture

The cultivated area of Jilin province is 70,300 square kilometers, accounting for 37% of

the total land area of Jilin province, ranking fifth in China (Jilin Government, 2022). These factors made Jilin Province a major producer of agricultural products in China. Jilin province ranks number one in per capita grain share, grain commodity rate and grain export volume in China. By the end of 2021, the total output value of agriculture, forestry, animal husbandry and fishing in Jilin province was 297,232.41 million CNY (40,708.65 million USD), including 130,291.32 million CNY (17,844.57 million USD) for agriculture, 7,259.33 million CNY (994.23 million USD) for forestry, 145,425.24 million CNY (19,917.30 million USD) for animal husbandry and 5,438.91 million CNY (744.91 million USD) for fishery. And by the end of 2021, the rural labor force in Jilin province was 6.6912 million people.

2.4.4 Deer Industry in Jilin Province

Jilin Province is the birthplace of Chinese sika deer, as well as a major deer producing area and deer product producing area in China. From a historical perspective, 300 years ago, during the Qing Dynasty, there were several royal paddocks in Jilin Province that provided deer products for the royal family. After the establishment of the People's Republic of China, the earliest state-owned deer farm in China was also established in Jilin Province. This makes Jilin Province have a very long tradition of deer farming. According to government statistics, there are over 4,000 large and medium-sized deer farms raising more than 50 deer in the province. Jilin Province mainly raises sika deer, with a smaller population of Wapiti deer. According to local government statistics, the breeding volume of Sika deer in Jilin Province is about 50% of the whole country. Moreover, according to Wang's (2014) summary, there are 6 subspecies of Sika deer in China, and most of the artificially bred Sika deer in China are descendants of the *Cervus nippon hortulorum*, one type of subspecies originating from the Northeast region. The advantages of germplasm resources have also promoted the development of the Jilin deer industry. According to the 2021 Jilin Statistical Yearbook, by the end of 2020, the total population of deer in Jilin province was 485,600 and the velvet antler output was 472,467 kg. In addition to the advantage in breeding quantity, the supporting industry of deer industry in Jilin province also had reached a certain scale. According to the summary, there are 198 enterprises engaged in deer product processing in the province, including 2 national leading enterprises and 24 provincial-level leading enterprises. Also, the Institute of Special Animal and Plant Sciences of CAAS (Chinese Academy of Agricultural Sciences) and Jilin Agricultural University are all located in Jilin province. These two are the leading scientific research units in the field of deer, which can bring scientific support to the local deer industry.

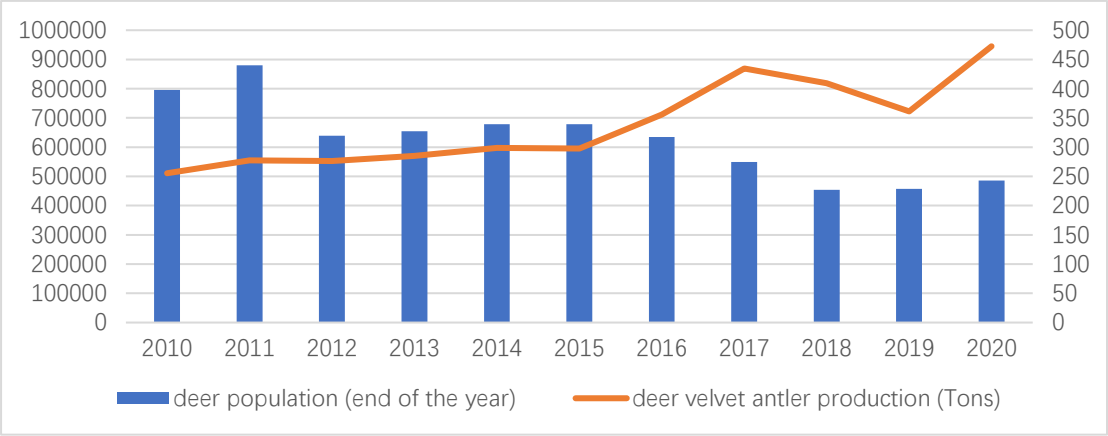

Figure 2-17: Deer population and velvet production in Jilin (Jilin Statistical Yearbook 2011-2021)

2.4.5 Deer Industry Policies in Jilin Province

After the introduction of national policies in 2020, Jilin Province has also introduced a large number of local policies that are conducive to the development of the local deer industry. In March 2021, the "Implementation Opinions of the Jilin Provincial Committee of the Communist Party of China and the Jilin Provincial People's Government on Comprehensively Promoting Rural Revitalization and Accelerating Agricultural and Rural Modernization" specifically proposed to improve the deer product industry chain, and enhance the competitiveness and influence of local velvet antler products. In the "Jilin Province Sika Deer Industry Development Plan (2021-2025)" launched at the end of 2021, it was proposed to achieve the deer industry output value of 100 billion CNY (13.665 billion USD) in Jilin Province by the end of 2025, with an annual velvet antler production of 1000 tons and a deer breeding population of 1 million. To achieve this goal, the Jilin Provincial Government has also launched multiple plans about expanding the breeding scale, constructing new farms, and improving breeding livestock quality. For example, in the plan to promote the scale of deer farming in Jilin Province, it was proposed to invest 900 million CNY (123 million USD) to improve the standardization of deer farming in this province and expand the scale of deer farming and invest 4.8 billion CNY (656 million USD) to build the breeding park and the deer product processing park. These targeted policies have provided significant support for the development of the velvet antler industry in this province.

Chapter 3 Literature Review

This chapter is divided into 6 parts. The first part briefly introduces the definition of the value chain. The second part discusses the general theories of the value chain. The third part introduces the analysis of the value chain. The fourth part introduces the application of the value chain in the agriculture field. The fifth part discusses the opportunities and challenges that the velvet antler value chain may face. The final section is about the framework of this thesis.

3.1 Definition of Value Chain

The concept of value chain was first put forward by Michael E. Porter. In 1985. In his early theory, the value chain mainly refers to the vertical integration enterprise, which covers the dynamic process of the value created by the company's basic activities such as production, marketing, etc. and emphasizes the competitive advantage of the enterprise (Porter, 1985). Value chain theory was widely used by the academic community. For example, many concepts such as commodity chain, supply chain and production chain can be concern as the value chain under certain circumstances (Sturgeon, 2001).

So, what is the value chain? Different scholars have different definitions of it. According to the definition of Porter (1985), the value chain is a series of business activities carried out by a company to design, produce, market and support its products. According to the theory of Kaplinsky et al. (2000), the value chain describes the various activities required by the product or service at different stages from concept to production, delivery to the final consumer and after use. Krugman's (1995) theory further broadened the research of the value chain to a larger geographical space. His theory links the value chain between enterprises and countries or regions as a whole, focuses on the problems that enterprises may face in various internal links under different environments and discusses the layout ability of enterprises to integrate all links of the value chain in the global market. In general, the value chain is a way to understand the various interactions between practitioners, enterprises and other participants during trade activities, different entities in the chain participate in and perform different processes.

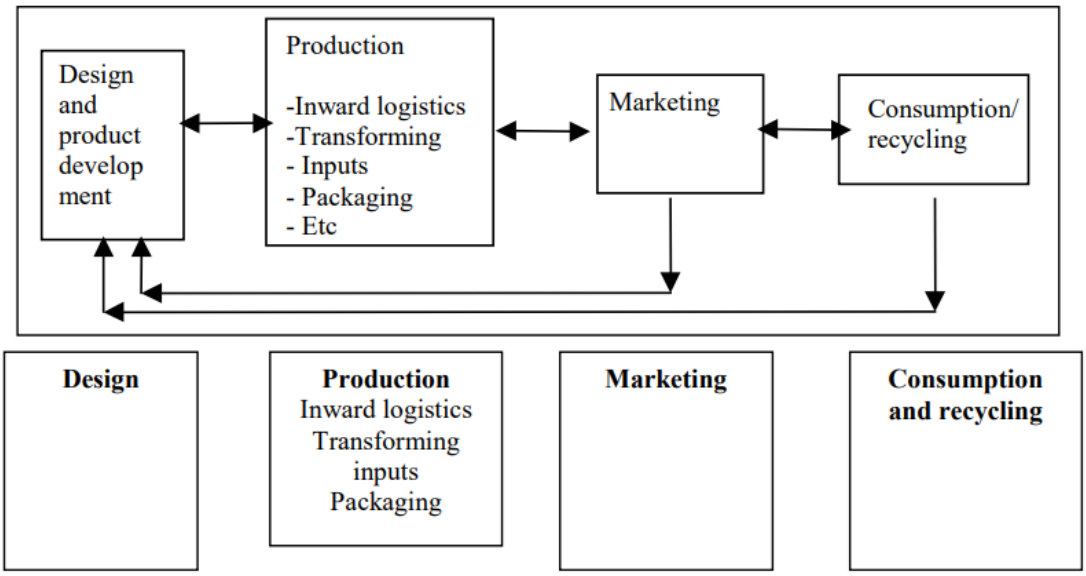

Figure 3-1 Four links in a simple value chain (Kaplinsky, R., & Morris, M. 2000)

In the simple value chain structure shown in the figure above, we can see four main value-added links and the participants in each link will perform specific activities (Kaplinsky, 2000). Of course, in the real world, because there are often more links in one value chain and some producers in the value chain may also participate in the production of a variety of other different value chains, the value chain in the real world is often more complex.

3.2 Theoretical Approaches of Value Chain

According to the summary of Trienekens (2011) and in combination with the analysis of different value chains by Golini, Kalchschmidt (2019), Acquirer, Valiorgue, Daudigeos (2017), Spithoven (2019) and other scholars, the main value chain theories are divided into four categories: global value chain (Gereffi, 1994); supply chain management (Cooper,1997); New Institutional Economics (Williamson, 1999); Network approach (Uzzi,1997). GVC focuses on linkages between multinational corporations. Supply chain management focuses on the operation and management within the value chain and tends to improve the value chain process. New institutional economics tends to focus on the management of relationships between companies. Network approach focuses on the horizontal and vertical relationships among the participants in the value chain.

3.2.1 New Institutional Economics

New institutional economics (NIE) includes transaction cost economics (TCE) and other theoretical branches, focusing on the governance of organizational relationships within and between companies (Trienekens, 2011). According to the summary of Jraisat (2010), transaction is the exchange of products, services and funds within the chain. NIE theory pays close attention to transaction cost, principal-agent problems and collective action problems

(Schneider, 2022). In the branch theory of New institutional economics, transaction cost economics, further analyzes the costs of trade behavior, including negotiation costs, risk costs, etc. and analyzes that under different circumstances, the price of the costs will be different (Ruben, 2007). As for the principal-agent problem, the problem of information asymmetry will be used by opportunists, such as the conflict between ownership groups (shareholders) and management groups (agents) within the enterprise (Schneider, 2022). Collective action problems, on the other hand, analyze that some members take the efforts of other members by hitchhiking to gain convenience. This reflects that in business activities, enterprises have sufficient reasons not to train employees because the employees might be hired by other enterprises after training, but on the other hand, if the enterprises refuse to train employees, it may lead to worse operating conditions for the company (Booth & Snower, 1996).

3.2.2 Network Approach

As the competition becomes fiercer while the market changes, the network approach that used to connect the enterprises are replacing the traditional market system (Halinen & Törnroos, 2005). There are many definitions of network. Wilson (1995) defines it as the information exchange or agreement between companies and further realizes long-term trade cooperation between them. Trienekens (2011) defined it as enterprises with complex vertical and horizontal directions seeking upstream and downstream service support and technical support. Wu (2008) defined it as a relatively stable connection between the company and its cooperative companies to obtain advantages in fields such as information and resources. Many factors affect the connection between participants. For example, good trade relations require the trust of both trading parties in each other (Trienekens, 2011). The strength of participants will also affect the distribution of interests in the value chain (such as trade negotiations) and the enthusiasm of other participants (Gereffi, 2005; Trienekens, 2011). Therefore, when analyzing the value chain and its participants, these factors also need to be considered. Since this study is focused on the domestic velvet antler value chain of China, the relationship between the value chain actors and the opportunities and challenges that the whole value chain and value chain actors may face, the network approach is the main approach of this study.

3.2.3 Supply Chain Management

The Supply chain management approach mainly studies the management within the value chain, focusing on improving the overall process of the value chain, improving the quality of the value chain, optimizing the product distribution process and optimizing the product inventory (Cooper, 1997). The success of an enterprise or industry's competitive strategy often depends on whether managers can have a good understanding of the current competitive environment, coordinate and organize activities within the industry and across industries according to their strategic targets and use limited resources to meet market needs (Stonebraker & Afifi, 2004), which also makes supply chain management very important. The emphasis on supply chain management enables the operators to better analyze business

related data and solve problems encountered in business (Jacobs, Chase & Lummus, 2014). With the development of science and technology, technologies in the new era such as blockchain and the Internet of Things can effectively improve the problems in the traditional value chain and make contributions to supply chain management (Hussain, Javed, Hakeem et. Al, 2021).

3.2.4 Global Value Chain

According to the summary of Gereffi (1994), the Global value chain theory focuses on the analysis of the relationship between multinational companies in international trade and the relationship between the lead firms, multinational companies and participants companies. GVC is defined as an all-round activity carried out by the enterprises and the workers to transform products from concept to end use. These activities can be completed by one company or by collaborators worldwide (Gereffi, Fernandez Stark, 2011). With the continuous development of the global economy, more and more global economies are built around the GVC theory. The application share of this value chain model in international trade, global gross domestic product, employment and other fields is also rising (Fernandez Stark & Gereffi, 2019). According to Alford & Phillips (2018), GVC theory has gone deep into many systems, including politics, social economy, etc., which also makes GVC theory have a continuous impact on most modern economic systems.

3.3 Value Chain Analysis

Combined with the research and analysis of Kaplinsky (2000), Taylor (2005) and other scholars, the main purpose of value chain analysis is to find the links between low productivity or efficiency in the existing chain and improve the performance of the whole chain through comprehensive analysis. Andrew (2012) and other scholars said that value chain analysis can reveal the strategic and operational dislocation within the chain, as well as the subsequent resource mismatch, to find improvement opportunities for creating value and economic sustainability. Rich, Ross, Baker and Negassa(2011) further proposed that the application of value chain analysis can help analysts understand the links between various stages within the chain and provide assistance for policy formulation. As an effective analysis tool, VCA can help developing countries or poor countries better understand the problems existing in their local chains (Bolwig, 2010). As Humphrey (2006) concluded, value chain analysis can sound an alarm for agricultural producers in developing countries about the increasing challenges they face from international competition.

In Trienekens' (2011) theory, value chain analysis consists of three important parts, the network structure, the value addition and value chain governance. And these three factors will further influence the upgrading option of the value chain. In Hellin's (2006) research, value chain mapping is important for having a clear understanding of the value chain and beneficial for analyzing the important factors of the value chain. Therefore, this section introduced the value chain mapping, network structure, value addition, governance structure and value chain

upgrading separately.

3.3.1 Value Chain Mapping

Value chain mapping can be considered an important part of value chain analysis. According to the summary of Christian & Barron (2017), value chain mapping can be a supplement to value chain analysis and generate new understanding during the research process, this is difficult to achieve if only relying on the traditional questionnaires alone. Kerr (2015) also concluded that value chain mapping provides readers with an easy-to-understand way to observe and understand the process and approach of the value chain.

According to Stein & Barron's (2017) summary, the mapping process is mainly divided into 2 stages and 7 steps, which are Stage one: Activities; Actor; Links; Context and Stage two: Participatory statistics; Validation; Upgrading strategies. In stage one, the researchers' task is to draw a map of the value chain. The activities step is to figure out what activities are necessary for product production. Actor step is to find the main actors involved in the value chain. Step 3 is link, at this step, researchers need to draw the linkages between different actors, the important part is to find the links that have significant influences on the operation of the value chain. Step 4 is context, at this stage, researchers need to find the factors outside the value chain that may have an impact on the value chain that need to be taken into consideration. At stage two, researchers need to analyze and interpret the value chain map that they constructed. The first step is participatory statistics, this stage is to analyze the data collected during mapping the value chain. Step two is validation, the researchers need to summarize and discuss the findings they got. The final step is upgrading strategies. At this step, the researchers need to identify and discuss the suitable upgrading strategy for the value chain and chain actors.

Value chain mapping can play a helpful role in the value chain analysis of many industries, from the analysis of the tourism industry on customer status (Fernández, 2020) to providing direction guidance for the development of the beef value chain (Asikin, 2020). In general, as Frederick (2019) summarized, value chain mapping, as a way to show the footprints of a certain industry in a country or region, plays an important role in the value chain and value chain analysis.

3.3.2 Network Structure

Network structure is one important component of value chain analysis according to Trienekens (2011), it can be divided into two dimensions: vertical and horizontal. The vertical direction shows the flow of a product from the producer to the final consumer. The horizontal dimension is the interaction between participants in the same phase. Lazarrini et al. (2001) proposed the concept of the network chain to show the relationship between horizontal and vertical dimensions in the value chain. As shown in Figure 3-2, the vertical relationship can go through each link of the value chain, or it may skip some stages of the value chain. The

horizontal relationship between actors on the same plane also has many different forms due to different subjects. As a bridge linking producers and consumers, sales channels can be understood as supply chains, providing channels for product sales. And because the value chain is dynamic, with the deepening of globalization, local producers or consumers are no longer restricted by geographical space as in the past. A typical example of this in the agricultural sector is the coffee industry (Kaplinsky, 2001.), After years of differentiated development, the coffee industry has established a professional distribution and sales network in the world.

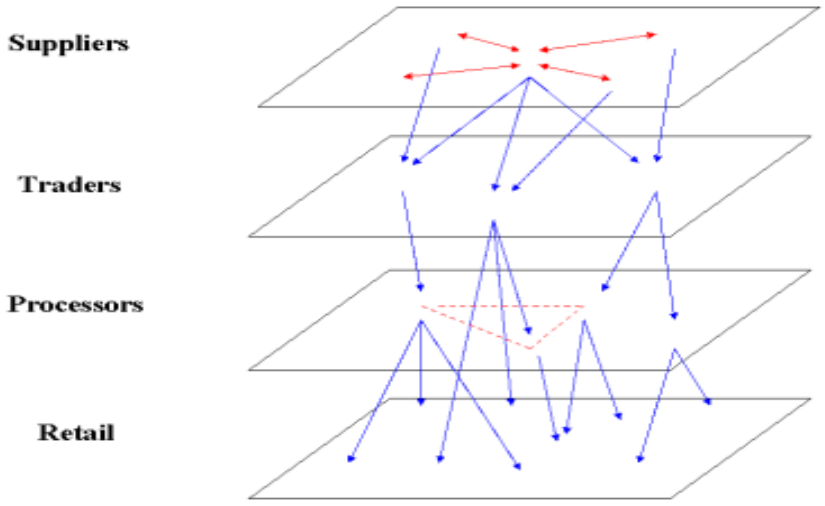

Figure 3-2: Example of a network structure (Lazzarini, 2001)

Vertical coordination

According to King (1992), vertical coordination can be defined as the consistency of direction and control among different departments of the same production or marketing system, by adjusting the requirements proposed by both parties in the transaction and finally reaching an agreement so that the chain can operate stably. With the continuous development of economic globalization, the market variability makes the participants in the value chain need to pay more attention to vertical coordination. The weak vertical coordination among the value chain participants may cause participants unable to enjoy the economic benefits of the value chain (Warsanga, 2014) or unable to obtain timely knowledge or information (Swinnen, 2007). Thus, good vertical coordination is the key to ensuring the profitability of the value chain. In the agriculture field, contract agriculture can be considered as one form of vertical coordination. Although there are deficiencies at the implementation level, effective measures can offset these problems and ensure that both farmers and acquirers can obtain benefits (Rehber, 1998). Therefore, this contract model is widely used in agriculture industries (King, 1992). And since good vertical coordination is beneficial for improving product quality, as consumer demands for product quality increase, vertical coordination has become increasingly important (Henderson, 2017).

Horizontal coordination

Horizontal coordination represents the relationships between peers that are at the same level but not in the same organization and the coordination between them will further influence the actor of the other stage of the chain (Hannachi, 2020). Excellent horizontal coordination can reduce negotiation costs (Coles, 2011). When the participants at the same level unite to establish an alliance, they can obtain better bargaining power and reduce the risks they may encounter in the market (Hannachi, 2020). Insufficient horizontal coordination may place actors at a disadvantage in the negotiation, resulting in loss of income (Warsanga, 2014). In general, horizontal coordination is to increase the coordination between participants in the same stage of the value chain, such as farmers' cooperatives. These relatively vulnerable groups reduce their production costs and enter higher markets through collective actions (such as buying inputs and selling products together) (Cuddeford, 2014).

3.3.3 Value Addition

In Trienekens's (2011) theory, the value added to the final product was created by the different value chain practitioners of different stages, therefore, analyzing the value addition can help researchers to find which actor or activities is more important for the value chain. According to Coltrain (2000), the definition of value adding is to change the current characteristics of the product into more preferred characteristics in the market, adding more additional features and using value to the products or services. It is worth noting that value creation and value adding have been used as synonyms in previous studies and are often used to analyze the potential capabilities of agricultural enterprises (Coltrain, 2000). Coltrain has also further defined value adding in a more specific way, that is, by processing agricultural products into the products required by customers and by this way to add value to agricultural products. Product value-added is created by different participants in different chains in the value chain. Value-adding can be related to quality, cost, time and other factors (Trienekens, 2011).

There are many ways for agriculture enterprises to add value to their products. Companies can hire professional consultants to improve their management level (Solomon, 1997). Improving the quality of the products to enter a channel that provides better prices is also one way to increase the added value of the product (Cucagna, 2018). Healthy food can achieve value-added through brand image building and increasing public relations investment (Bimbo, 2016). In China’s velvet antler industry, researchers found that higher brand awareness can make consumers more willing to believe in the quality of products and pay higher prices (Zhang, 2018). The processed dried antler is also more valuable due to its longer shelf life (Zhang, 2021).

3.3.4 Value Chain Governance

Value chain governance refers to the relationships between all participants in the value

chain, which can be buyers, sellers, or official regulatory agencies. The relationships between participants can have an impact on the product or services throughout the entire production process, it is about the power and how the power exerts control over the value chain (Gereffi, 2005), it essentially is a form of non-market coordination for economic activities. Value chain governance includes factors such as the formulation of value chain rules and the division of activities and responsibility among different participants, which is related to the distribution of power among participants (Kaplinsky, 2000) and that is one reason why analyzing the value chain governance is important for value chain analysis. Also, according to Humphrey (2001), there are many reasons why researchers need to pay more attention to value chain governance, for it can help people to have a clear understanding of the value chain, figuring out who are the leading enterprises in the field and how would these actors influence the value chain. For example, sometimes, even without market barriers, some actors may still find it hard to enter the market since the sales channel is dominated by limited buyers who are only willing to give the chance to the actors with higher production efficiency. In addition, since each link of the value chain is composed by different actors, and their relationships will affect the value chain, therefore, analyzing the value chain governance is important for value chain analysis (Kanda, 2009).

3.3.5 Value Chain Upgrading

The essence of value chain upgrading is the enterprises or sectors improving their efficiency, providing better products, or shifting into other businesses in order to improve their performance or increase their income (Giuliani, 2005). With the rapid changes in the market, the upgrading of the value chain has become a necessary condition for a company to enhance its competitiveness (Humphrey, 2004). Many factors promote the upgrading or evolution of the value chain, especially in the field of agriculture. Take Africa's agri-food market as an example. Its development trend in recent years is largely affected by local demographic changes, changes in per capita income, changes in eating habits, changes in consumer preferences and other factors (Kilelu, 2017). According to the classification of Kaplinsky (2002), value chain upgrading can be simply divided into four categories: Process upgrading; Product upgrading; Functional upgrading; and Chain upgrading.

Process upgrading simply means improving the efficiency of input and output by adopting better production technologies or improving production systems (Gereffi, 2001). Whether it is to reduce production costs or increase production, it is to better cope with the growing competition in the chain. Take Guatemala’s fabric industry as an example, the local hand-made fabric industry has been challenged by cheap substitutes from East and Southeast Asia. Stimulated by this, many local manufacturers choose to use modern techniques or reduce the complexity of the production process to improve their daily production (Bloom, 2007).

Product upgrading is an upgrading way to improve product quality to make consumers feel the value of the product, normally through changing the external features or the actual use value (Trienekens, 2011). The specific implementation method of this upgrade is to

launch new products or upgrade the existing products more swiftly (Kaplinsky, 2001). In addition, the necessity of product upgrading has something in common with the process upgrading mentioned above, that is, to ensure that the products meet the local quality standards or safety standards of the target market and ensure the market access of the products by improving the quality of the products (Laven, 2010).

According to Kaplinsky (2002), the functional upgrade is to change the internal activities of the company (such as outsourcing accounting and logistics) or shift the focus of activities to other stages of the value chain. Neilson further defined functional upgrading as the attempt of producers or production enterprises to change their original position and enter higher added value links in the value chain to improve their competitiveness (2009). However, Neilson also pointed out that in developing countries, this type of value chain upgrading is rare in the upstream of the value chain.

Chain upgrading can also be understood as cross-department upgrading. Its essence is that companies or producers enter a new value chain by producing another product or providing another service. Some nut producers in Sudan have transformed into butter producers or exporters and entered a new value chain (Humphrey, 2002) and some tropical plantations have also transformed from coffee planting to rubber planting (Neilson, 2009).

3.4 Agricultural Value Chain

This section introduces the definition of the agricultural value chain, the stages of the agricultural value chain and the agricultural value chain analysis cases.

3.4.1 Definition of Agricultural Value Chain

According to Cuddeford (2014), the definition of agricultural value chain is the activities that can bring the basic agricultural products like grain or plant fibers from the farm to the consumers through phases such as processing, distributing, transport and aftersales. With the deepening of economic globalization, the agricultural value chain has also become more complex. As summarized by Kumari (2021), Juejuan (2020), Qiu (2013) and many other scholars, agricultural producers, especially small-scale farmers, are often limited by geographical space, sales channels, low added value and other factors, resulting in low profitability. However, a reasonable analysis of the value chain can help individual agricultural producers enter more profitable markets (Rich, 2011). A well-organized value chain can help agricultural producers in many ways. For example, a customized value chain can better help producers meet the requirements of consumers (Porter & Millar,1985). It can also display the important points of the value chain that are conducive to value creation (Ensign, 2001). In addition, the analysis of the value chain can help practitioners better find the problem of power inequality in the value chain (Kaplinsky, 2000). It is also helpful for actors to identify their roles and how will they influence the value chain (Hellin, 2006).

3.4.2 Stages of Agricultural Value Chain

According to the research of Cucagna and Goldsmith (2018), the agricultural value chain can be divided into four stages. The four major stages are: input and equipment, production, processing and manufacturing, distribution retail, and services. The participants of the first stage are the suppliers of agricultural products and services to farmers. They provide seeds, fertilizers, breeding animals, feeds and other products that are necessary for agricultural production to farmers. The second stage is production activities, farmers planting crops or raising animals. The third stage is the processing stage, where the primary products produced by farmers are processed into semi-finished products or finished products. The last stage is to provide these products to consumers and the market. The main participants in this stage are individuals and enterprises engaged in product distribution, transportation, retail, after-sales and other services.

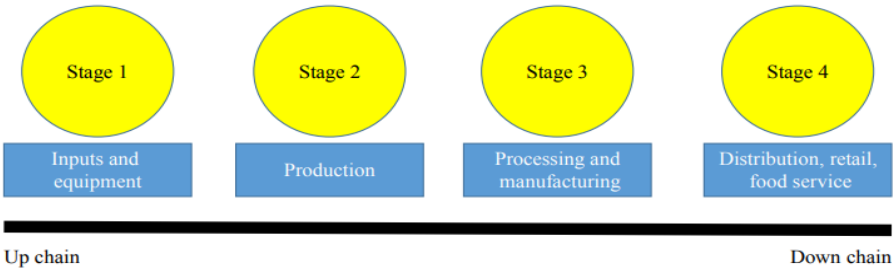

Figure 3-3: Stages of agricultural value chain (Cucagna & Goldsmith, 2018)

In stage one, according to the research, the value of this stage is often influenced by intellectual property. The purpose of enterprises' investment in this field is often to establish their leading position in fields such as seeds, breeding livestock, or equipment, and to enhance their competitiveness by widening the gap between the enterprise and other competitors (Goldsmith, 2001). At this stage, the price of a company's products or services is influenced by its intellectual property rights and brand awareness.

The stage two is all about the agriculture production. At this stage, the profit margin of agriculture products is always low and the differentiation between the same type of products is also low, which results the high competition between the companies. All the actors in this field tried to reduce the cost and improve efficiency to increase their competitiveness (Goldsmith, 2004).

Stage three is transforming the raw agricultural material into products such as food, beverage, or medicine. This stage added value to the agricultural products through methods such as changing the appearance, increasing the nutritional value, or extending the shelf life (Gopinath, 1996). Also, when facing different consumer groups, the requirements of the consumers will also be various, therefore, in order to meet the various requirements of different types of consumers and the modern market, the actors at this stage may pay more

attention to increasing their own competitiveness through increasing the quality of their products or providing different type of products (Omidvar, 2006).

The last stage is about providing services to the consumers. Most of the actors at this stage are retailers. These actors improve their competitiveness through building brand awareness and providing better services. According to the study, larger retailers are constantly expanding their influence and the concentration of the industry is constantly increasing. Moreover, powerful retailers are constantly expanding their business upstream, creating their own production brands and changing the original value chain structure (Burch, 2005).

3.4.3 Agricultural Value Chain Analysis

The value chain is constantly developing, and the factors that restrict the development of the value chain, such as market access, market orientation, available resources and other factors, will also affect the development of the value chain (Trinekens, 2011). As the economies of the developing countries continue to grow, the per capita disposable income of their residents also rises, and the consumers' requirement for high-quality products will also grow day by day, which will change the agricultural value chain system of developing countries. According to the analysis of Trinekens (2011), and Ruben (2007), developing countries often have three value chain systems.

1. A-system represents the local low-income market. Although many individuals participate in the chain, the economic benefits are low. A-system is more common in areas where agricultural production is still dominated by small-scale producers. Taking China as an example, according to the research of Yu & Helian (2003), although chain supermarkets have gained high popularity in China, the fresh agricultural products purchased by consumers are still mostly from the local low-income farmers' markets. In markets like this, consumers are mainly concerned about the quality and price of agricultural products (Wolf, 2005). At the same time, according to Trinekens (2011), the agricultural production system of developing countries has advantages in output volume, but has disadvantages in the field of value generating.

2. B-system stands for local middle-high income market. This system has fewer participants, the organizational degree of participants is higher, and it has greater economic benefits. The output of the B-system is lower than A-system, but since the products under this system can meet national or even international quality standards, its product value is also higher. This also promoted the transformation of agricultural systems in developing countries from A-system to B-system. Taking China as an example, in urban areas, chain supermarkets grew rapidly and farmers' market share gradually shrank (Zhu, 2004). Due to the brand effect and product safety guarantee of supermarket products, the prices of products in supermarkets are often higher than those in farmers' markets.

3. The C-system is about the export market, with better benefits but having higher requirements for product quality and the production capacity of participants. It is worth

noting that the international market has higher requirements for product quality, while developing countries often have not yet formed a systematic and unified quality standard, which has become a challenge that many developing countries must face when conducting export trade (Ruben, 2007).

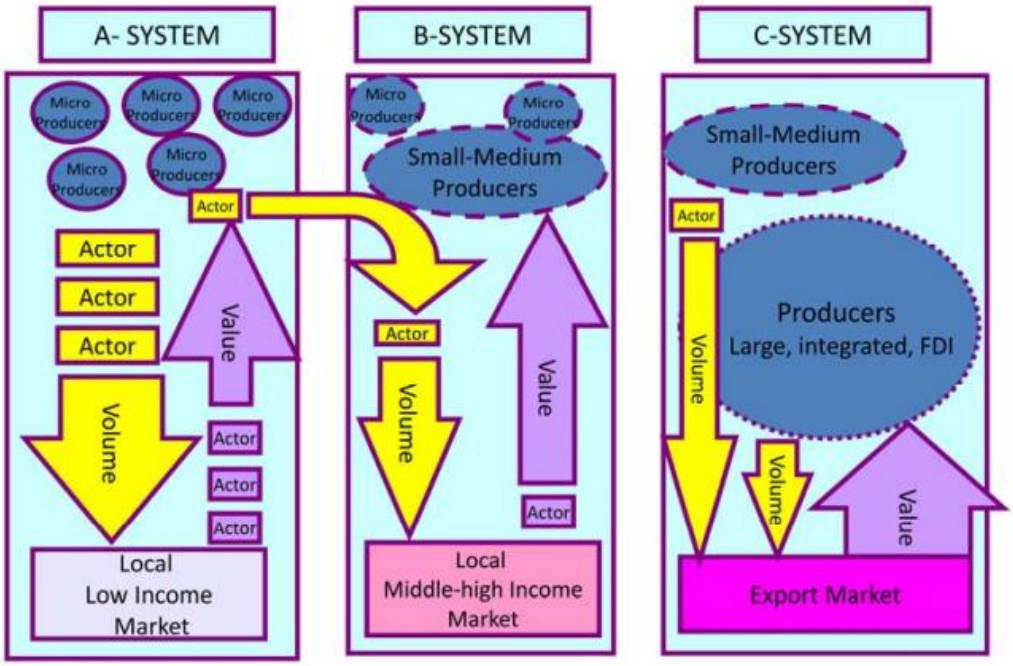

Figure 3-4: Economic sub-systems in developing countries (Ruben et al. 2007)

3.4.4 Agricultural Value Chain Analysis Cases

This study aims to study the velvet antler value chain of China, but according to the research of Li (2011), Zheng (2016) and other scholars, this industry is less developed compared to other main-stream animal husbandry industries, resulting less studies in the velvet antler value chain. Therefore, the study cases of similar agricultural value chains will be helpful and play a reference role in this study.

Since velvet antlers are being regarded as precious medicinal herbs, therefore, the value chain of traditional herb-medicine can play a good reference role. Take the research of Booker, Johnston and Heinrich (2012) on the value chain of herbal medicine in Asia as an example. As shown in the figure below, they have divided the value chain of medicinal plants into several types. Type A value chain is the simplest model. The value chain of this model is to simply and directly connect growers or therapists with patients or consumers. According to the author's summary, the type B value chain is equivalent to an upgrade of the type A value chain. In this mode, therapists can rely on small-scale local sellers to help them ensure their materials. Compared with type A, this mode will have an impact on product quality, product price and other factors. However, this model is still a relatively simple one-to-one relationship, while type C and type D are more complex value chains. These value chains involve more middlemen, and raw materials are purchased from a wider range of primary producers. In this mode, middlemen become a bridge linking primary producers, retailers and consumers.

However, it is worth noting that type C is a national market chain, while type D is an international market structure. Type E are the chains that achieved vertical integration with the participation of multiple companies. Type F represents the chain that is controlled by a single enterprise (pharmaceutical manufacturer / large retailer).

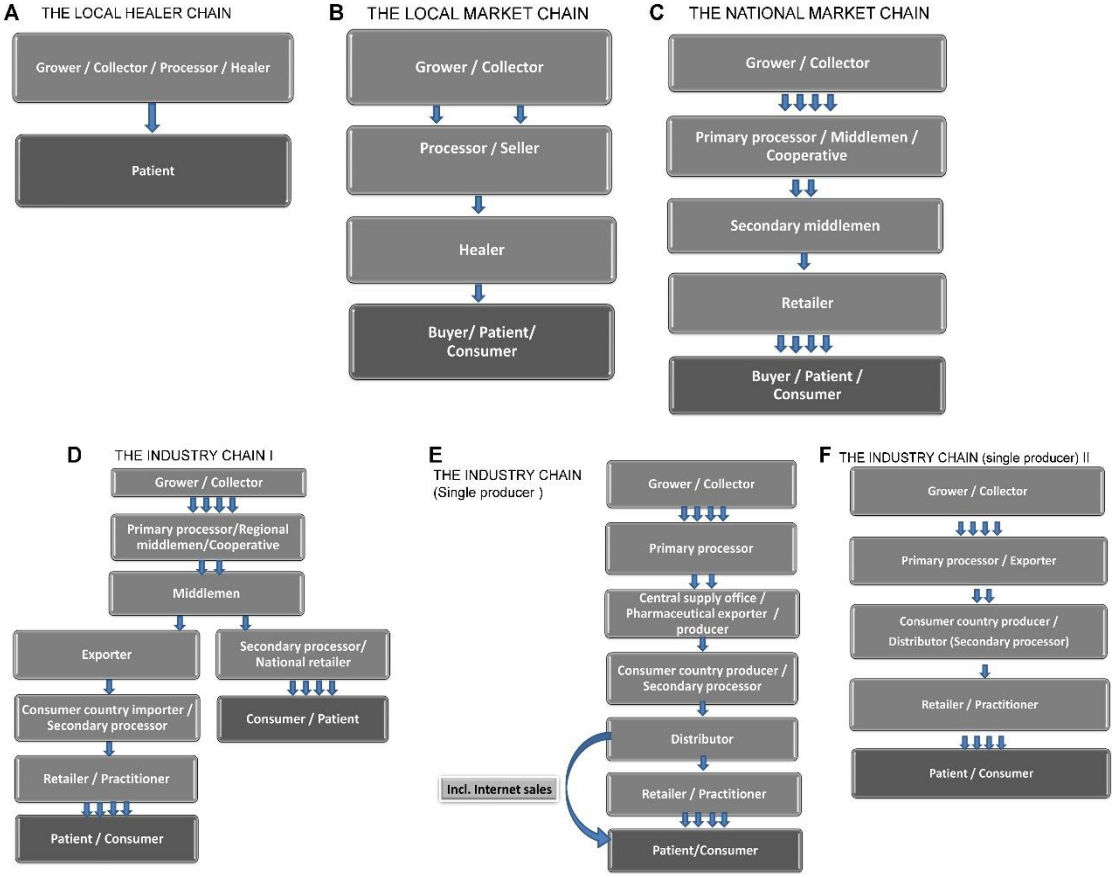

Figure 3.5: Six types of value chain of herbal medicines (Booker, Johnston & Heinrich, 2012)

Second, is the animal products characteristic of the velvet antler. In most cases, there is no need to slaughter deer to harvest velvet antlers, which makes the velvet antler industry fundamentally different from other meat industries. As Goss (1983) summarized, if farmers wish to achieve stable antler production, it is necessary to ensure the life span and health of deer. Accordingly, industries such as the dairy industry, which is based on food products produced by animals, have a better reference role. Here, take the value chain of goat milk as an example. The reason for using the goat milk value chain as an example is that in China's agricultural industry, although the number of sheep is far more than the deer, compared with pigs, cattle and other livestock, the breeding area of sheep is more concentrated in some provinces, which is similar to the deer industry (Fu, 2020). According to the summary of Lie et al (2012), local goat milk will eventually flow to three consumers or markets, home consumption, informational market consumers and local market consumers. The goat milk flowing into the formal market is generally collected and processed by the local milk collector and processing center. According to Cui's (2018) and Wang's (2020) study, the material flow of velvet antlers shows similar characteristics like dairy products.

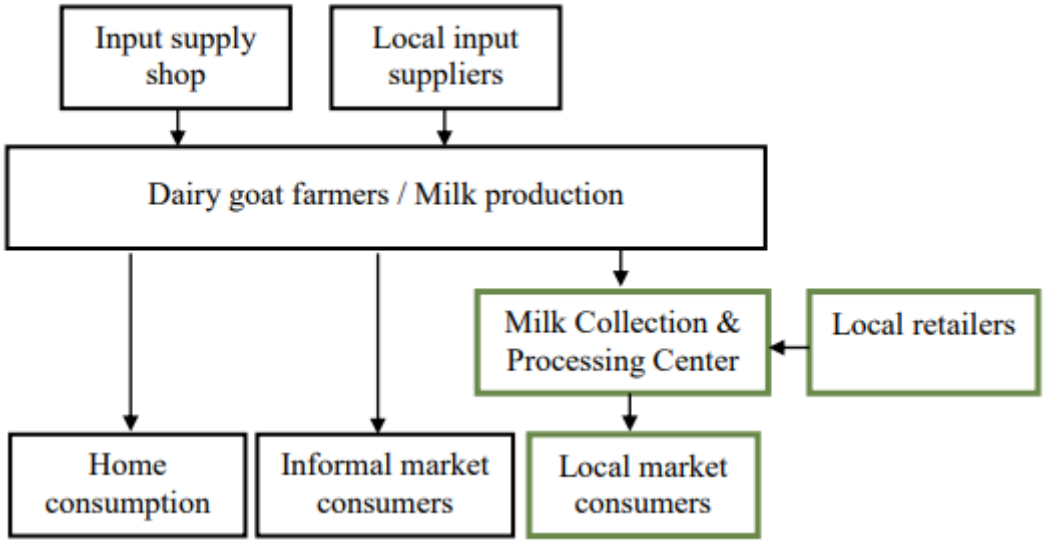

Figure 3-6: The semi-formal value chain of Tanzania's goat milk industry (Lie, Rich, Kurwijila & Jervell, 2012)

Other than China, many countries in the world also have deer industry and have formed a certain scale of antler production capacity. Therefore, the velvet antler industry cases in these countries may also be a good reference for this study. Take New Zealand as an example. The deer in New Zealand were hunted as invasive species in the early days, but the economic value of venison made New Zealanders find business opportunities and convert the original hunting mode to commercial breeding (Nugent, 2001). With the emergence of the international velvet antler market, people have found that velvet antler has a higher value. Therefore, the deer industry in New Zealand has repeatedly shifted its production focus to the velvet antler at the right time (Nixon, 2004). By 2019, New Zealand's export of velvet antlers had reached 700 tons (Uys, 2019). The success of the New Zealand deer industry comes from many factors, such as the establishment of a detailed Animal Welfare Act to ensure that the animal rights and interests of deer are not infringed, reducing the prejudice of animal protectionists against the industry (Walsh, 2002); Establishing good trade relations with trade partners in the Americas and Europe and established a long-term trade chain that can coexist with each other (Beverland, 2005); New technologies were applied to the velvet antler industry in New Zealand and the production capacity was improved (Morris & Archer, 2007). These factors together turn deer, a native invasive species, into a high-yield industry and create the advantageous position of the New Zealand deer industry in the international market. Moreover, according to the summary, the velvet antler industry in New Zealand (Pearse, 2022) and Australia (Tuckwell, 2001) have already established a traceability system for their products, which can provide consumers with detailed product information and sufficient food safety guarantees. All these will be important elements for this study to refer to.

3.5 Opportunities and Challenges for livestock industry value chain development in developing economies

As Fearne (2012) concluded, value chain analysis can be used to reveal the dislocation of strategy and operation within the value chain. If researchers wish to achieve their goal, they need to analyze the framework of the value chain and determine the good or bad factors that affect the chain. Therefore, it is also important to analyze the opportunities and challenges of the value chain (Zamora, 2016). Howieson (2016) also believes that identifying the opportunities and challenges is one important step for value chain analysis. However, the value chain is not homogeneous. Managers' investment in different directions may lead to different results. Therefore, it is necessary to analyze the opportunities and challenges of each step of the value chain (Kaplinsky, 2000). For example, in the process of economic globalization, as the food standards in various countries continue to improve, small farmers who cannot meet the requirements of overseas standards due to poor economic and low technical levels will lose the opportunity to send their products to overseas markets that have better profits, which has become a challenge for small farmers in developing countries (Lee, 2012). But correspondingly, the improvement of product standards will also encourage the farmers to improve their product quality and enhance their competitiveness.

3.5.1 Opportunities

Many factors may have a positive impact on the agriculture industry, whether it is technological progress or better management model. However, according to Deichmann (2016), the development of information technology is an important opportunity that will change the agricultural industry, especially in developing countries. Deichmann’s research has proposed that in the past, the integration level of agricultural markets in developing countries was low and agricultural markets showed a highly localized characteristic. Buyers and sellers were limited in a small market due to the influence of distance and the inconvenience of information transmission. If practitioners want to establish connections with distant buyers or sellers, they need to pay high search costs. Intermediaries can indeed alleviate this problem, but according to Prahalad (2002), in many cases, intermediaries are exploitative and their efficiency may not be ideal. The intervention of intermediaries will increase the transaction costs and time. What is more important is intermediaries will use information gaps to obtain more benefits and put themselves in an advantageous position in negotiations. The development of information technology can improve the transparency of prices and reduce the dependence of buyers and sellers on intermediaries. In the research about fishermen in India, researchers found that mobile phones and new social patterns have a positive effect on reducing transaction costs, helping buyers and sellers form an efficient connection (Steyn, 2016). In research targeting the Chinese market, it has also been found that new social media and e-commerce platforms can help reduce transaction costs for farmers and help them sell their products to further markets (Ma, 2022). Chen (2022) also pointed out that trading platforms that directly connect buyers and sellers can reduce unnecessary trading stages and

improve efficiency. In China, the promotion of e-commerce platforms such as Taobao has also provided assistance in selling local special agricultural products to further markets (Zhao, 2016).

Another assistance that information technology can bring to the agriculture industry is that it can improve the popularization efficiency of new technologies among farmers (Deichmann, 2016). According to the summary, after the development of new technologies such as better breeding methods, it probably will be impossible for most farmers to have access to it in a short time, especially in developing countries. But the information technology is helpful for the popularization of technology. In Getahun's (2020) research, new information technologies helped transmit agricultural information in Ethiopia's agricultural industry. Information technology also helps Chinese farmers to receive new agricultural technologies more quickly (Zhang, 2019).

The improvement of information technology can also contribute to the development of other supporting industries. Among all supporting industries, the improvement of the logistics system has a significant impact on the agriculture industry. According to Deichmann (2016), the efficiency of the logistic system relies on the efficiency of information transmission, and only with a better information interchange system can the enterprises maintain full monitoring over the whole transportation process. This leads to another opportunity that is helpful for the agriculture industry, which is the development of logistics systems. According to Wu (2018), the development of logistics systems plays an important role in the transportation of agricultural products and the development of the agriculture industry in China. The cold chain logistics system developed from the original logistic system also plays an important role in the agriculture industry. This technology not only enables agricultural products to remain fresh during transportation, but also reduces transportation losses (Han, 2021). In recent years, China's cold chain system has been continuously improving. According to Shen (2020), by the end of 2019, the total capacity of refrigerated warehouses in China had reached 60.53 million tons, and the number of refrigerated trucks for the cold chain had reached 212,700. These are beneficial for the development of agriculture.

Another factor that has a significant impact on the development of agriculture is policy adjustments. According to Trienekens (2011), policy adjustments often have a significant impact on the industry, especially in developing countries. Imperfect policies may become obstacles to the development of one industry. Correspondingly, a good policy can provide assistance to the industry. Taking China's deer industry as an example, before 2020, domestic deer were classified and managed as wildlife in China, there are many restrictions on breeding deer and trading deer products, which has led to long-term restrictions on the development of China's deer industry and the supporting industries. The industry standards affected by these factors were also incomplete. In 2020, the new policies lifted the restrictions and brought policy dividends to the development of China's deer industry (Fu, 2021). The relaxation of policies has also attracted more investment to the industry, which further promotes its development.

For China’s velvet antler industry, another opportunity is market changes. Velvet antler is a precious traditional Chinese medicine and health product, recognized by Chinese consumers. However, due to its relatively high prices and the characteristics of non-daily necessities, the size of its consumer group is limited (Yu, 2016). The changes in the healthcare product market have brought opportunities for the development of the industry. According to Wang's (2022) summary, the development prospects of China's healthcare product market have a bright future. The healthcare market size in 2019 reached 222.7 billion CNY (30.55 billion USD), increased to 270.8 billion CNY (37.15 billion USD) in 2021, and is expected to exceed more than 325 billion CNY (44.59 billion USD) in 2023. In addition, according to Xing's (2021) summary, the impact of the epidemic and the increased emphasis on health issues among consumers can all promote the development of China's velvet antler industry. Moreover, according to Ren (2022), a new concept of ‘health punk’ is becoming increasingly popular among young people in China. The essence of this concept is that young people know their lifestyle is unhealthy, but they are unable or unwilling to make changes. Therefore, young people begin to rely on taking health products regularly hoping to improve their health condition. The popularity of this concept represents that the youth group that was not originally considered as ideal customers of health products are becoming health product users, and according to Zhang (2020), this market has great potential.

3.5.2 Challenges

According to Trienekens (2011), the lack of access to resources and infrastructure will influence the agriculture industry. Resources contain many elements, including physical resources such as infrastructure and intangible services such as credit services. First, is the crisis on germplasm resources. The protection of germplasm is important for the agriculture industry, for it can provide stable genetic resources for the future development of the agriculture industry. The degradation of the local breed will lead to a decline in local agriculture producers’ competitiveness. For example, the Georgia farmers found they were unable to compete with the imported products due to the lack of competitiveness of domestic breeds (Kharaishvili, 2018). According to Xing (2021) and Zhang (2021), China’s deer industry is facing a germplasm resources crisis. There are over 20 types of hybrid deer in China (Mi, 2014). Some hybrid deer are similar to purebred deer and difficult to distinguish. The continuous increase in the number of hybrid deer breeding is likely to lead to the degradation of germplasm resources, and this may lead to a decline in domestic deer products’ competitiveness (Xing, 2021).

Second, is the lack of professional knowledge, technology and resources. In Pakistan, researchers found that most of the small and medium farmers lack knowledge about marketing and professional agricultural management (Hassan, 2021). Low management levels and lack of resources will affect agriculture production or even cause disease outbreaks among livestock (Madan, 2005). In India, researchers found that farmers generally lack understanding of some animal epidemics, which affect the production of the farm (Singh, 2019). In China’s deer industry cases, since deer have a certain degree of anti-disease ability, it is sometimes hard for the farmers to find out the actual health condition of the deer (Zhang,

2003). Which makes diseases also become problems challenging the deer industry. In Fu's (2013) survey of 630 deer serum samples from 8 farms, they found the positive rates of tuberculosis and brucellosis were 19% and 28%. According to Zhang (2021), there are over 70 types of diseases that may occur in deer farms.

Third, is the lack of labor. Agriculture is a typical labor-intensive industry in developing countries, especially in areas with low levels of mechanization (Grabowski, 2015). Labor loss and population aging have become the main problems affecting agricultural production. More and more rural young laborers choose to migrate to cities for higher wages (Liu, 2020), and according to Qian (2016), most of them are unwilling to come back. Moreover, as young people migrate to cities, the phenomenon of aging has become increasingly evident in rural areas (Baozhong, 2022). And this problem is more severe in underdeveloped areas. In Northeast China, due to the stagnation of local economic growth, most young people leave their hometowns for better jobs, and the problem of population loss and aging has become more serious (Ma, 2020). The reduction of labor not only affects agricultural production efficiency (Zhu, 2018) but also influences the popularization of new technology. Sun (2021) and Cui (2018), found that middle-aged and elderly farmers have lower enthusiasm for adopting new technologies.

Fourth, is the geographical location of producers. Giuliani (2005) pointed out that the closer the company is to its target market, the higher efficiency it has in adjusting its production activities based on feedback. The longer distance between buyers and sellers will affect the efficiency of market information transmission and the chance of seizing opportunities (Han, 2010). Also, the long distances will force buyers and sellers to pay more transportation fees (Issahaku, 2012). Taking Russia's velvet antler industry as an example, the final price of the product will be greatly influenced by the transportation costs (Zuve, 2020). Lost during transportation is also inevitable. A study on the African tomato industry shows that 20% of the farmers need to bear the losses caused by transportation (Arah, 2015). According to Gao (2015), the loss of Chinese agricultural products during transportation may reach 25-30%. Unprofessional logistics companies may also increase loss during transportation (Zheng, 2018).

Fifth, is financial challenges. Most agriculture producers in developing countries are small farmers, they have insufficient funds and limited scale (Minot, 2018). And are fragile when facing challenges (Harvey, 2014). Farmers need funds to expand their business, but, according to Abdesamed (2014), smaller enterprises are easily affected by economic risks and are unwilling to take more risks. This makes farmers unwilling to undertake more economic burden. In the case of Kenya, researchers found farmers are unwilling to borrow loans to expand their business (Shee, 2015). In the study of farmers in Jilin, the lack of guarantee mechanisms also influences farmers' enthusiasm for borrowing loans (Chen, 2021).

The sixth is production capacity. According to the data from the third agricultural census (2017), the number of small farmers in China accounts for over 98% of agricultural business entities. In Zhang's (2021) study, most deer farmers in Jilin province are small farmers, with

only 47% of the deer farms owning over 100 deer. Low levels of specialization and production capacity are the common characteristics of most small farmers (Hazell, 2005). These problems made small farmers unable to compete with international peers who have better technology (Carte, 2010). The survey in Nepal also found similar problems (Kc, 2019). Wang (2012), Zheng (2016) and Xing (2021) also pointed out that international peers are already in an advantageous position when competing with the domestic velvet antler industry, and China had already become the main market of international velvet antler, which is a challenge to domestic producer. Other than this, small producers generally tend to seek more benefits for themselves and lack sufficient loyalty to the chain (Cui, 2018), and as Kanda (2009) summarized, the conflict of goals between members has a negative influence on the value chain.

In Trienekens' (2011) theory, another obvious challenge for the agricultural industry is institutional voids. Developing countries often have incomplete standards and regulations due to the disadvantage of backwardness (Liu, 2018). The backward standard may become an obstacle for producers who try to expand the market (Henson, 2001). According to Sun (2018) and Zhang (2019), there are more than 1,200 standards in China's deer industry, but only 4 of them are national standards. The structure of the standards is unreasonable and some of the standards are already backward and unable to provide references for the industry (Zhang, 2017). The private standards lack transparency and authority, not suitable for the entire industry (Webb, 2015). Bad policies can also have negative impacts on agriculture. Taking Sri Lanka as an example, the wrong organic agriculture policy has had a catastrophic impact on local agricultural production (Nordhaus, 2022).

From the relevant research, another challenge faced by the domestic velvet antler industry is lack of trust. According to He (2017), there are counterfeit and inferior velvet antler products on the market. Researchers collected 40 different velvet antler products from different sources, of which only 20% are Sika deer, 15% are Wapiti deer, and the rest of them are antlers that are not recognized by the Chinese market (Gao, 2016). This phenomenon seriously damaged the credibility of the local velvet antler industry. And once the credibility of the food industry is damaged, it will be hard to rebuild. The impact of the Sanlu incident on the dairy industry is a typical example (Maitiniyazi, 2021).

3.6 Conceptual Framework

This section is about the conceptual framework of this study. According to Leavy (2022), the conceptual framework can provide a map of the research problem by linking all the relevant conceptions (Leavy, 2022). The literature review provides theoretical approaches to the value chain, the steps of value chain analysis and the usage of value chain analysis in the agriculture field. The literature review also provides the potential opportunities and challenges that China's velvet antler industry may face. Therefore, based on the research question, research objectives and the literature review, the conceptual framework of this study is as follows.

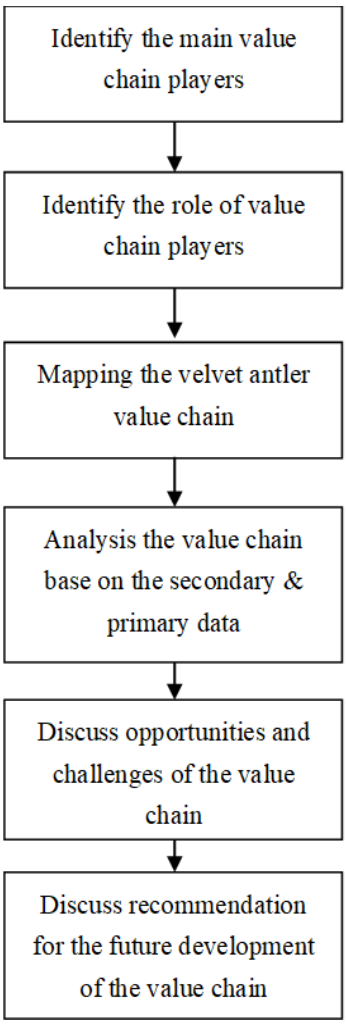

Figure 3-7: Framework of the thesis

Chapter 4 Method of analysis

This chapter introduced the method of analysis adopted by this study. The first section is about the research questions and objectives. Section two introduces the research philosophy and approach. The third section introduces the research method adopted by this study. Section four introduces the study area. Section five outlines the sampling approach of this study. Section six carries out the data collection method. Section seven explains the data analysis. Section eight talks about the ethical considerations of this study.

4.1 Research Questions & Objectives

Questions

What is the current situation of China's velvet antler industry? What opportunities and challenges does this industry face? How will the industry develop in the future?

Objectives

1. Mapping the velvet antler value chain.
2. Developing a framework for analyzing the velvet antler value chain in the study area.
3. Analyzing the opportunities and challenges of China’s velvet antler value chain.
4. Providing recommendations for China’s velvet antler value chain.

4.2 Research Philosophy and Approach

According to Zukauskas (2018), generally, there are four common research philosophies applied to the research, that is pragmatism, positivism, realism and interpretivism. Pragmatist research philosophy focuses on the facts. In this theory, the research problem determines the choice of research philosophy. It believes that the external world will have influences on the researchers’ point of view. Positivist research philosophy claims that the social world is objective and can be understood by the people in an objective way. Researchers are objective analysts and should be free from any prejudice. Realistic research philosophy believes that the world is objective and independent from humans’ thought but the researchers are biased. Interpretivist research philosophy believes that the world can be interpreted subjectively. The researchers are part of the research as their research behavior will interact with the subject they are researching. Because the aim of this study is to study China’s velvet antler value chain, analyze the opportunities and challenges faced by the participants and conduct interviews with practitioners. Researchers cannot be completely independent from the research and will have certain subjective factors. Therefore, this study adopts positivist research philosophy approach.

Based on the purpose of the research, it can be divided into three types, descriptive,

explanatory and exploratory (Taherdoost, 2022). Descriptive research is suitable for research that tends to define or describe a particular phenomenon. It aims to find connections between different things and offer sufficient information. The explanatory research is suitable for the research seeking to answer the question 'why'. It is for researchers who are trying to find an answer to the phenomenon. Exploratory research is for the field with less research and information or is at an early stage. This type of research is suitable for researchers who wish to come up with some initial understanding of the question and further carry out more extensive study. Since the velvet antler industry in China is a non-mainstream industry compared to other animal husbandry industries, the lack of government attention has made it difficult to obtain specific data about the actual status of the industry. Researchers need to construct a correct understanding of this value chain through field investigations and face-to-face interviews. Therefore, this study can be classified as an exploratory study.

4.3 Research Method

There are three types of research method strategy that researchers can choose, quantitative, qualitative or mixed methods strategy, and all these methods have been widely used (Edmonds, 2016). Quantitative method pays more attention to data, it puts more emphasis on the analysis and deduction of the theories found in the research based on the actual data (Paley, 2000). Qualitative method is a more subjective method, which focuses on words rather than numbers. It infers the nature and development trend of things by relying on the rich practical experience, subjective judgment and analysis ability of researchers or participants in the research content. There are always debates about quantitative method and qualitative method, some argue that the quantitative method is more objective, while others claim that the qualitative method has less restriction and participants can express their real thoughts (Sale. 2002). Both methods have their own advantages and disadvantages and this study chose to use the qualitative method. According to the summary of Cooper (2006), the qualitative method is more suitable for exploratory research. And qualitative research can analyze the information collected by researchers during interviews in a more flexible way (Mbaka, 2021).

Survey research is one of the most widely used research methods (Mukhopadhyay, 2014). Survey research is usually conducted through structured or semi-structured questionnaires and interviews (Bhattacherjee, 2012). A structured questionnaire consists of standardized closed questions and respondents need to choose from several predefined answers. This mode is simpler, faster and researchers can complete interviews more efficiently and it does not require stable connections between researchers and interviewees. But it also has some shortcomings, respondents can only passively choose from predefined answers and the closed questions do not take the respondents' viewpoints or attitudes into account, making it hard to further probe deeply into the questions (Bhattacherjee, 2012). The semi-structured questionnaire, on the other hand, can include open-ended questions and therefore collect more additional information. The advantages and disadvantages of a semi-structured approach are also obvious. This model allows respondents to more fully express their views and opinions on the questions, which is beneficial for researchers to gain more information about the

question. As for the disadvantages, the respondents' views on certain issues may be subjective, researchers need to think independently and ask further questions when it is necessary. Also, unlike structured questionnaires, this method may take more time (Bhattacherjee, 2012). Questionnaire surveys can be divided into various methods such as face-to-face interviews, mailing and online (De Leeuw, 2008). Methods such as online or email are convenient, the common problem is that the response rate will be very low. Face-to-face may consume more time, but it can form connections between the researchers and respondents and give the researchers a chance to explain the questions and further investigate. Since the relevant data about the velvet antler value chain is not sufficient. Therefore, it is necessary to obtain sufficient relevant information and their opinions on certain questions from practitioners as much as possible. Moreover, the majority of respondents do not speak English, so sufficient translation is required during the interview. Therefore, this study adopted the semi-structured questionnaire and was conducted through face-to-face interviews.

Before conducting the interview, the researcher first agreed with the time and location with the interviewees, as well as the duration of the interview. Before the interview actually begins, the researcher first introduces himself, creates a harmonious environment, explains the purpose of the interview and the rights of the interviewees and provides a translated questionnaire. During the interview, both written and audio recordings were made to ensure the accuracy of the information. When conducting the interview, the researcher first began with simple questions and then moved to complex questions. The main purpose of this is to let the interviewee gradually adapt to the interview and have better control over the pace of the interview. When respondents answer questions, the researcher chooses the appropriate time to expand the questions to collect more useful information. The researcher mainly plays a guiding role in the interview process.

4.4 Study Area

Jilin Province of China is the main research area of this study. There are several reasons why Jilin Province was selected as the main research target. First, Jilin is the largest velvet antler producer in China. According to ‘Jilin Sika Deer Industry Development Plan’ (2021-2025) released by the provincial government, by the end of 2020, the number of Sika Deer raised in the province alone had reached nearly 600,000, accounting for about 50% of the total amount of the country and the output of fresh velvet antler had reached nearly 900 tons. The province also has nearly 4,000 deer farms, more than any other province.

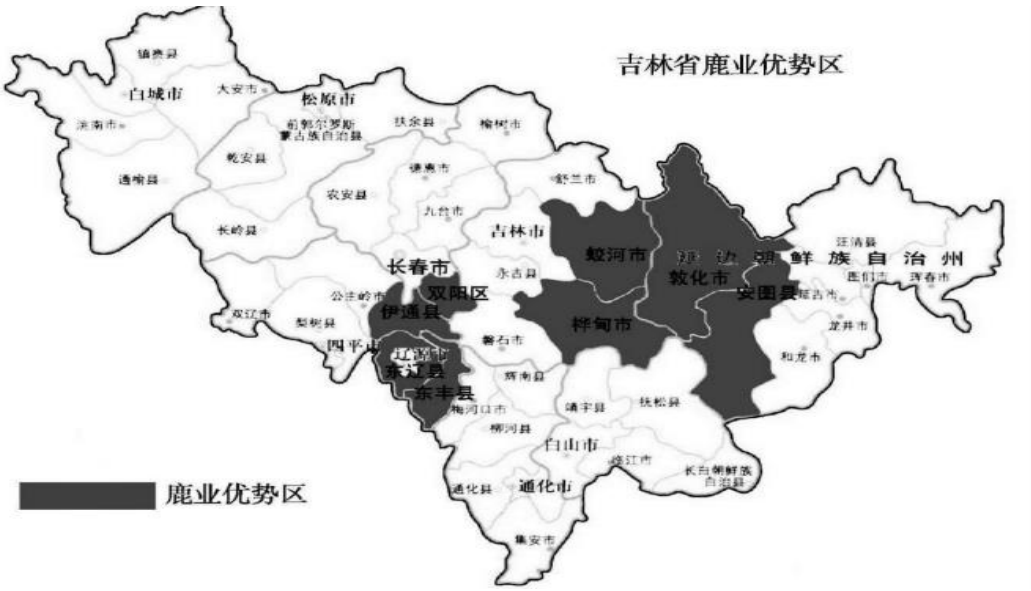

Figure 4.1 Jilin Deer Industry Advantage Zone (Zheng, Quan, Ling, Zhang & Liu, 2016)

Second, the upstream and downstream supporting institutions of the deer industry in this province are larger than those in other provinces. The Institute of Special Animal and Plant Sciences of CAAS and Jilin Agricultural University located in Jilin province are leading scientific research units in the deer field in China. There are also a large number of food, medicine and health care products production enterprises using deer products as raw materials in this province, which has formed an industrial cluster. This enables the researcher to have easier access to midstream and downstream practitioners in the velvet antler value chain and collect useful information

About the definition of deer farm scale, according to Jilin province local regulations, farms that raise more than 30 deer can be defined as scale farms, but there is no further classification about the deer farm based on this. But in the “Scale Standards and Filing Management Measures for Livestock and Poultry Farms (Trial) (Draft for Soliciting Opinions)” which was published by the Ministry of Agriculture and Rural Affairs of the People’s Republic of China in 2023, it provides a further requirement on the scale of the large deer farm, the farm that raises 500 deer by the end of the year as a scaled farm. Therefore, combining these two standards, in this study, the small-scale farm has less than 30 deer, the medium-scale farm has more than 30 but less than 500 deer and the large-scale farm has more than 500 deer. In addition, the deer population data of the farm refers to all the deer on the farm, not just the male deer that produce antlers.

4.5 Sampling Approach

Sampling is an important part of any research, which can effectively reduce the potential threats of over research or insufficient sampling after setting clear sampling standards (Boddy, 2016). Sampling technology includes both probabilistic and non-probabilistic sampling. Probability sampling includes simple random sampling, systematic sampling, stratified

sampling and cluster sampling. Non-probability sampling includes convenience sampling, voluntary response sampling, purposive sampling and snowball sampling (Acharya, 2013). In this study, the target interviewees include deer farmers, intermediaries, processors, distributors, retailers and other individuals who participate in velvet antler production, processing and sales as their source of income and the income of this business accounts for nearly 50% of their total income. In the probability sampling method, because the selection of samples is random, the probability of each individual in society being selected is equal. Non-probability sampling, on the other hand, uses a subjective, non-random method to select suitable samples from the population, resulting in some groups in the society not being selected. This study used purposive sampling. Firstly, due to the large population base of the research area, limited by time and other factors, it is not suitable to adopt probability sampling. Secondly, purposive sampling can let researchers choose the most suitable interviewees by relying on their own judgments. Some local practitioners have a short working time and lack understanding of the current situation of the velvet antler industry, making them unsuitable as interviewees, probabilistic sampling may not be suitable for this study to collect relevant data and information.

During the field investigation, 19 different value chain actors were interviewed. They are:

- Ten farmers (Producers)
- Two collectors
- Two processers
- Two distributors
- Three retailers

4.6 Data Collection

Other than collecting primary data through semi-structured questionnaire interviews, it is also necessary to collect secondary data as support. Primary data is the first-hand data collected by researchers themselves, while secondary data is the relevant information collected by non-researchers for other purposes (Rabianski, 2003). Secondary data can help researchers save time and costs, but it is worth noting that whether secondary data has sufficient accuracy, relevance and timeliness needs to be tested and verified by the researchers themselves (Kalu, 2019). The secondary data of this study was collected through government documents, company documents, newspapers and magazines and other information sources.

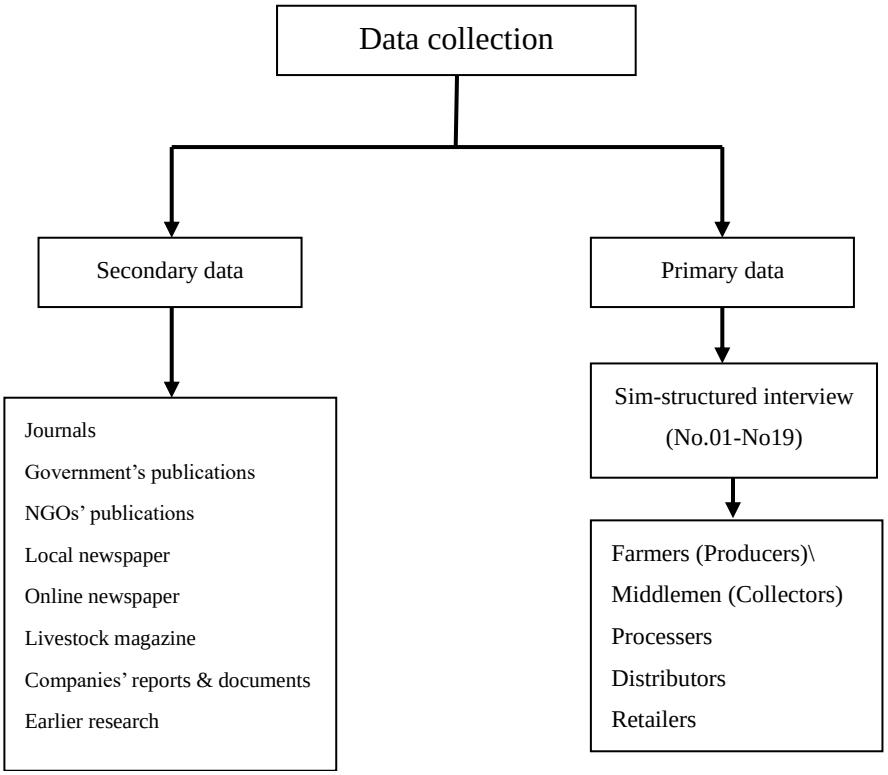

Figure 4-2: Source of data collection

4.7 Data Analysis

In Dey's (2003) qualitative data analysis technique, the whole process of data analysis can be divided into three steps, as shown in Figure 4-3, the three steps are describing, classifying and connecting. Describing is transforming the information that the researchers collected during the investigation into written form. Classifying is about reclassifying the transcribed data. The final stage of the data analysis is connecting, the researchers need to confirm the connection between themes and connect the data into reasonable and meaningful relationships (Dey, 2003). The data analysis method adopted by this study has followed this structure. First, convert the recordings obtained during the interview into detailed and accurate written text. Second, the transcribed results are graded based on elements such as content and relevance. Finally, search for the connections between data of different themes. Repeat this process multiple times during the data analysis process until the researcher has formed a deeper and clearer understanding of the research objectives. In actual operation, the researcher divides all the transcript interviews into detailed sections based on the questions raised during the interview, highlights all important information and simplifies them to eliminate useless information. Finally, find the connection between these information. For example, what are the main challenges faced by the farmers and how do these challenges influence the management of the farm, which further affects farmers' planning for future business.

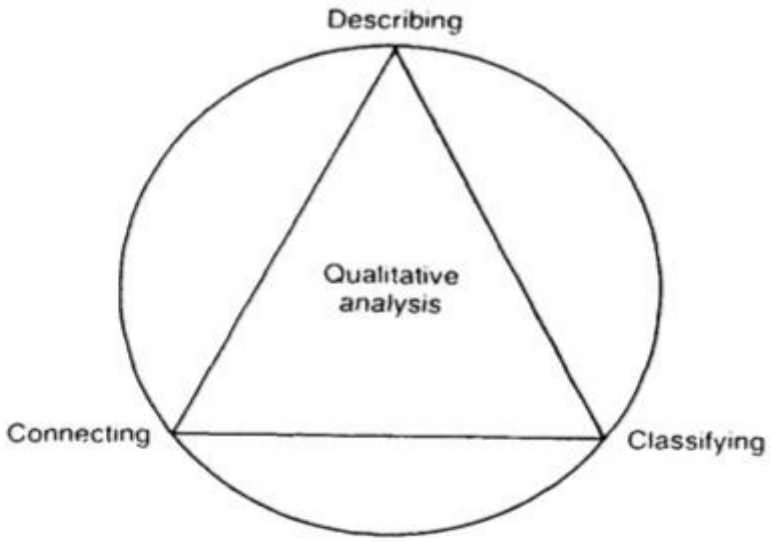

Figure 4-3: Qualitative data analysis process (Dey, 2003)

4.8 Ethical Considerations

This study had been assessed and approved by the Massey University Human Ethics Committee as a low-risk study for the respondents. The study was conducted under the requirements of "Massey University the Code of Ethical Conduct for Research, Teaching and Evaluation Involving Human Participants". Before the interview formally started, the researcher informed the interviewees of all important information such as their rights, the purpose of the study, the potential risks, etc. All interviewees volunteered to take part in the interview. Through the whole interview process, the interviewees were free to withdraw. If any questions they found uncomfortable or inconvenient to answer, they had the right to refuse to give an answer or ask to suspend the interview. Throughout the whole research process, the anonymity of the interviewees was maintained. The researcher made sure that all the sensitive information such as ID, income and price was not to be published or given to any people or third party and the respondents had been informed of that.

Chapter 5 Results

This chapter introduces the results of this study. Section one introduces the material flow of the velvet antler. Section two provides an analysis of the value chain actors. Sections three and four describe the challenges and opportunities of China's velvet antler value chain.

5.1 Material Flow of Velvet Antler

This section will draw the entire material flow of velvet antler products from fresh velvet antlers harvested by farmers to the products purchased by consumers, and explain what activities each value chain actor conducts and how it influences the products.

5.1.1 Raw Material Harvesting

As the beginning of velvet antler products, harvesting fresh velvet antlers is the main task of producers. The factors that influence the price and quality of fresh velvet antlers are the breed of the deer, the harvesting time and the harvesting method.

According to the summary in Chapter 2, there are three types of deer that produce antlers in China: a) Sika deer, b) Wapiti deer, and c) Hybrid deer. These deer have their advantages and disadvantages, but affected by the traditional perception of the Chinese market, Sika deer velvet antler is considered the best by Chinese consumers, but the price is also higher.

the production capacity of male deer over three years is stabilized, and velvet antlers can be harvested at least twice a year in June and August. Antlers will continue to grow over time and grow new branches through the whole process until they ossify and become low nutritional antlers. Therefore, choosing a good harvesting time is important for deer farmers since the shape of the velvet antler will also influence the price. The common sika deer velvet antlers and wapiti deer velvet antlers on the market can be roughly divided according to the following standards. Notice, the Hybrid deer velvet antler normally will be sold in the name of the type of deer it looks like.

a) Sika deer velvet antler

There are two types of common Sika deer velvet antler in the China market: Two-branches Sika deer velvet antler and three-branches Sika deer velvet antler

Two-branches Sika deer velvet antler

Two-ranches mainly refer to Sika deer velvet antlers with one side branch. Due to their short growth time, these types of antlers have a lighter color, soft and dense fluff, softer texture, higher nutritional content, and higher unit price. Two-blanches is the most popular

type of velvet antler in the Chinese market, according to a survey.

In the market, two-branches will be divided into two categories: first-harvest and second-harvest. Since velvet antlers can be harvested twice a year, after the first harvest, new antlers will grow again from the incision. The growing time is limited, second-harvest is generally two-branches velvet antler. and because it is grown from the incision of the previous harvest, the quality, appearance and price of the second-harvest are lower than the first-harvest.

Figure 5-1: One typical two-branches velvet antler

Three-branches Sika deer velvet antler

Three-branches mainly refer to Sika deer velvet antlers with two side branches. Due to its longer growth time, this type of velvet antler has a darker color and harder texture. The fluff on the antler is sparse, and the bottom of the velvet antler is ossified. Due to its lower nutritional value, the price of three-branches is lower than two-branches.

Figure 5-2: One typical three-branches

b) Wapiti deer velvet antler:

Wapiti Deer velvet antler is also a recognized velvet antler in the Chinese market, but compared to the Sika deer, Wapiti deer velvet antler's nutritional value is considered to be lower, the popularity and price are also lower. This type of velvet antler on the market is also distinguished by the number of side branches, but unlike the Sika deer velvet antler, although the price may be influenced by the number of branches, the overall price difference is not significant. In the field investigation, the number of Wapiti deer raised by farmers in the study area is relatively small, and the number of Wapiti deer velvet antlers in the local market is also relatively small. According to local news reports, there are people selling Wapiti velvet antlers in the name of Sika deer velvet antlers, making Wapiti deer velvet antlers not very popular among consumers in the local area.

Figure 5-3: Wapiti deer velvet antler

c) Hybrid deer velvet antler

Hybrid deer velvet antler is a special category, they are not sold in the name of the hybrid deer. Hybrid deer and the velvet antler they produced are sometimes unable to distinguish through obversion. Therefore, the hybrid deer velvet antlers are usually sold in the name of the type of deer it looks like.

In the Chinese Pharmacopoeia, both Sika deer velvet antlers and Wapiti deer velvet antlers are considered nutritious and valuable medicines. However, in traditional Chinese medicine theory and consumer consumption concepts, the quality and efficacy of the Sika deer velvet antler are better than Wapiti deer velvet antler and other deer antlers. Therefore, in the market, the average price of Sika deer velvet antler is always higher than Wapiti deer velvet antler, and Sika deer velvet antler is also the more popular product in the market.

The primary task of velvet antler harvesting is to keep the deer stable. According to the deer farmers, there are two methods to keep deer stable, the mechanical method and the drug method, sometimes, both of these methods will be used during harvest. The mechanical

method uses equipment to fix the deer, while the drug method uses anesthetic to anesthetize the deer and then fix it. The drug method is more commonly used, because it can minimize the stimulation to the deer, ensure the harvest work and prevent the deer from hurting themselves or personnel due to struggle. After anesthesia, the farmers will pat the deer's face to ensure that it is out of consciousness before starting to saw the deer antler. When harvesting velvet antlers, it is necessary to keep the cut surface flat and finish harvesting as soon as possible. The cutting position should be about 1-1.5cm higher than the antler base. After harvesting, immediately cover the wound with hemostatic powder and fasten the tourniquet. If the blood spurts and it is difficult to stop quickly, then cover the wound with absorbent cotton and then apply the medicinal powder. After the bleeding at the antlers is stopped and dried up, it is necessary to wash the blood around the antlers and the deer's head with liquid medicine and inject wake-up drugs for the deer and keep observation after the deer wakes up to prevent accidents.

5.1.2 Storage

Fresh velvet antler has a short shelf life after harvesting without further processing. Therefore, if it is not possible to process velvet antlers immediately, an appropriate storage method is required. Practitioners will use cling film or vacuum bags to package the fresh velvet antlers separately. Make sure the package is sealed from the outside and store them in the refrigerator or cold storage. However, this freezing behavior cannot last too long because the longer the frozen time is, the nutrient and water loss will become more severe, resulting in a lower price of the velvet antler.

5.1.3 Processing

Due to the short shelf life of the velvet antler, to extend its storage time and make it possible to be sold in the further market, processing is required. The result of this study revealed that most processors adopt traditional processing methods. Some big companies have adopted processing modes with a higher degree of mechanization, but in essence, it is still similar to traditional processing modes. Due to the fact that fresh velvet antler contains water, blood and nutrients, without proper processing, it will quickly decay at room temperature, losing its original medicinal value, and causing serious economic losses to practitioners. Processing velvet antlers is actually about removing water from the antler while maintaining its original form, keeping it dry and beneficial for long-term preservation. Because the weight of velvet antlers will significantly decrease after processing due to the loss of water, the price of dried velvet antlers will also have a significant increase. According to different processing methods, the processed deer antler is mainly divided into blood contained velvet antler and blood drained antler. The processing flow of these two products is generally the same, the main difference between these two types of velvet antler is whether the processer had drained the blood contained in the velvet antler or sealed the incision before the formal process. This section will introduce the steps of processing the velvet antler from the beginning to the end separately.

a) Drain the blood (only required for blood drained velvet antler)

The step of blood draining only exists in the process of processing blood drained velvet antler. Some larger processors use vacuum pumps to drain the blood of the antler. Most small-scale processors will use a needle to pierce 2-3 cm into the medulla of the velvet antler and use an air pump to expel blood out of the velvet antler. Extra caution is required when using this processing mode. If the pump speed is too fast, it may burst the skin of the velvet antler and affect the price of the product. Generally speaking, the step will squeeze out the blood that is about 5-8% of the total weight of the fresh velvet antler.

b) Clean the skin of the velvet antler

The skin of fresh velvet antler is covered with oil, and the oil on the skin is not conducive to subsequent processing, so it needs to be cleaned. The processors will use a soft bristled brush and warm weakly alkaline water at 40 degrees Celsius to repeatedly clean the skin of the velvet antlers. During the cleaning process, processers have to prevent water from flowing into the interior of antlers through the incision at the bottom. After cleaning, it is necessary to rinse again with clean water to prevent residual pollutants.

c) Seal the incision (only require for blood contained velvet antler)

Due to the requirements of retaining the velvet antler blood and other nutrients inside the velvet antler and preventing them from loss during the process, the incisions need to be sealed. The processor will sprinkle flour on the incision and seal it with a soldering iron.

d) Boiling

During the boiling stage, the whole velvet antler except the incision part needs to be soaked into the boiling water with the incision upward and ensure the incision will not contact with water. The velvet antler will be boiled for about 10s and lifted up to check whether there is any damage. If there is no damage, the boiling stage can be continued. The velvet antler will be soaked into the boiling water again and boiled for 10-60s and then lifted up. This will be repeated for 4-5 times. After this, the processer will let the antler cool down for about 20-30 minutes and repeat this stage again. The blood drained velvet antler and blood contained velvet antler are different during this stage. Since the incision of the blood drained velvet antler is not sealed, the blood inside the velvet antler will continue to leak during the boiling stage. When pink blood foam is seen draining from the incision of the velvet antler, it indicates that the remaining blood in the velvet antler has been basically drained. But since the incision of the blood contained velvet antler has been sealed before boiling, the blood will remain in the velvet antler. After the boiling stage, the velvet antler will be cleaned and cooled down for 30-60 minutes and prepared for the next stage.

Figure 5-4: velvet antler at the boiling stage

e) Baking

The purpose of baking is to further dehydrate the velvet antlers. During the baking process, temperature changes may cause the skin of the velvet antlers to expand or burst. Therefore, the processors need to observe the condition of the velvet antler throughout the entire process and control the baking temperature. Before baking, the temperature of the oven needs to be preheated to 70-80 degrees Celsius, and then the velvet antler should be placed flat in the oven with its branches facing upwards. The temperature needs to be stable throughout the entire stage and should not exceed 80 degrees Celsius. The baking time is not fixed and needs to be adjusted based on factors such as the number and size of velvet antlers. When some small oil droplets ooze from the skin of the velvet antler, it represents the baking stage is over.

f) Air-drying

After the baking stage, the velvet antlers need to be airdried. The drying place for velvet antlers requires dryness and good ventilation. The incision of the velvet antler will hang upward during the air-drying process.

Figure 5-5: Velvet antler at drying stage

g) Repeat the boiling, baking, air-drying process

After the above process is completed, velvet antler still needs to undergo the three steps of boiling, baking, and air-drying several times. The purpose of repetition is to disinfect and accelerate the dehydration of velvet antlers. The overall operation process of this stage is similar to the previous stages. After each boiling stage, velvet antler needs to be baked and air dried again. Velvet antler usually needs to undergo 3-4 cycles of processing to meet the marketing standards.

h) Shaping (optional processing stage)

According to the practitioners, when the drying degree of velvet antler reaches 80%, processers can boil the top of velvet antler soft, and press the top of the antler on a smooth and shape the top of velvet antler into a semicircle fist shape. This shape is relatively attractive to consumers, and may sell at a better price.

i) Velvet antler eligibility criteria

The eligibility criteria for processed velvet antlers are the moisture content of it is lower than 18%. The skin of the blood drained velvet antler is supposed to be orange red and glossy; the color of the incision appears pink white. The skin of the blood contained velvet antler supposed to be black brown and glossy, the color of the incision appears dark rad. When meeting all these standards, velvet antlers can be prepared for packaging and marketing.

Different processors may have different requirements during the actual processing process, and according to the respondents, there are no strict requirements in this industry. For some processors, the specific processing process is their commercially confidential and is not publicized to others. Therefore, this chapter only provides a brief introduction. But it is universal that if the processor makes mistakes during process, it may cause damage to the velvet antler and affect the price. Moreover, due to the different quality, weight, and size of velvet antlers, the existing processing technology is not perfect, and there is no systematic and precise processing standard for practitioners to refer to, the processers will have to make adjustments during the actual process. Therefore, experienced processing personnel are important for processors.

Figure 5-6: One traditional process workshop showing in the local museum

Processing velvet antlers requires many infrastructures and devices. The workshop can be mainly divided into two parts: the processing room and the drying room. The processing room mainly includes necessary processing equipment such as a ventilation system, stove, drying box, etc. for boiling fresh velvet antlers. The drying room is a place to air-dries the boiled velvet antlers. This area needs to be kept dry and ventilated at all times, and is equipped with facilities such as insect repellent facilities, fans and shelves.

5.1.4 Slicing and Grading

The processed whole velvet antlers now have the characteristics of long-term storage and can be sold as a product to further markets. But the more common velvet antler products in China’s market are the sliced and graded dried velvet antler slices. The market prices of different velvet antler slices are also different. Since that after the velvet antler is sliced and classified into different products the price between the different velvet antler slices will be great, this section will briefly introduce the classification and differences of different velvet antler slices.

A. Wax slices of deer velvet

B. Half wax slices of deer velvet

C. White powder slices of deer velvet

D. Yellow powder slices of deer velvet

E. Red powder slices of deer velvet

F. gauze slices of deer velvet

G. bone slices of velvet

Figure 5-7: Different types of velvet antler slices and where it from

a) A & B. Wax slices of deer velvet

It is a thin slice cut from the softest part of the tip of the antler. Because the cut surface is translucent and looks like wax, so it is called wax slice. This type's price is the highest and the nutritional value is also the highest. Most people will also divide the wax slices into two parts, the whole-wax and half-wax. The whole-wax slices are the two or three slices taken from the tip of the antler, the traditional Chinese medicine theory regarding this type of antler is the most nutritious, making this kind the most expensive product of all.

Figure 5-8: Wax slice of velvet antler

b) C, D & E. Powder slices of deer velvet

The thin slice cut from the upper part of the antler is called powder slices of deer velvet because the cut surface has fine small holes, just like powder. In the private trading market, powder slices of deer velvet will be further classified into three categories: white powder slices of deer velvet； yellow powder slices of deer velvet； red powder slices of deer velvet. The price and nutritional value of these three types of products also gradually decrease from top to bottom.

Figure 5-9: Different types of powder slices (left to right: White; Yellow; Red)

c) F. Gauze slices of deer velvet

This type of product is a thin slice cut from the middle and lower part of the antler. The

cut surface has large and loose holes, so it is named gauze slices of deer velvet. Because the overall color of this type is dark red, it is also called blood slices of deer velvet in the private market. The nutritional value and price are lower.

Figure 5-10: gauze slices of deer velvet

d) G. Bone slices of velvet

The slice cut from the bottom of the antler. There are obvious bony outer rings on the edge of the slice. It is the category with the lowest efficacy. Because the quality is very low and not favored by consumers, this type is difficult to see on the market. According to respondents, this category is generally ground into powder and used for other purposes.

5.1.5 Packaging

In markets closer to the origin, the packaging of velvet antler products is not necessarily required. But if companies want to sell their products to the national market, enhance brand awareness, or increase product added value, packaging is necessary. Packaging can prevent velvet antler products from being contaminated during transportation, it can attract consumers' attention, and also help enhance brand image. In the market, the packaging of velvet antler products from low-level to high-level is generally plastic bags, paper boxes, wooden boxes, etc. The higher the price of the product, the better the packaging is. Velvet antler slices of different levels will be sold uniformly, a box of well packaged products only includes velvet antler slices of certain grades. From the perspective of the national market, packaged velvet antler products are the most common products for consumers, and packaging can be considered as the final stage of the material flow of velvet antler products.

5.2 Analysis of Value Chain Actors

This section describes the role of different velvet antler value chain players. The actors of China’s velvet antler value chain as shown in Figure 5-11 are input suppliers, producers, collectors, processors, distributors and retailers.

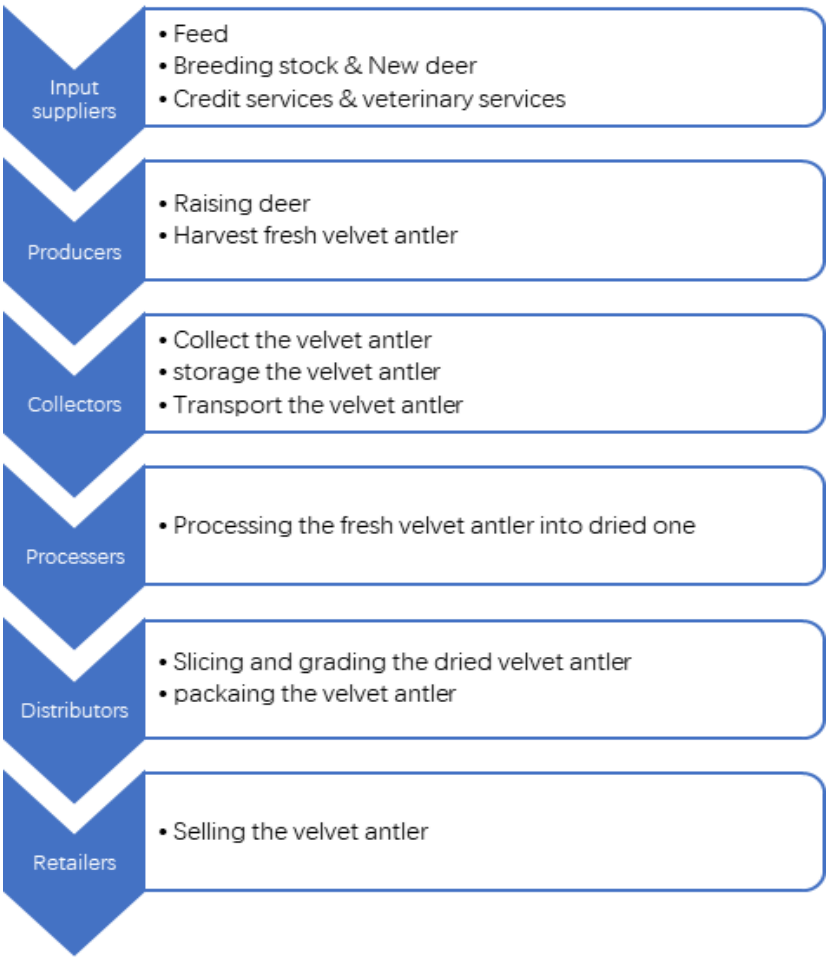

Figure 5-11: Value chain actors and their roles in the value chain

5.2.1 Input Suppliers

According to the survey, the input supplies required by deer farmers include feed, breeding stock & new deer, credit services and veterinary services. This section will introduce these value chain actors.

First, is about the feed. Deer has relatively developed digestive organs and is suitable for a wide range of feed options. The breeding of deer in China is mainly carried out in artificial captivity, with only a small number of large deer farms adopting grassland grazing. Therefore, artificial feeding is the main way for deer to obtain nutrients. Due to the lack of prepared feeds that are specifically suitable for deer, farmers purchase or collect different types of feed and organize the proportion of the daily feed according to the age and variety of the deer. Most farmers mainly use soybean meal, corn as concentrated feed, and hay as the main roughage. Due to the high local grain production (Jilin Province ranks 5th in terms of grain production nationwide in 2022), these feeds are usually purchased locally from the nearby farm or the feed mill.

'There is no ready-made deer specific feed for the deer on the market, so we usually purchase or collect different materials and mix the feed

ourselves.'(Respondent 2)

Figure 5-12: Place where farmers stack and prepare to mix the feed

Among all the input supplements, feed is the most important one. A deer may consume around 4-5kg of feed per day, with an average annual consumption of around 1,500-1,800kg of feed. Therefore, farmers must ensure that sufficient feed is always prepared. According to the respondents, farmers will prepare suitable feed based on local crop resources or use by-products from agricultural production as raw materials for roughage. Other than roughage, farmers also need to mix a certain number of other feeds including concentrated feed, minerals, etc. in the daily feed.

> *'There are many options for feed, my friend as an example sometimes buys vinasse from the winery as feed.'(Respondent 7)*

As for breeding stock and new deer, for farmers in China, there are many ways to obtain them. Farms with a certain scale usually cultivate new deer by themselves, small deer farms sometimes purchase new deer from nearby larger deer farms. Breeding companies that specialize in selling livestock can also provide livestock for farmers. In addition, some small farms do not primarily focus on selling velvet antlers, but rather on selling fawns.

> *'Normally, we breed new deer by ourselves. But if we choose to buy new deer or fawns, we usually go to larger farms or reputable farms in the surrounding area…there is not any company that has a really important role in the field of deer breeding.'(Respondent 1)*

The credit services or loan options are different depending on the size of the farmers. Taking individual farmers as an example, rural credit cooperatives in China offer small loans to farmers, but the loan amount may be relatively small, ranging from 50,000-100,000 CNY (6,910-13,821 USD), with interest rates ranging from 5.60% to 6.40% depending on the loan duration. Farmers can also form joint guarantee groups with multiple individuals to guarantee each other's loans, and in this case, the loan amount will also be higher. The Agricultural Bank of China also provides rural production and operation loan services for the agricultural sector, with a loan amount of over 300,000 CNY (41,464 USD), but the requirements for lenders are

also higher.

> *'If we need loans, we usually go to rural credit cooperatives or agricultural banks, which are close to us. But to be honest, most of my friends and I don't usually go to loans. Most of us are not willing to take more risk.' (Respondent 4)*

The veterinary services are also different depending on the farm scale. Large deer farms often have hired professional veterinarians and researchers, while small and medium-sized deer farms rely on themselves to take care of the health of herds. In addition, the local government where the farm is located also provides professional veterinary services to the farm. When the region is affected by infectious diseases such as anthrax or foot-and-mouth disease, the government will also assist in controlling the epidemic and provide economic subsidies.

5.2.2 Producers

Producers are farmers engaged in deer farming. They mainly breed three types of deer, the Sika deer, the Wapiti deer and the hybrid. The production of velvet antlers is the main reason for \farmers to raise deer. Unlike agricultural models that mainly focus on producing meat or leather, the production of velvet antlers is a long-term and complex process. Velvet antler is a precious material for traditional Chinese medicine and healthcare products, and the price of it is high. An adult male deer can provide velvet antlers for farmers for at least ten years, many farmers raise deer as a sideline to generate additional income, this has led to a large number of local farmers choosing to raise deer. Affected by the material conditions, the scale of the deer farm is quite diverse, from individual farmers who raise no more than 10 deer in their own backyard to large farms with hundreds of deer, they are all the initial producers of the velvet antler value chain

Before China's 'reform and opening up' (which began in 1978), the management model of deer farms in China was mainly state-owned or collective. However, with the development of the economy and changes in business models, China's deer farming industry has developed different business management models. With the gradual reduction of state-owned farms, the majority of farms in the research area now are mainly owned by self-employed farmers and enterprises. Self-employed farmers' farms are entirely managed by individuals, and the scale of the herd is often not too large. The business model is more flexible, but it is also more susceptible to market fluctuations. The scale of farms operated by enterprises is relatively large, with stronger economic strength.

This study divides the producer group into three categories based on the herd scale: a) small-scale producers; b) medium-scale producers; c) large-scale producers. The main difference between these farms of different sizes lies not only in the size of the herd, but also in whether deer farming is the main business of the farmer, the number of farm employees, the professional level, etc. The larger the scale is, the stronger the comprehensive strength it

has. But whether it is a small-scale or a large-scale farm, the management of the deer is the same.

The deer on the farm are divided into three categories based on gender and age: male deer, female deer, and fawn. The male deer takes the role of producing antlers. The female deer produces the new fawn. Fawn plays the role of ensuring the sustainable production of the farm. The management of these three types of deer is different.

Since velvet antler is the main income of deer farmers, taking good care of the male deer is the top priority. Generally speaking, January to March is the early stage for the male deer antler to grow. April to August is the growth period for antlers. Since the production capacity of the male deer over 3 years old is already stable, the farmers generally harvest velvet antlers twice a year in early June and early August, respectively. The mating period is from late August to mid-November, and the recovery period is after November. Farmers will adopt different management strategies and provide different proportions of feed according to different periods. The period that the deer farmers will pay additional attention to is the growth period of deer antlers. During this stage, management personnel will appropriately increase the feeding level, and conditional farms will increase the proportion of nutrient rich green feed and other supplementary feed to ensure sufficient and comprehensive nutrition for the deer to grow antlers. Management personnel also need to ensure the cleanliness of the farm, keep the ground dry and clean, and prevent male deer from getting sick during this stage, which affects the growth of antlers. Moreover, when the mating period arrives, male deer will become more aggressive, so breeders need to pay attention to preventing the herd from engaging in fighting and transferring overly aggressive individuals to the separate deer yard. This can help to prevent the deer from hurting themselves.

For most farms, raising female deer is to ensure the farm has a sufficient supply of fawns, so ensuring the health and reproductive ability of female deer is key for farms to be sustainable. According to the summary, female deer will stop lactation after their fawn is weaned in August and will be able to mate from mid-September to late November. At this period, it is necessary to ensure the nutritional supply of female deer and try to prevent the problems of prolonged breeding periods or infertility caused by malnutrition. The pregnancy period of female deer usually lasts for about 7-8 months. During this period, farmers need to ensure the hygiene of the farm, conduct regular disinfection work, and pay attention to the condition of pregnant deer to prevent miscarriage. After giving birth to the fawn, the female deer will start lactation, which will last for about 90 days. During this period, the farmers need to increase the amount of the daily feed and increase the nutrition of the feed, to ensure the nutritional needs of the female deer during the lactation period. Generally, this stage occurs during summer, when there is a high likelihood for the disease to occur, so farmers need to pay attention to the hygiene of the farm, do a good job in cleaning and disinfection, and prevent the milk of the female deer from being contaminated, which affects the health of the fawn.

The fawn has to be taken good care of after being born. Farmers need to make sure that

the fawn can receive the milk from their mother. As the age of the fawn increases, farmers usually will start providing feed to the fawn when they are about 30 days old. After the deer is about 90 days old, the fawn will be weaned based on the health condition of the fawn. Weaned deer still require additional attention from farmers and require domestication and cultivation. The male deer will be able to produce velvet antlers at the age of two, but the capacity of it will not be stable until the age of three.

a) Small-scale producers (Less than 30 deer)

Small-scale producers in this study represent the farmers who have less than 30 deer. The common characteristic of small-scale farmers is that although they are raising deer, their main business may still be traditional agriculture activities such as planting crops. Some of them are new practitioners, with a certain understanding of relevant knowledge, but lacking experience. Some have been engaged in deer farming for many years, but due to their economic strength, they did not choose to expand the herd.

As the secondary income of the family, they choose to raise deer for different reasons. Since there is a strong tradition of raising deer in the research area and the quality of the velvet antler produced by Jilin is quite famous throughout the country, some farmers choose to raise deer mainly due to the influence of surrounding villagers and a certain degree of herd mentality. Others also expressed recognition for the velvet antler as one type of ideal product, since, unlike meat livestock like pigs, male deer can produce velvet antlers at least twice a year as long as they are well kept, which is a sustainable business.

According to interviews, most farmers who mainly focus on planting crops will use straw as a supplement to dry feed. Sometimes, farmers will also go to the surrounding unowned grasslands to collect green grass as juicy feed. In addition, the distiller's grains from local brewing workshops are sometimes purchased by farmers as a supplement to feed. But overall, these sources of feed are not sufficient to meet the needs of breeding activities, so farmers still need to purchase sufficient amounts of forage and other supplements.

> *'Raising deer is not my main business, our family mainly focuses on farming..... Straw can be used as good hay after being dried and crushed, and can help me to save some money.' (Respondent 1)*

Because this type of farmer regards deer raising as their sideline, their attention to this business is relatively low compared to their main business, and their cost estimation is not very accurate. They generally adopt direct money and goods transactions and hardly sign contracts.

> *'My calculation of costs in the deer business is not precise. It is difficult for me to calculate because it is complicated for me… The price of the fresh velvet antler might fluctuate from time to time, but generally speaking, the price is always higher than our input.' (Respondent 3)*

Due to the limited scale of the herd, this type of farm usually obtains new deer through purchase. According to respondents, they do not attach great importance to the bloodline of deer. On the contrary, they are more concerned about the productivity of the male deer. The main source of fawns comes from other larger farms in the surrounding area, but they also cultivate their own fawns. The composition of deer herds is mainly influenced by the management strategy of farmers. If farmers tend to recover the investment faster, the proportion of male deer in the herd will be greater. If farmers prefer long-term management and cultivate fawn by themselves, they will tend to purchase more female deer, as a consequence, the income will be lower at the early stage. Correspondingly, such small-scale farm rarely hires a veterinarian to provide specialized services for their farms, but instead seek the help of professional veterinarians from local veterinary stations or animal husbandry bureaus.

Figure 5-13: One deer yard for about 10 deer

The size of the herd influences the yield of velvet antlers of the small-scale farms. The less attention to the bloodline of the deer influences the quality of the velvet antler. Limited by these problems, their bargaining power is low. Due to their small scale and low attention to the market, their understanding of market conditions is limited, and they lack of stable and controllable sales channel. Therefore, this type of farmer often tends to sell velvet antlers as soon as possible after it is harvested, which makes the prices they receive slightly lower. Some farmers also indicate that when market prices are not ideal, they will choose to freeze velvet antlers in hopes of better prices. However, the long-term freezing will influence the quality and price of the velvet antler. Therefore, in most cases, farmers still tend to sell the fresh velvet antler as soon as possible.

> *'Fresh velvet antlers should not be left at room temperature for too long after harvesting. They need to be frozen, and if they are frozen for too long, they will not be sold at a high price. We are not very good at handling antlers, so we tend to sell them to the nearby buyer as soon as possible.' (Respondent 2)*

'Because our scale is small and we don't have many sales channels, we usually sell our antlers directly to the local market..... Yes, the buyers often tend to cut our prices to a low level.' (Respondent 6)

Since the scale of the herd is small, small-scale farms generally only require one deer yard, and some also have one smaller yard for isolation or other purposes. Generally, one deer yard can accommodate around 30 deer. The deer shed includes one ventilated barn, an outdoor sports field, and a feeding trough and sink will be installed on the sports field. The area of the sports field is generally about twice larger than the barn. The surrounding walls of the deer yard are built with bricks or concrete, and metal fences were erected, with a height of 2-3m.

According to feedback from small-scale farmers, except for the large amount of initial investment in building farm and buying deer, the main annual cost in the deer business is buying feed. The average annual feed cost for a deer is approximately 1600 CNY (221 USD). Some small-scale farmers expressed a tendency to expand their deer business in interviews, but due to their economic strength, they are unable to execute. When asked if they are willing to take out a loan, farmers generally expressed their fear of bearing debt.

b) Medium-scale producers (30-500)

Medium-scale producers are farms having more than 30 but less than 500 deer. Medium-scale farmers have higher requirements for management level since the management difficulty increases as the herd expands. The more deer one farm keeps, the more attention and investment it needs. Therefore, most medium-scale producers regard deer raising as their main business. According to respondents, their deer herd scale was not very large by the very beginning, but gradually increased the herd scale as they expanded their business. Years of raising deer and selling velvet antlers make them have more experience compared to the small-scale new entrants, and the experience makes them have better understanding of the market requirements.

'In my early days, the size of my deer herd wasn't very large. The farm expanded because I had been working in this field for a long time, gained experience and had more connections… After all, if you blindly invest too much in the early stages, the risk will be too high.' (Respondent 8)

The medium-scale farms generally breed fawn by themselves, and the male-to-female ratio of deer is relatively more balanced than small-scale farms. However, such farm still purchases new deer from other channels or sell the newly produced deer to other farms. Unlike small farmers who focus on velvet antler output, medium-sized farmers pay more attention to the bloodline of the deer. For this reason, they sometimes will introduce breeding deer of excellent bloodline to the farm.

Since the herd become larger, these farmers sometimes will choose to hire employees to

assist with the management. The increasing population of deer in one limited place also increases the risk of disease outbreaks, making the assistance of professional veterinarians becoming more important. However, not all medium-sized farms hire a dedicated veterinarian to serve their farms, which is mainly influenced by the cost estimates. As for the feed, which accounts for the main cost of raising deer, medium-scale farms are similar to small-scale farms, but are influenced by the higher purchase volume. Farmers generally indicate that the more feed you buy, the lower the feed price is.

Medium-scale farmers have higher velvet antler production, more resources, and stronger bargaining power. When selling a large amount of velvet antlers, they sometimes will sign contracts. Moreover, due to their experience in the industry, they had formed connections with many value chain actors which allows them do not have to rely solely on one or two intermediaries and have stronger bargaining power. Also, according to the respondents, they have already established their own online store on some e-commerce platforms and sold frozen fresh velvet antlers to the consumers, which further reduces their dependence on intermediaries.

The internal facilities of medium-scale farms are not significantly different from those of small-scale farms, and the medium-scale farming area is equivalent to multiple deer yards connected by corridors. But since the herd size is larger, medium-sized farms will set up separate deer yards for different purposes, one deer yard may only contain one type of deer, such as male deer, female deer or fawn. Some farms will also set up special deer yards for lactating female deer and fawns and yards for isolating diseased deer. Due to the larger scale of the business, in addition to the breeding area, certain auxiliary production buildings (such as feed warehouses) and management buildings (such as offices, dormitories, etc.) will also be required for one medium-scale farm.

Figure 5-14 Corridor connecting the separated deer yard

c) Large-scale producers (more than 500 deer)

There are only a small number of large-scale farms having more than 500 deer in the area investigated in this study. The ownership of such farms is complex, some belonging to private enterprises and others belonging to local village collectives, or the local cooperative.

These large-scale farms have a larger land area, larger herds, and more complete infrastructure. The management personnel of large-scale farms are also more professional, and professional veterinarians and managers are hired to assist in the operation of the farms. The economic and talent advantages of large-scale farms make them more influential in market competition compared to other peers. This type of farm has higher requirements for the quality of velvet antlers and deer bloodline. They often breed deer specifically for breeding purposes, or breed deer with higher yields. They still purchase new deer, but the main purpose of this behavior is to introduce quality breeding deer. The farming mode of this type of farm is still mainly fence farming.

Due to its strong comprehensive economic strength and large scale, large-scale farms have expanded their business to fields like processing velvet antlers and selling fawn. This has further enhanced their economic strength and reduced the impact of intermediaries on product prices and income. Due to the large transaction volume of large-scale farms, they are often more formal than small and medium-sized farms when conducting transactions. They generally will sign contracts to ensure the rights and interests of both parties during the transaction.

> *'Our deer farm now not only engaged in deer raising and selling fresh velvet antlers. We expanded our own velvet antler processing business a few years ago, so that the velvet antler we produce can be processed by ourselves and the price is less easily controlled by intermediaries.' (Respondent 10)*

Another characteristic of large-scale farms is that compared to medium-scale farms, they require more employees and must have more complete supporting facilities and buildings. In addition to buildings such as deer yards, feed warehouses, agricultural machinery warehouses, offices, and dormitories, large-scale farms also have facilities such as guest houses, canteens, and shops to meet the needs of employees and visitors.

Figure 5-15: Large-scale farm with more supporting building

In the category of large-scale deer farms, there is a special type, that is the deer farm under the name of the pharmaceutical companies. This type of farm has relatively strict requirements for deer breed, breeding methods, and other standards. However, unlike other

types of farms, most of the velvet antlers produced by this type of farm directly flow into the internal production chain of the enterprise. As raw materials for the enterprise's products, few directly flow into the market.

5.2.3 Collectors

The main activities undertaken by the collectors are to collect fresh and frozen velvet antlers from farmers, store them, and sell them to downstream buyers. Its essence is to provide a sales channel for producers and supplements for processors. When the season of harvesting velvet antlers arrives, collectors will gather the newly harvested velvet antlers in two ways. One is collectors will drive from farm to farm to purchase fresh velvet antlers from the farmers, the other is farmers will transport the velvet antlers to the market where the collector is located. If the collectors cannot find buyers in a short time or the current price is not ideal, they will store the velvet antler through freezing. The scale of collectors is mainly influenced by various factors such as the business capabilities, relationships with customers, sources of goods, storage space, etc. of the operators. For collectors, it's important to establish good relationships with deer farmers and gain their trust to ensure sufficient supply and stable sales.

> *'Establishing good relationships with farmers is important... you can have better quality products from them... Setting a good price is indeed a challenge, you need to ensure your profits and don't make the farmers feel their benefit being injured.' (Response 11)*

In addition to locally produced velvet antlers, some collectors also choose to purchase imported velvet antlers. Based on the Chinese customs data, the imported velvet antlers in the Chinese market mainly come from New Zealand and Australia. Due to the long transportation distance, imported velvet antler is mostly frozen. The average price of the imported velvet antler is lower than the local one. But precisely because of its low price, it also has a certain audience in China. According to the respondents, the price of locally produced fresh velvet antlers is generally between 1.2-2.4 CNY (0.16-0.33 USD). While the average price of imported velvet antlers rarely exceeds 1.4 CNY (0.19 USD).

According to feedback from some respondents, the collector's business is being replaced by other value chain participants. From the perspective of upstream producers, farms can sign agricultural contracts with downstream practitioners. Some agricultural cooperatives also have the business of purchasing and selling member products. Some large-scale farms have established their velvet antler processing workshops and no longer rely on intermediaries. From the perspective of downstream practitioners, they also can hire professional managers to help them acquire raw materials or expand their business upstream. Affected by these factors, some collectors also act as retailers to sell the velvet antlers they purchased in local farmers' markets.

> *'Since I have my store in the local market, in addition to supplying*

downstream products, we also sell the velvet antler we have purchased as products to consumers.' (Response 12)

Collectors claim the costs of their business mainly focus on transportation and warehousing. Due to the perishable characteristic of fresh velvet antlers, unless the transportation distance is short, collectors need to freeze the velvet antler before transportation to prevent it from rotting during transportation. When the transportation distance is longer, it will be necessary to use cold chain transportation or air transportation, resulting in higher costs. Moreover, according to respondents, if the skin of the velvet antler is damaged, it not only will rot faster, but the price of it will significantly decrease. Therefore, collectors also need to pay additional costs for purchasing container fillers. Especially when the buyers' address is located in a further place, the transportation cost will be higher. In terms of warehousing, storing is not the only problem, as the frozen time increases, the quality and price of velvet antlers will continue to decline, therefore, they are also not willing to freeze the velvet antler for too long, choosing the right time to sell the velvet antler is the best choice.

5.2.4 Processors

The main task of processors is to process fresh velvet antlers into shelf-stable dried velvet antlers, and to reduce transportation costs, most processors are generally located in rural areas closer to the production. According to the research, the processing modes adopted by local processors in the study area are similar, essentially through three steps of processing: boiling, baking, and air drying. The main difference between small-scale processors and large-scale processors lies in multiple aspects such as processing efficiency and mechanization.

Small-scale processors often adopt traditional processing methods, where processors repeatedly boil velvet antlers in boiling water, let them cool, and then bake and air dry them after the boiling process is completed. The characteristic of this processing method is that it is difficult to control the baking temperature and boiling time. If the baking temperature is too high, it will scorch the velvet antler. If the temperature is too low, it will not work and may even accelerate the decay speed of the velvet antler. If the boiling time is insufficient, the skin of the velvet antler will wrinkle and the quality will also decrease. If boiling for too long, it will cause damage to the skin of the velvet antler, and the nutrients inside the antler will be lost, which also leads to a decrease in the quality and price. Moreover, traditional processing modes take longer and have lower working efficiency. Therefore, small processing factories require higher levels of working experience of processing personnel.

'The most important part of our job is the working experience. An experienced processor knows how to handle a fresh deer antler…An experienced worker can reduce the damage caused to the velvet antler during the process.' (Respondent 13)

'It probably takes 20-30 days of processing to turn a fresh velvet antler

into a qualified dried velvet antler.' (Respondent 13)

Larger-scale processors no longer rely solely on traditional processing modes. According to interviews, large-scale processors have purchased mechanized processing equipment such as microwave equipment and infrared drying boxes to improve the processing process, and reduce reliance on staffs' experience. Modern equipment has improved working efficiency and shortened processing time. However, according to feedback from respondents, these modern processing modes are essentially the same as traditional processing modes, that is processing fresh velvet antlers into dried velvet antlers through boiling, baking, and air-drying. Moreover, the mechanized processing mode is still unable to avoid errors showing up during the processing process.

As for supplies and sales. According to the survey, these processing workshops or factories are generally OEM (Original Equipment Manufacturer) factories or processers under certain brand names. They generally maintain stable connections with upstream and downstream actors. So, for them, normally there is less need to worry about supplies and sales. When it comes to the processing method of velvet antler, they also mentioned that the mechanization level of the current processing mode is still relatively low, relying on the experience of processing personnel, and lacking unified standards. However, there are no suitable alternatives yet.

5.2.5 Distributors

Distributors are mainly responsible for further grading, packaging, and branding the velvet antler products. In many cases, brands have a significant impact on the price of velvet antler products. Affected by this, the business philosophy of distributors of different scales also varies. The products of well-known brands often have higher prices compared to small and medium-scale brands due to their brand awareness.

Small-scale distributors are generally local or emerging brands, with lower brand influence and less brand added value to products. They generally have the problems such as lack of economic strength, low level of business capabilities, unstable supply channels, or lacks of quality guarantee. Due to the lack of brand and quality assurance, their products generally appear in individual retail stores, rather than in more influential chain stores. At the same time, the product packaging of this type of distributor is often simpler, some may even choose not to package. This is mainly because packaging will further increase the cost of production, leading to an increase in product prices. Due to the limited brand awareness of this type of distributor, their sales strategy is mostly to attract consumers with higher cost-effectiveness, the fine packaging that increases the cost is undoubtedly contrary to their strategy.

> *'Packaging is a problem for us. According to our calculations, further packaging may increase product costs by 15-25%, which will further weaken our competitiveness.' (Response 15)*

Large-scale distributors are larger brands with higher brand awareness. They have established stable commercial partnerships with large farms, processing factories, and downstream retailers that meet their standards through signing contracts. Some large distributors have established their deer farms and processing factories to ensure stable supplement and product quality. This type of distributor has higher requirements for product quality, which also leads to higher costs for their raw materials and processing processes. Better quality is also the reason why they can gain consumer trust. The complete and formal qualification certificates, testing certificates, and other documents of the brand products allow consumers to intuitively feel the quality of the products. In terms of sales, they also generally establish stable trade relationships with retailers, especially chain stores. Moreover, according to field investigations, some large distributors have specialty stores under the company's name. In terms of packaging, products of this type of distributor are all finely packaged, with higher additional value added. According to respondents, more refined product packaging can better attract consumers' attention and maximize the brand's influence.

5.2.6 Retailers

According to the summary, physical velvet antler retailers in China can be mainly divided into three types: a) Farmers' markets, b) Individual retailers, and c) Chain stores. Due to their different geographical locations, scales, and target customers, their business philosophies and business models are different, and the prices they receive are also different.

a) Farmers' market

Farmers' market is closer to the origin of velvet antler, Due to its geographical advantages, transportation and storage costs are lower and prices are relatively cheaper in this type of market. Farmers' markets are located in rural areas far from the city, and the purchasing desire of urban consumers is often influenced by the long distance. The products that farmers' markets sell are often rough processed products with low technical content and no brand guarantee such as unprocessed fresh velvet antlers and some simply processed dry velvet antlers. Lack of brand support, low added value, and relatively high cost-effectiveness are the characteristics of the product in this market. According to the field investigation, the average price of the velvet antler products in this type of market is about 2.0-3.8 CNY/g (0.27-0.52 USD/g)

Figure 5-16: One counter at the local farmers' market selling fresh velvet antlers

According to the feedback, consumers buy velvet antlers in farmers' markets mainly for making medicated wine or as a seasoning for medicated food. The consumers are either buying velvet antlers for themselves or ingredients for other products, few will use them as gifts. However, purchasing velvet antlers in the farmers' market requires consumers to have some knowledge of velvet antler products and be able to identify different types and grades of velvet antlers to prevent spending more money on low-quality goods. Since the main products sold in farmers' markets are fresh velvet antlers, which are only released in large quantities during the two harvest seasons of each year, farmers' markets are highly seasonal. According to the survey, it's common for local farmers or collectors to act as retailers in the farmers' market, so the supply of goods is relatively stable. This also makes this type of retailers not overly pursue retail sales, as even if they fail to sell all the products in the farmers' market, they can still find interested buyers in other places.

b) Individual retailers

Individual retailers are mostly located in suburban or urban areas. The brand and quality of velvet antler products sold in individual stores are mainly influenced by the retailer's economic strength and supply channels. There are big brand products that are well packaged, but there are also products that are sold by weight. Due to the longer distance from the origin and the need to consider food safety and other factors, the products sold by this type of retailer are all processed dried velvet antler products. In this market, consumers have higher requirements for the quality of the products and will be concerned the brand awareness when purchasing products, the influence of the brand begins to appear, making the participation of the distributors become necessary. Since this channel mostly only sells velvet antler slices, this section will use the middle-end product (red powder slice of deer velvet) and high-end products (wax slice of deer velvet) as examples. In this market, the average price of middle-end products is 6-10 CNY/g (0.82-1.36 USD/g), while the price of high-end products is 50-80 CNY/g (6.81-10.89 USD/g). Since the products in this channel are all processed, the processed velvet antler will lose about two-thirds of its weight. Therefore, if the weight loss during the processing is taken into account, then the actual price is the middle-end is 2-3.33 CNY (0.27-0.45 USD), the high-end is 16.67-26.26 CNY (2.27-3.63 USD).

The rich in variety and grade of the products make the purpose for consumers who purchase velvet antlers in this market very diverse. Some are buying health products for themselves, while others are buying them as gifts for others. In theory, this type of retailer has more autonomy in setting prices, but according to field investigation, within the same region, this type of store is highly concentrated, and consumers have many choices when purchasing products. Therefore, in reality, they cannot set prices arbitrarily. One of the problems faced by this type of retailer is the lack of consumers' trust, mainly because there are people selling low quality products as high quality ones.

> *The most common questions that customers will ask are: Is the velvet antler really from Sika deer? Did you sell Reindeer or Wapiti antlers as*

Sika velvet antlers? Are these velvet antler slices dyed with pigment? Some of these questions may sound ridiculous, but you can tell there is a lack of trust.' (Respondent 18)

Figure 5-17: Velvet antler specialty store

c) Chain stores

Chain stores are mostly located in urban areas. The velvet antler products sold in this market are all well processed velvet antler products from brands with certain influence, and most of the products have the quality certificates. Therefore, the quality of the product will be guaranteed. The packaging of the product is more exquisite, with detailed information on the packaging. The average price of velvet antler products in this sales channel is much higher than the first two channels, this is mainly due to factors such as brand and store rent. Still using the middle-end and high-end as examples. The price of middle-end products is about 8-20 CNY/g (1.09-2.72 USD/g). The high-end products are more expensive, about 100-125 CNY/g (13.62-17.02 USD/g). If counting the weight lost, the middle-end is about 2.67-6.67 CNY (0.36-0.91 USD), and the high-end is 33.33-41.67 CNY (4.53-5.67 USD).

The business philosophy of chain stores is different from the other two. Firstly, the prices of chain stores are already set by the superior company, and the store owner cannot adjust them at will. The velvet antler products are not the only products they sell, so they do not rely on velvet antler products to generate income. This results in a lower level of enthusiasm for them in selling velvet antler products. According to feedback, most of the consumers who buy velvet antler products in this sales channel are using them as gifts for others. However, respondents also stated that in recent years, due to the influence of COVID-19, more and more customers have come to the store to purchase health products, and the sales of velvet antler products have also increased in recent years.

5.3 Challenges

The production process of velvet antler products actually can be divided into two levels, farm management level and value chain level. The subjects of the two levels are different, and the challenges they face are also different. Therefore, this section will discuss the challenges on the farm level and the challenges of the whole value chain separately.

5.3.1 Challenge of Farm Level

According to respondents, the main challenges at the farm level are financial issues, farm management problems, germplasm resource crisis, lack of labor force, diseases and international competition.

a) Financial issues

According to the respondents, one biggest problem that they faced was insufficient financial resources. especially when they are trying to expand their business. Although other participants in the value chain may also face the challenge of insufficient funds, the pressure for farmers is heavier, especially small farmers with weaker economic strength. According to feedback, the annual cost of raising a deer is approximately 1600 CNY (221 USD), which does not include the additional costs of hiring breeders and veterinary services. The cost of purchasing new deer and building new deer yards is high, which most farmers cannot afford. Although farmers can choose to apply for loans, due to their limited economic strength, they are generally afraid of the risks brought by loans. Moreover, as farmers generally lack property that can be used as collateral, so they generally do not apply for loans. Although there are some credit products specifically targeting the deer industry, they are not universal since the coverage of financial services in rural areas is relatively low. From the perspective of financial institutions, they are more inclined to lend money to enterprises that have stronger economic strength, than the farmers.

b) Limited farm scale & Low level of farm management

The second challenge is the low level of professionalization of the farm management. Since the majority of the farmers are small-scale farmers, they have less systematic knowledge about how to manage the farm but rather rely on their experiences. This includes the lack of breeding technology, low management level of the farm. The lack of professional knowledge makes it difficult for them to expand their business scale and stabilize the output and product quality of the farm. When new technologies emerge, they also find it difficult to quickly embrace and apply the new technologies. Due to the lack of macro understanding of the industry, it is also difficult for them to catch the opportunities. This problem not only affects farmers, but also affects the entire industrial chain. The insufficient production capacity and unstable quality of the upstream will further influence the downstream actors.

c) Germplasm resource crisis

The third challenge for the farmers is the germplasm resource crisis. The artificially raised deer in China are mainly divided into three types: Sika deer, Wapiti deer, and hybrid deer. Sometimes, due to the high similarity in body size and appearance between some hybrid deer and purebred deer, it is sometimes difficult for non-professionals to distinguish the differences. According to feedback, many farms have raised a lot of hybrid deer and some

hybrid deer are unable to distinguish the true bloodline without professional means. Most large-scale farms can avoid accidentally purchasing hybrid deer that they do not want by cultivating their own deer, but small and medium-sized farms may find it difficult to avoid this problem. This problem not only will influence the farmers, but also influence other downstream actors. Farmers may pay more money for the type of deer that they are not willing to buy, and downstream buyers who are looking for Sika deer velvet antlers may end up buying hybrid deer velvet antlers, which is harmful to the whole industry.

d) Lack of labor force

The fourth challenge for most farmers is the lack of labor. As the urbanization process continued to accelerate, the loss of young and middle-aged labor force in rural areas has become more serious, and the urban population's siphon effect on rural areas has become increasingly obvious. According to the interview, more and more rural young people choose to go to cities for better jobs or higher salaries, some even choose to leave their hometowns and find jobs in further southern cities. Although some of them choose to return to the countryside to help deal with farm affairs during the busy farming period, but this unique 'migratory bird type' of shift of labor is not beneficial for the development of rural areas. Some young people who have settled in cities will give up inheriting the farms of elderly people living in rural areas, or invite them to live with them in the city and give up the rural business.

> *'The development prospects of cities are better than rural areas, many young people choose to work in cities…The living conditions in the city are better, and the income is also higher. For them (the young group), there is indeed not much need to stay in the countryside and engage in agriculture business.' (Respondent 4)'*

> *'Our children invited us to live in the city together, and they are not planning to inherit this business. We may also be preparing to retire in recent years.' (Respondent 6)*

e) Diseases

The fifth challenge is diseases. Like all animal husbandry, the diseases are no doubt a challenge for most of the farmers. Farmers of all sizes have expressed some concerns about diseases. According to incomplete statistics, there are nearly 30 infectious diseases that are prone to outbreaks in deer herds, over 30 common diseases, and over 20 parasitic diseases. Among them, infectious diseases have the most severe impact on herds.

> *'Compared to other diseases, infectious diseases have the greatest impact on us, and the higher the deer population is, the heavier the impact. Such as tuberculosis, rabies and foot and mouth disease.' (Respondent 8)*

f) International competition

Only a few medium and large-scale farmers and some local enterprises have expressed concerns about international competition. Since the production of domestic fresh velvet antlers is unable to meet the requirements of the domestic market, the Chinese market needs to import a large amount of foreign velvet antlers each year. According to the interview, the price of imported velvet antlers was lower than the average price of domestic ones. Moreover, according to feedback, New Zealand's Red deer velvet antler is being called as New Zealand Wapiti deer velvet in China, and since there are fewer farmers raising Wapiti deer in the research area, the name change allows it to further expand its market share.

5.3.2 Challenge of Industry Level

For the respondents, the industry-level challenges are the low level of credibility, insufficient coordination among the actors, transportation costs and the backward standards.

a) Low level of credibility

according to the respondents, one big problem of the domestic velvet antler industry is the low level of credibility. Some respondents found their customers lacked trust in the quality of the velvet antler products, especially the processed velvet antler slices. This is because there are fake and inferior products in the velvet antler market. Some people are selling antlers (such as Reindeer and Moose) that are not recognized by Chinese consumers in the name of the Wapiti deer or Sika deer. And since the Sika deer velvet antler is more expensive than the Wapiti deer velvet antler, and it is hard for non-professionals to distinguish the difference between the processed velvet antler products, there are people selling the Wapiti velvet antler in the name of Sika deer velvet antler. The identification of hybrid velvet antlers is even harder and may rely on DNA technology. Famous brands can ensure the quality of their products since they have better control over the whole material flow, and they can provide quality certificates for their products, but the majority of the small brands' products are unable to achieve this, especially the products that are sold by weight. As consumers' income increases, their requirements for product quality are also increasing, and the problem of lack of trust still exists. For all practitioners, consumers' distrust of the industry is a challenge.

b) Insufficient coordination among practitioners

Most farmers don't have the capability of establishing a stable sales channel by themselves. Therefore, farmers, especially small and medium-scale farmers, rely on the middlemen and downstream actors to provide a stable sales channel. Middleman and downstream actors have a more timely and comprehensive understanding of the market and have access to more sales channels and market information due to their business scope and partners. Small and medium-sized farmers and processors can only obtain limited market information and lack the opportunity and ability to further understand the current market

situation. Moreover, based on feedback, they are generally willing to trust intermediaries who have long-term cooperative relationships with them. These factors make them the passive recipients of the price offered by the buyers. Moreover, as mentioned earlier, the harvest of velvet antlers is seasonal. Since velvet antlers cannot be frozen for too long, most of the farmers prefer to sell the velvet antlers to the buyers once it is harvested. When a large number of products are launched, the price of the products will drop, and the manager responsible for collecting fresh velvet antlers will seize this moment to try to lower the prices of the producers. Under the influence of these factors, the coordination between value chain members becomes very unstable. Due to the fact that most practitioners are self-employed, their goal is to maximize their benefit, and even encroach on the interests of neighboring actors, which makes the entire chain unstable.

c) Geographical limitation

According to the respondents, the challenges brought by geographical limitations are transportation costs and the acquisition of market information. The main market of China's velvet antlers is located in the southern part of China and the main production of velvet antlers is located in the northern part of China. Taking Guangdong province, one of the areas that have the tradition of using traditional Chinese medicine and one ideal market for velvet antler products as an example, the direct distance between Jilin Province to Guangdong Province is about 2,603 kilometers and the actual distance for land transportation is about 3,269 kilometers. The long transportation distance forces the velvet antler companies to pay more transportation costs. As the transportation distance increases, the loss during transportation will also increase. Other problems may also occur during long-distance transportation, such as packaging damage or product contamination, and the practitioners will have to pay more to avoid these.

On the other hand, affected by the long distance between origin and market, there is a significant time and space difference in information transmission and communication between the buyers and sellers. Some respondents claim that they had been traveling to the place of sale in order to collect market information, but the result was not ideal. The lack of timely information makes it difficult for the industry to make quick adjustments to market changes.

d) Lack of standards

The problems with the standards for China's velvet antler industry mainly lie in two aspects: on the one hand, some standards are outdated, and on the other hand, some standards are missing. There are many related standards for deer product production and quality identification in China's deer industry. However, according to the practitioners, some of the standards had actually fallen behind. With the development of the deer industry, the requirements of those outdated standards are already lower than the actual production level of the industry. The standards are important for measuring whether the product quality meets the lowest requirements. The lack of standards can lead to a lack of standardization awareness among practitioners, and the unstable product quality will damage consumers' confidence,

which is not conducive to the development of the velvet antler industry. On the other hand, it can also lead to a lack of reference standards for relevant supervision and inspection agencies when inspecting product quality.

5.4 Opportunities

This section introduces the opportunities of the China's velvet antler value chain. They are the improvement of E-commerce and logistic systems, information technology, policy influence, the growth of the health care product market and traceability system.

5.4.1 E-commerce & Logistic System

Among the respondents, some of them stated that they or the companies they work for have set up their online stores on E-commerce platforms. Especially for medium and large-scale farms, as well as some processors and distributors. There are many benefits to establishing online stores. Firstly, e-commerce platforms have expanded the sales channels of agricultural products. As summarized earlier, most farmers are small and highly dispersed, limited by their own economic strength and management capabilities. They lack awareness of market changes and do not have a good sales channel. E-commerce platforms can effectively solve such problems, E-commerce platforms effectively reduce the impact of information asymmetry on upstream and midstream producers and processors. Moreover, through online platforms, producers can directly communicate with consumers across space and time constraints, reducing the demand for intermediaries and saving transportation and entry fees. Not only does it increase the income of farmers and processors, but it also can provide customized services to meet the needs of consumers. Taking farmers who set up online stores as an example, they stated that the price of high-quality fresh velvet generally does not exceed 2.4CNY/g (0.33 USD/g), but in online stores, they often can receive higher prices.

> *'We usually sold our velvet antler directly to the farmers' market before. Although we could make a profit, the prices we received from the buyers are not ideal. Now we have our online store, selling frozen fresh velvet antlers directly to the consumers, and the price we get is much better than what the middleman gave us before.' (Respondent 8)*

> *'We don't have an online store, but we have established a chat group on social media, which has many regular customers. During the velvet antler harvest season, they will purchase fresh velvet antlers from me through this chat group.' (Respondent 7)*

E-commerce platforms can also help increase the chances of rural youth staying in their hometown to start businesses and find employment. The popularization of e-commerce platforms makes some young people willing to stay in rural areas and start businesses through e-commerce platforms instead. Which to some extent, alleviates the problem of young labor

loss in rural areas.

> *'My child came back to help us run the online store because we are old and not very good at dealing with the internet.' (Respondent 7)*

Also, the advantages brought by online e-commerce platforms do not exist independently, they require a comprehensive and efficient logistics system to support them. China's relatively complete and efficient logistics and cold chain system have made the popularization of e-commerce possible. This is particularly evident in the field of agricultural products. Fresh velvet antlers, as summarized above, may quickly decay and spoil within 3-5 days if stored improperly during transportation after harvesting. If lack of an efficient logistics system, it is impossible for fresh velvet antlers to be delivered to consumers far away from the origin before the expiration of their shelf life only by using the preservation treatment that ordinary farmers can do for fresh velvet antlers (such as freezing, wrapping with plastic film, adding ice cubes to the preservation box, etc.). Moreover, after investigation, most e-commerce platforms have established stable cooperative relationships with logistics companies, they provide preferential policies for sellers, which can effectively reduce the investment of buyers and sellers in the field of transportation.

5.4.2 Information Technology

The development of information technology has also brought significant benefits to the velvet antler industry. In the past, farmers had limited sources of information and lacked of understanding of the market. Small and medium-sized processors and distributors are mostly local enterprises, lack of information about the markets of other provinces in China and the ability to influence or communicate with distant markets. However, with the development of information technology and the popularization of social media platforms, agricultural producers can more conveniently receive current market information, exchange information with peers and make production adjustments based on information. Middle and downstream players can also obtain national market information through more efficient information platforms. With the continuous popularity of social media platforms such as Weibo or WeChat, in China, practitioners' social circles have also been expanded. This not only reduces the cost of advertising their products, but also provides practitioners with the opportunity to meet more potential buyers or adopt new sales models.

> *'I have an account on the video platform, and I often make videos about my farm or use live webcast to sell my products…I have met many people through this business and I think it has worked very well. (Respondent 9)'*

The opportunities brought by the development of information technology not only lie in the transmission of market information, but also contribute to the popularization of new technology. In the past, due to geographical location, the efficiency of information transmission was low, and the popularization efficiency of new technologies was relatively low. Therefore, when the new technology emerges, the agriculture producer won't be able to

have access to it in a short period of time. But with the popularization of smart phones and the internet in rural areas, agricultural producers can have more easily access to new production technologies through the internet or get in touch with experts. Moreover, according to the respondents, farmers will also exchange their farm management experience with each other through social media platforms like WeChat or QQ, and this is helpful for the new partitioners will less experience and skill.

5.4.3 Positive Policy Influence

The research area of this study is Jilin Province. According to local government reports, a summary of multiple official data such as the Local Statistical Yearbook and the China Statistical Yearbook. Jilin Province is now one of the most important agricultural provinces in China. Taking the data from 2022 alone as an example, the total grain output of Jilin Province in that year reached 40.808 million tons, ranking fifth in China, and the unit yield of grain ranks first among the 13 major grain producing provinces in China. Both grain crops and harvested straw are good feed, which indirectly promotes the breeding industry in Jilin Province. The advantages of Jilin Province in the field of agricultural production have led both national and local governments to make effort to transform the province into a highly clustered, mechanized, and modern agricultural advantageous province. Therefore, Jilin province is more active in deepening rural reform, promoting rural financial products, innovating services, and promoting more advanced agricultural production technologies. This will also be an opportunity for the velvet antler industry in Jilin Province. From a macro perspective, since the deer breeding policy changed in 2020, the Ministry of Agriculture and Rural Affairs has listed domestic Sika deer and Wapiti deer into the category of ordinary livestock, which is under the management of the Ministry of Agriculture and Rural Affairs rather than by multiple departments as in the past. The clarification of the management department has greatly reduced the various documents and certificates required for breeding deer and selling deer products and simplified the process. Which is beneficial for the development of the industry. Moreover, governments at all levels have also introduced relevant policies to support the velvet antler industry. The “14th Five Year Plan for the Development of the National Animal Husbandry and Veterinary Industry” issued by the Ministry of Agriculture and Rural Affairs of China clearly proposes to focus on promoting the development of the deer breeding industry in Jilin Province, expanding the scale of local deer herds, improving product quality, enhancing the specialization level of local deer industry, and expanding the deer product industry chain. The local government of Jilin Province has also launched the “Jilin Province Sika Deer Industry Development Plan (2021-2025)”, setting the direction for the future development of the deer industry in Jilin Province, and providing policy and economic support.

5.4.4 Growth of the Healthcare Product Market

According to the respondents, they generally believe that the market of healthcare products will continue to increase, there are two reasons for this, the increase of the elderly

population in China and health problems of the younger groups. According to the results of China's seventh population census, the population aged 60 and above has reached 264,018,766, accounting for 18.70% of the total population in China, and there has been a clear trend of increasing. The elderly population has a higher demand for health care products, and velvet antlers have always been considered as one of the best tonics. On the other hand, the sudden outbreak of COVID-19 by the end of 2019 had a negative impact on the whole society. This serious health problem has made people realize the importance of health and has also made the demand for improving their immunity system become a common requirement of people of different ages. In addition, the increase in work pressure and life pressure has put many young and middle-aged people in a sub-health condition. Affected by this, more young people now have a positive attitude towards health products, and the group of young people who continuously purchase and use health products for a long time is also constantly increasing. According to public information, the market scale of health care products in China had reached 270.8 billion CNY (37.15 billion USD) by the end of 2021 and has a clear tendency to continue to grow. Velvet antler products as one type of most famous traditional health care product will also benefit from this.

5.4.5 Constructing Traceability System

According to the previous summary, food safety and drug safety are the main concerns of Chinese velvet antler consumers. Due to the lack of supervision and control over the entire production process, the velvet antler products produced by most small and medium-sized enterprises are unable to gain the trust of most consumers. However, some large and medium-sized brands have already established a traceability system for the entire production process of velvet antler products through technologies such as the Internet of Things and big data. Some large enterprises have also achieved full control from deer breeding to velvet antler product processing and sales by establishing a production line under the name of the enterprise. The products produced by these enterprises can provide origin certificates, quarantine certificates, quality assurance, and other certificates that help enhance consumer confidence. This system is conducive to the development of China's velvet antler industry and is also worth learning from other velvet antler value chain practitioners.

Chapter 6 Discussion

This chapter will map the velvet antler value chain of China, analyze the structures, and discuss the opportunities and challenges of the value chain based on the conclusions of the previous chapter.

6.1 Different Types of Value Chains in the Research Area

Based on the results of this study, four different types of velvet antler value chains were found in the research area. Which can be classified as the low-income value chain, the medium-income value chain, the high-income value chain, and the E-commerce value chain based on the value chain actors and the types of products that this value chain sells. These value chains have some similarities to the research of Ruben (2007) in some aspects but there are also differences.

6.1.1 System A: Low-income (Local markets)

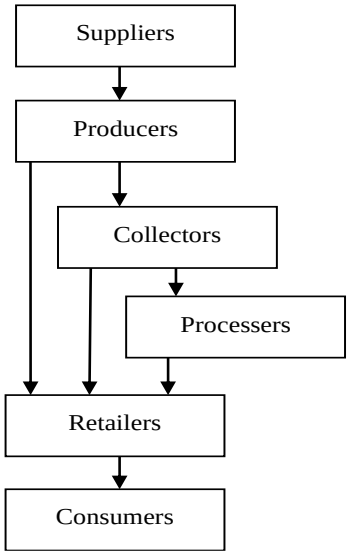

Figure 6-1: Low-income value chain

The system A value chain is the simplest value chain in this study. It generally only exists in the areas closer to the production, mostly located in the rural areas. Therefore, this market is not widespread and its influence and coverage are relatively small. Though this is a low-income value chain, it is not the same as the low-income value chain in Ruben's (2007) study, but more similar to the low-income herbal value chain of the Asian region in Booker's study (2016), which herbal suppliers either directly connect with consumers or rely on some small-scale local traders to provide trading channels.

The products being sold in this value chain are mostly fresh velvet antlers without any

processing and rough-processed dried whole velvet antlers. Like most of the agriculture products sold in the farmers' market, these velvet antlers products don't have brand or formal packaging, making the added value and the final prices of these products relatively low. Just like Wolf's theory (2005), the main selling points of products in this market are freshness and high cost-effectiveness.

As shown in Figure 6-1, there are fewer participants in this type of value chain. The main actors in this value chain are suppliers, producers, collectors, processors, and retailers. Since there are not many requirements for opening a store in the farmers' market, therefore, retailers can be the farmers who produce velvet antlers, collectors who purchase velvet antlers, or processors who process velvet antlers. Because the farmers' market is closer to deer farmers and the transportation distance is short, it is not necessary to process fresh velvet antlers into dry ones to sell to consumers, therefore, the processor can be skipped. And since the products in this market are mainly rough-processed products with lower prices, distributors are often absent in this market. This is similar to the study conducted by Booker (2012) on the value chain of low-income local herbs value chain in Asia.

The final price of the products in this market is lower compared to the other markets. First of all, it is mainly because of the low processing level and low added value of the products. Just like Goldsmith's (2004) study, unprocessed or simply processed agricultural products have lower profit margins. Secondly, since the farmers' market is closer to the production, buyers have many other options when purchasing velvet antlers. Also, this study found that this type of market has a rather high seasonal characteristic, it mostly emerges during the velvet antler harvesting season, which means that there are a lot of fresh velvet antlers in the market. These factors showed that this market is a buyers' market. Therefore, the final price of the product will be pressed very low, and farmers often cannot receive the most ideal price due to market competition and pressure from the buyers.

Due to the lack of brand, consumers in this market pay particular attention to the quality and cost performance of velvet antlers. Moreover, since most of the velvet antler products in this market are fresh velvet antlers and low-processed level dry velvet antlers, the appearance characteristics of the velvet antler products have not undergone significant changes. Therefore, relatively professional consumers can distinguish the source and the actual quality of the velvet antlers. According to the respondents, in this market, most consumers buy velvet antlers mainly for use as the raw material for a Tonic Diet, medicated liquor, or health products, few will use them as gifts for others.

6.1.2 System B: Medium-income (National markets)

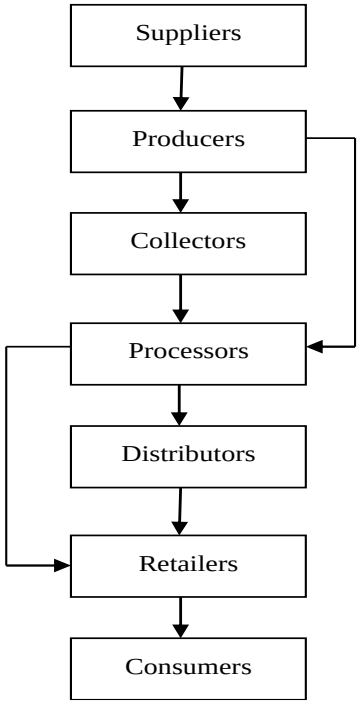

Figure 6-2: Medium-income value chain

System B is a relatively more complex value chain, the end retailers are private health product stores, private specialty product stores, or private traditional Chinese medicine stores, mostly concentrated in urban areas and suburban areas, facing diverse consumers with different requirements. Compared to the low-income system A, this type of value chain is more common, being able to reach more customers, having wider coverage and the final price of the products is also higher. However, this value chain is still quite similar to the low-income local market value chain in Ruben's (2007) theory. This type of value chain has more participants, but the degree of organization between value chain participants is low, the coordination relationship between different value chain actors is unstable since most of the actors are focusing more on improving their income. The transaction costs between different members are higher. Most of the actors in this value chain are small-scale actors and they run their business independently. And just like Kanda (2009) analyzed, when the goals of value chain actors are conflict, they may encroach on the interests of other value chain actors for their own gain, making the value chain unstable.

Since this type of market is further from the production area, the products sold in this value chain are all processed dried velvet antler products that have a longer shelf life. And because this market faces diverse customers with different demands for products, the product categories in this market are also very diverse. The velvet antler products in this market include different grades of dried velvet antler slices sold by weight, packaged dried velvet antler slices, and packaged whole dried velvet antlers. A series of processes have extended

their shelf life, changed their appearance, increased their use value, and therefore, increased their price. (Gopinath, 1996).

The actors in this value chain as shown in Figure 6-2 are suppliers, producers, collectors, processors, distributors, and retailers. In this value chain, sometimes, the producers will directly provide fresh velvet antlers to the processers without the collector stage. Some retailers that sell velvet antlers by weight will directly purchase dried velvet antler products from the processors. Therefore, the collector stage and distributor stage are not necessary in some circumstances. But as shown in the material flow for velvet antler products, processing fresh velvet antlers into dry velvet antlers and then selling them as a product is a relatively complex process, it requires the collaboration of multiple value chain actors, and the collectors and distributors are playing the roles as bridges connecting upstream and downstream actors. This is similar to the goat milk industry in Tanzania studied by Lie (2012), that is if farmers want to sell their products to a farther, larger, and more formal market, they need the assistance of intermediaries or collection centers. In this study, due to the geographical dispersion of farmers, collectors are helpful for gathering fresh velvet antlers from different farmers and providing stable supplements of raw materials for processors. Retailers are important for providing sales channels for the processors and the brand of the distributors will also influence the final price of the products. Just like the research in Booker's (2012) study, for the national value chain, the participation of intermediaries is quite important, especially for the value chain with many small and medium-scale actors.

The final price of the products in this market is higher compared to the system A. This is mainly because the products in this market need to go through a complete processing process to extend their shelf life, and some products will also have more formal packaging, these processing stages increase the final price of the product (Cucagna, 2018). And because retail stores are generally located in areas far from the production, the transportation cost also increases, and the rental and labor costs of stores in cities are also higher than those in rural areas. In addition, the importance of brand awareness is also obvious in this value chain, the higher the brand awareness of the product, the higher its price compared to the same type of product. However, just like the agriculture value chain of developing countries in Ruben's (2007) study, due to the fact that the participants in the chain are still mainly small and medium-sized, the coordination relationship between value chain members is unstable, and the organization level is low. These factors limit the final quality and price of products in the value chain.

Because this type of store is mainly located in urban and suburban areas, it mainly targets consumers with higher per capita disposable income. Correspondingly, these types of consumers also have higher requirements for product quality and brand. Since the main participants in this type of market are still small and medium-sized actors. These actors have lower brand awareness and lack the capability to control the whole processing process. Therefore, the sales strategy of actors in this type of market is to provide customers with more cost-effective products, and the main customer group in this market is also price-sensitive customers. According to the respondents, the main purpose of consumers purchasing velvet

antler products is to use it as a health product for themselves or as a gift for others.

6.1.3 System C: High-income (Well-known Certificated Brands)

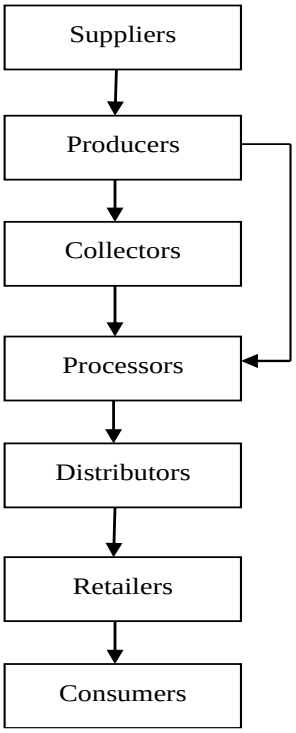

Figure 6-3: High-income value chain

The final retailers of this model are chain pharmacies or chain specialty stores located in the urban area. The products sold in this market are all from famous enterprises with good reputations and high market influence. In Ruben's (2007) theory, this type of high-income value chain is actually the upgrade of the middle-income value chain. The market share of his type of market is lower compared to medium-income System B, but it is mainly because most of the actors in this industry are unable to meet the standard of joining the high-income value chain. However, according to the summary, due to the increase in per capita income and the continuous expansion of urbanization, this market will become increasingly common in the future (Zhu, 2004).

The velvet antler products sold in this market are all highly processed well-known brand products with exquisite packaging. Because practitioners in this market have strong control over the entire production process of products and have higher requirements for product quality, velvet antler products in this market are generally able to provide complete quality certificates, which helps them gain more trust from the consumers. Just like Wang's (2020) study on Chinese deer product consumers, product information has a positive impact on consumers' purchasing behavior. On the other hand, since this type of market is also a national market located in the urban area far away from the production, the store rental and transportation costs are also higher, and practitioners also need to pay more costs (Issahaku, 2012). All these factors make the final price of the products in this market higher than the

same level products in the other markets.

The main actors in this value chain as shown in Figure 6-3 are suppliers, producers, collectors, processors, distributors, and retailers. As in Ruben's theory (2007), this type of chain can be considered as an upgrade of the B system medium-income value chain, the two are relatively similar, but there are differences in details between them. Firstly, due to higher requirements for the quality of raw materials, not all the products produced by deer farmers can meet the standard requirements for joining this market. In most cases, only larger farms can meet the requirements of downstream enterprises. This type of farm often has stable cooperative relationships or contracts with downstream actors, and some companies have also established their deer farms, so the collectors are not needed in most cases. As analyzed by Burch (2005), well-known brands will continuously expand their business to the upstream and downstream of the value chain in order to ensure stable supply, reduce transaction costs and improve brand competitiveness. Although collectors can still play a role as intermediaries in acquiring fresh velvet antlers in this market, they are mostly employed as managers of downstream enterprises and lack business autonomy. Secondly, unlike the medium-income value chain, which sometimes the processors can directly sell the processed velvet antler to the retailer without the assistance of distributors. In the high-income value chain, only brand products with complete certifications, quality assurances, and complete packaging can be sold in chain stores. Therefore, the stage of brand distributors cannot be skipped in this value chain. As Cucagna (2018) pointed out in the study about the agricultural product value chain, factors such as brand awareness, sales channels, and after-sales service are important factors that determine whether the product can meet consumer needs. Thirdly, due to the fact that retailers in this value chain are mostly chain stores, the prices of products in the stores are determined and cannot be adjusted arbitrarily. And in most cases, velvet antler products are not the only products of retailers. Therefore, the operational autonomy and enthusiasm of retailers in this market to promote velvet antler products are lower.

Compared to systems A and B, the same type of product in this market has the highest price. In addition to processing, transportation, and store rental costs, the products in this market also have a high investment in packaging. The products in this market, especially high-end products, generally adopt more exquisite packaging, which also leads to an increase in the final price of the products. In addition, same as Zhang's (2018) study about velvet antler consumers, the influence of brand awareness on product prices is also very significant, well-known brands always have higher prices than ordinary brands.

According to respondents, consumers in this market place greater emphasis on the brand, package, and quality of their products, with relatively low emphasis on products' cost-effectiveness. Because the products in this market generally have sufficient quality assurance and are well-known brands. Therefore, most consumers in this market purchase velvet antler products with the purpose of giving them as gifts to others. Better packaging of the products can make the recipient feel respected, which is also the main reason why consumers value brands and packaging more in this market.

6.1.4 System D: E-commerce Platform (E-commerce Channels)

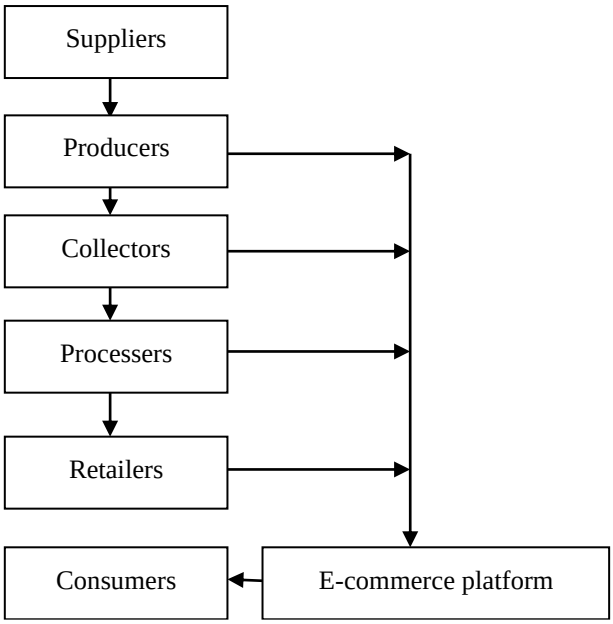

Figure 6-4: E-commerce value chain

As an emerging new market, this system is the most unique. With the help of the E-commerce platform, the value chain actors can sell their products to the final consumers without the assistance of the downstream actors. Like Neilson's (2009) study, the wide use of the E-commerce platform is actually a form of functional upgrading option for the value chain practitioners, which means that practitioners at different stages can change their original position in the value chain and try to enter higher income stages. The E-commerce platforms do not directly participate in velvet antler production and processing activities, but provide a direct trading channel for the value chain actors, consumers can communicate directly with the seller, make requests, and place orders directly online.

The variety of velvet antler products sold in this market is the most diverse among the four types of value chains. From frozen fresh velvet antlers that haven't been processed to finely processed dried velvet antler products, all can be found in the online store thanks to the continuous improvement of logistic system and cold chain system (Han, 2021). All the value chain actors can set up online stores and directly connect with consumers if they can meet the qualifications, which is also the reason for the rich variety of products on e-commerce platforms.

In Figure 6-4, it can be found that other than the suppliers, all the value chain actors can use the E-commerce platforms to sell their products directly to the final consumers. As analyzed by Prahalad (2002), intermediaries are exploitative in most cases, though they can provide sales channels, they also will increase the transaction costs and utilize their information advantages to gain more benefits. An e-commerce platform that directly links

buyers and sellers can effectively improve transaction efficiency, reduce the reliance of the intermediaries, increase price transparency, and enhance the autonomy of practitioners (Ma, 2022). However as found in this study, not all the value chain actors have sold their products online. Some of the respondents, especially the aged ones were either not willing to take risks in the field that they were not familiar with or didn't know how to operate the online platform, and some were afraid that their production capacity could not meet the requirements of the market. As pointed out in Cui's (2018) study, some farmers are unwilling or difficult to accept new things due to their factors.

The prices of products in this market are generally lower than in the offline market. Even the high-end products from well-known brands, the price of it is lower in the online store. This is mainly because online stores, unlike physical stores don't need to pay more cost in fields such as store rental. The online stores do need to pay more transportation costs, but with the improvement of China's logistics system and the improvement of transportation efficiency, transportation costs are significantly decreasing. Moreover, according to respondents, most E-commerce platforms have established stable cooperative relationships with logistics companies, and sellers can enjoy preferential shipping fees. Therefore, products on e-commerce platforms have a clear price advantage. However, online markets cannot completely replace real markets. Based on feedback from respondents, when purchasing expensive velvet antler products, their consumers still prefer the physical stores, consumers claim they have concerns about purchasing counterfeit goods on E-commerce platforms. This is mainly because the existence of counterfeit and inferior products in the market has affected consumer confidence (He, 2017).

6.2 Analysis of the Challenges and Opportunities

This section will provide analyses of the challenges and opportunities that China's velvet antler value chain faces.

6.2.1 Challenges

Based on feedback from respondents, the challenges faced by China's velvet antler value chain include financial issues, lack of labor force, germplasm resource crisis, international competition, etc. Based on the influence that these challenges bring to the value chain and the value chain actors, they can be divided into four categories: financial challenges, technical challenges, market challenges, and policy challenges.

Financial challenges	Technical challenges	Market challenges	Policy challenges

• Financial issues • Limited farm scale • Lack of labor force • Geographical limitation	• Low level of farm management • Germplasm resource crisis • Diseases	• International competition • Insufficient coordination among practitioners	• Low level of credibility • Lack of standards

Table 6-1: The categories of the challenges faced by China's velvet antler value chain

a) Financial challenges

Most respondents stated that insufficient funding is the main challenge they face. Especially small-scale actors, they generally lack sufficient funds to expand their business. Due to the fear of risk, they are generally unwilling to bear more loans, especially in rough economic conditions. The impact of COVID-19 on society and the economy has led most respondents prefer to reduce unnecessary expenses and reduce their economic burden, which is consistent with Abdesamed's (2014) theory, that due to poor risk resistance, small and medium-sized economies may reduce investment due to fear of risk. This study also found that there are relatively limited financial products available for the deer farming industry on the market, and most financial institutions tend to provide loans to enterprises with more economic strength. It was also found that the guarantee mechanism for loans is not perfect, resulting in most of the farmers are not willing to apply for loans. This was the same in the study of the farmers in Liaoyuan City, Jilin Province (Chen, 2021). Due to the lack of sufficient funds, the scale of the farm cannot be expanded, the production capacity of the farm will be affected, and the income of farmers will also be limited, and this will create a vicious cycle. Similar problems also exist in the agricultural industry of most developing countries, farmers refuse to expand their business through loans due to fear of the economic burden and risks brought by loans, and their own economic strength is not enough to improve the performance of their farm (Shee, 2015).

The shortage of labor is also an economic challenge for the local velvet antler industry. During the investigation of this study, it was found that the young and middle-aged labor force in the local rural areas is losing year by year. This has also been proved in the Jilin Statistical Yearbook (2022), the rural population in Jilin Province has decreased from 12.70 million in 2011 to 8.70 million in 2021, accounting for only 36.64% of the total population. The sector that is being affected most seriously is the local agriculture production activities. The farms in the study area are mainly small and medium-sized, with low mechanization and high demand for labor. The decrease in the labor force will lead to an increase in employment costs, as Qian (2016) study, when urban areas can provide better jobs with higher wages, rural employers need to provide higher salaries to employees to attract them. And this is the additional burden that most small and medium-scale value chain actors cannot take.

The financial challenges brought by geographical limitations to China's velvet antler

industry stem from two aspects: shipping costs and collecting market information. Most of the velvet antler production areas in China, including the research area, are located in northern China. However, according to respondents' feedback, velvet antler products are mostly sold in the southern provinces far from the production area, and the distance between the production and sales places can reach 2,000-3,000 kilometers, the long-distance transportation will increase the final cost of the product (Issahaku, 2012). The same problems also exist in the Russian velvet antler industry, according to Zuve (2020), due to the production areas of velvet antlers in Russia being far away from the market, the value chain actors always have to pay more transportation fees. The loss caused by long-distance transportation of agricultural products is also a problem that practitioners must face. According to Arah (2015), about 20% of tomato producers in Africa need to endure the economic losses caused by long-distance transportation. According to Gao's (2015) analysis, the loss rate of agricultural product transportation in China may reach 25-30%, which increases the economic burden of the practitioners. Another problem caused by the distance between the production area and the sales location is value chain actors are unable to collect real-time information about the target market. As Leonidou (2006) pointed out, the distance between buyers and sellers can lead to poor information transmission, practitioners have to pay more costs to improve the efficiency of obtaining timely information.

b) Technical challenges

Technical challenges include the low level of farm management, germplasm resources, and diseases. Firstly, as mentioned earlier, most farms are small-scale and medium-scale farms. The management level of these farms is low, the farmers mostly rely on their experience instead of professional knowledge. This is common among small-scale farmers in developing countries, researchers found the same problems in the study about Pakistani farmers (Hassan, 2021). On the one hand, insufficient management levels may cause the spread of diseases among deer. Unless the symptoms of sick deer are obvious, it is difficult for the farmers with less professional knowledge to notice in a short period of time. Especially for the small farmers who do not rely on raising deer as their primary income, they pay relatively less attention to deer herds and do not hire professional personnel to assist with management. Similar issues were also found in research targeting Indian farmers (Singh, 2019). On the other hand, due to the lack of professional breeding knowledge, most farmers place greater emphasis on the yield of velvet antlers of the deer and less attention to the purity of the deer bloodline. Since there is a lack of professional and authoritative companies in the field of deer cultivation in the research area, farmers generally purchase breeding livestock from the nearby farm, which may cause the bloodline of the deer in the research area become chaotic. According to the summary of scholars such as Zhang (2021) and Xing (2021), the germplasm resource crisis is now one of the main crises faced by China's deer industry, since it already causing the degradation of some excellent local varieties. The degradation of varieties will cause the agriculture products lost their competitiveness, leading to local producers losing control over the market. Taking the vegetable market in Georgia as an example, due to the lack of competitiveness of local varieties, the market share of local producers has gradually been replaced by imported products (Kharaishvili, 2018).

c) Market challenges

the market challenges include international competition and insufficient coordination among practitioners. Imported velvet antlers have advantages in price compared to domestic velvet antlers. According to feedback from respondents and market research, the average price of imported velvet antlers is generally lower than 1.4 CNY (0.19 USD), while the average price of locally produced velvet antlers is about 1.8 CNY (0.25 USD). In order to reduce costs, some companies have chosen to use imported velvet antlers as the raw material for producing velvet antler products. This is a challenge for local velvet antler producers. Since the market share is limited, as local production capacity gradually increases, competition between imported products and local products will be more severe. However, due to the unstable production capacity and product quality of most of the domestic velvet antler producers, they are at a disadvantage position in market competition, which may lead to the loss of control over the domestic market (Xing, 2021). In the context of internationalization, the challenges posed by international competitors with stronger productivity and better production technologies to local agricultural producers are very obvious (Carte, 2010). For example, in a survey of agricultural producers in Nepal, it was also found that due to outdated production technology and insufficient production capacity, their products lack of competitiveness compared to the international competitors (Kc, 2019), the velvet antler industry in China may face the similar question.

On the other hand, the competition between domestic value chain actors has also posed challenges to the Chinese velvet antler industry. In the middle-income and low-income chains, the participants in the value chain are independent individuals, and most practitioners aim to maximize their interests, which may lead to some value chain actors sacrificing the interests of the practitioners in other stages to improve their profits. Phenomena like collectors pressing down the price or vicious price-cutting competition were found during the study. Like Kanda’s (2009) conclusion, when the aims of the practitioners in the same chain are inconsistent, the relationships between practitioners will become unstable, and the efficiency of the entire chain will also be affected.

D) Policy challenges

The policy challenges include the low level of credibility and lack of standards. This study believes that the main challenge for China's velvet antler industry lies in the lack of relevant policies. Based on the development history of China's velvet antler industry and the research of scholars such as Ding (2012) and Xing (2021), it can be found that due to the problems such as the multi-departmental management of China's deer industry before 2020 and domestic deer were managed as wildlife, many policies were not beneficial for the development of the industry and had brought limitations to the development of the industry. The negative impact of incorrect policies on industrial development is very obvious. In the case of Sri Lanka, without fully understanding the current situation of the domestic agriculture industry, policymakers blindly promoted organic agriculture nationwide, limiting

the application of fertilizers and insecticides, which seriously affected the country's agriculture (Nordhaus, 2022). As Trienekens (2011) pointed out that policy is one of the most influential factors in the agricultural industry in developing countries, and it is the same in China’s deer industry. Due to the lack of national support policies in the past and unclear departmental responsibilities for managing the deer industry, the development of China's deer industry has been restricted. For example, raising deer or selling deer products requires a large number of relevant documents, which limits the enthusiasm of investors. Xing (2021) pointed out that due to the uncertain development prospects of the deer industry, it is difficult for the deer industry to attract more investment. From 2010 to 2020, the national investment in the deer industry only accounted for 0.008% -0.012% of the total investment in animal husbandry. Insufficient investment has limited the development of the deer industry, leading to significant deficiencies in China's deer industry in areas such as breeding standards, disease prevention and control, and product standards. Some of the challenges proposed in the previous text are actually caused by past policies. Taking the relevant standards of the deer industry as an example, by the end of 2021, there are nearly 1240 relevant standards for China's deer industry, of which only 4 are national standards, and the rest are mostly enterprises’ standards or local standards (Zhang, 2022). Although there are many standards, the structure is unreasonable, and the proportion of national standards is extremely low, which is not conducive to industrial standardization. Webb (2015) pointed out that private industry standards often do not have authority, and overly complex standards are not conducive to the healthy development of the industry. The lack of key standards can lead to a lack of reference standards for testing agencies to test deer products, which leads to a lack of quality assurance for velvet antler products in the market. This is also the main reason why China's deer antler industry is facing a credit crisis. Therefore, this study believes that the main challenge faced by China's velvet antler industry is policy challenges.

6.2.2 Opportunities

Firstly, it is the opportunities brought about by policy changes. As mentioned earlier, the incomplete policies in the past have stunted the development of China's velvet antler industry. The policy adjustments in the deer industry after 2020 have brought opportunities to the development of China's velvet antler industry. Firstly, engaging in deer businesses no longer requires a lot of qualification certificates as it used to be. Taking farmers as an example, before policy adjustments, if they want to engage in the deer farming business, they need to go to different departments to obtain qualification certificates such as ‘Wildlife Domestication and Breeding License’, ‘Wildlife Operation License’, and ‘Animal Epidemic Prevention Certificate’. The production, sale, and transportation of deer products without sufficient relevant licenses will be illegal. The complex demand for documents has an impact on the enthusiasm of practitioners. However, the policy adjustment has greatly simplified the documents required for deer farming. Farmers no longer need to apply for various qualifications as in the past. All respondents expressed a positive attitude towards this change. From a macro perspective, the relaxation of policies and the reduction of restrictions can attract more investment. According to Fu's (2021) summary, after the introduction of new policies, multiple farms and processing enterprises immediately began to expand their farm

scale and build new facilities, which was also found in the field investigation of this study. This not only helps these enterprises increase their competitiveness, but also helps them to enjoy the dividends of national policy adjustments as early as possible and attract investment from society. National-level policy adjustments often lead to changes in local policies. Taking the survey area of this study, Jilin Province as an example, multiple targeted assistance policies have been launched since 2020, and it is expected to invest a large amount of funds to promote the development of the deer industry in this province. According to the government bulletin, it is expected to increase the annual output of velvet antlers of the Jilin velvet antler industry to 1000 tons by the end of 2025, and the scale of domestic deer will increase from nearly 600000 in 2021 to 1 million in 2025. Correct and proactive policies can bring good guidance to the development of the industry. Take the deer industry in New Zealand as an example. In the early days, deer was considered a harmful alien species in New Zealand, but after the economic value of venison was discovered, the government's policy towards deer promptly shifted from simple hunting to commercial farming (Nugent, 2001). After the emergence of the international velvet antler market, New Zealand then timely adjusted its business direction and strategy, seizing opportunities (Nixon, 2004). In the subsequent development, through continuous improvement of relevant regulations and standards (Walsh & Wilson, 2002), New Zealand's deer products have gained favor and recognition in the global market. New Zealand's deer industry enterprises also seized the opportunities brought by government policies in this process. These are valuable examples for China's velvet antler industry to refer to. A good market prospect and proactive policies will provide tremendous assistance to the local velvet antler industry, and if practitioners can seize this most important development opportunity, they can not only enjoy the dividends of policies but also improve their production efficiency.

The opportunities brought by the e-commerce platforms, logistics systems, and information technology are also beneficial for the velvet antler industry. As summarized earlier, in the traditional velvet antler value chain, velvet antler products need to go through multiple stages and actors to be purchased by consumers. During this process, intermediaries will lower the seller's price to increase their profits, which makes it difficult for upstream practitioners to receive the ideal price but also increase the final price that consumers receive. The e-commerce model has changed the traditional sales process, allowing upstream practitioners to enter higher revenue stages, as summarized by Kaplinsky (2002), this is a form of functional upgrading. Multiple respondents stated that they have opened online stores to sell velvet antler products, and this behavior has been proven to help increase their revenue and strengthen their connection with consumers. According to Zhao (2016) and Ma (2022), in recent years, China has been encouraging agricultural products to be sold to further markets through e-commerce platforms, and e-commerce platforms have also provided preferential policies for the sale of agricultural products. This is a good opportunity that practitioners in the velvet antler industry should seize. The use of e-commerce systems is not only supported by current policies but also helps practitioners achieve functional upgrading and improve their profits. The development of information technology can help farmers alleviate the challenges posed by insufficient professional knowledge. Farmers can receive emerging breeding technologies through the internet and social media, thereby improving the problem of low

levels of farm management. This is exemplified in studies targeting Indian fishermen (Steyn, 2016) and Ethiopian farmers (Getahun, 2020). In recent years, China has been promoting the informatization of agricultural production and attempting to increase the coverage of the Internet in rural areas. If practitioners can better utilize emerging information technologies such as the Internet, they can further enhance their professional level and improve information collection efficiency.

The changes that have occurred in the healthcare product market are also opportunities that practitioners should seize. According to Wang's (2022) summary, the prospects of China's health product market are very promising, and it is expected that the scale of China's health product market will exceed 325 billion CNY (44.59 billion USD) by the end of 2023. Due to the impact of COVID-19, the sales of health products, including velvet antler products, have increased in recent years, which was also demonstrated in Xing's (2021) study. In addition, life stress and unhealthy lifestyles have led young people who were not the target customers of health products in the past to regularly purchase health products (Zhang, 2020). The changes in society have led to the emergence of new markets. If the velvet antler industry can seize the opportunities of market changes and promote marketing in response to these new social trends, it can further expand the market, cultivate consumers' habits, and profit from it.

As mentioned earlier, due to incomplete policies in the past, there was a lack of authoritative and clear standards for velvet antler products. The lack of standards makes it difficult for consumers to determine the true quality of products, leading to a loss of confidence in the industry. This problem can only be fundamentally solved by improving the relevant law and national standards. However, this will take a longer time and is not controlled by velvet antler practitioners. For how to solve the problem of lack of credibility, well-known certified brands provide a good reference, which is to build a traceability system. Through the traceability system, enterprises can ensure the quality of the product and find the problem that occurred in the processing process. Consumers are also more willing to trust enterprises that can provide sufficient quality certificates and product traceability services. This has been exemplified in Zhang's research (2018) and Wang's research (2020) on deer product consumers in China. The promotion of new information technologies such as the Internet of Things and big data can help enterprises build a complete product traceability system more efficiently. If practitioners in the velvet antler industry can establish a comprehensive product traceability system, they can provide more protection for consumers and improve the brand's reputation and popularity. Taking the deer industry in New Zealand (Pearse, 2022) and Australia (Tuckwell, 2001) as examples, their deer industry has established a comprehensive product traceability system, which can effectively monitor the production process of products and provide consumers with sufficient product information and safety protection. This is also one of the main reasons why their deer products can gain the trust of the consumers.

Chapter 7 Conclusions

This Chapter can be divided into three sections. Section 1 summarizes the findings of the study. Section 2 provides recommendations for China's velvet antler industry. Section 3 introduces the limitations of this study and provides suggestions for future research.

7.1 Summary of the Study

This study aimed to analyze the value chain of China's velvet antler, observing the activities of participants in the value chain, and further analyzing the opportunities and challenges faced by China's velvet antler value chain. The data used in this study can be divided into secondary and primary data. Secondary sources are from public sources such as journals, local newspapers, and government publications. Primary data is from face-to-face semi-structured questionnaire interviews. The interviewees were selected from local velvet antler industry practitioners through purposive sampling. Through analyzing the velvet antler value chain in the study area, the main participants in the velvet antler value chain include input suppliers, producers, collectors, processors, distributors, and retailers.

Through analysis and discussion, four different types of velvet antler value chains were identified in the survey area, namely Low-income value chain; Medium-income value chain; High-income value chain; E-commerce value chain

The low-income value chain only exists in the vicinity of the production area, with limited coverage, and can only attract a limited number of consumers. It also has obvious seasonal characteristics and often does not appear during non-harvest seasons. There are few participants in this value chain and are mostly small-scale practitioners. The products sold in this market are mainly unprocessed or rough-processed products, with lower added value and final prices. It is a simple and relatively traditional value chain that is not common to see outside the rural area.

The medium-income value chain is a nationwide value chain. Its final market is mostly concentrated in urban or suburban areas, which can cover markets farther away from the production areas of velvet antlers and reach more customers. The products sold in the market are all processed dried velvet antler products, so the average price is higher than the products in the farmers' market. The variety of products is more diverse, and the price difference between products of different levels is also greater, which can meet the needs of different customer groups. This value chain has more participants, and the bridging role of collectors and distributors in linking the upstream and downstream of the value chain can also be reflected in this market. It is the more common type of value chain in the survey area. However, this value chain is not perfect. The practitioners in this value chain are still mostly small and medium-sized enterprises, some of them lack the capability of controlling the quality of the products and the coordination relationships between practitioners are unstable.

The high-income value chain is also a nationwide value chain, which can be considered as the upgraded version of the medium-income value chain. The final retailers are chain stores located in urban areas that sell fine processed branded products. The final price of products in this market is much higher than the products in other markets. It is mainly because of the brand premium and better-quality assurance. However, due to the higher price of the products, the value chain can only attract fewer customers. The practitioners of this value chain are mostly large-scale farms and enterprises with stronger economic strength and business capabilities, which have better control over the production process of products. They often choose to sign contracts to make their coordination relationship more stable. However, most of the velvet antler value chain actors are unable to meet the standards for entering the high-income value chain, so compared to the medium-income value chain, this type of value chain is not that common, but it is still the future development direction.

E-commerce value chain is a relatively special type. Practitioners at different stages can directly sell their products to consumers through e-commerce platforms without going through the downstream stages. The E-commerce value chain can be considered as providing an opportunity for all practitioners in the value chain to achieve functional upgrading. By using e-commerce platforms, practitioners can change their original position in the value chain and thereby increase their profits. Through online platforms, value chain practitioners can reach potential users nationwide. The product categories in this value chain are also the most diverse, able to meet the different needs of different consumer groups, and because online stores do not need to bear additional costs such as store rent, the actual price of products in online stores is always cheaper. But this value chain is not perfect. Compared to physical stores, customers in online stores cannot have direct access to the products they want to purchase, nor can they observe the actual quality of the products. Due to the high price and concern for food safety, most consumers are unwilling to bear the risk of purchasing inferior products. However, due to the advantages like low cost, convenient operation, and wide market coverage that this value chain can provide, it is becoming more and more popular among the value chain actors.

The challenges faced by China’s velvet antler value chain can be divided into four categories: financial challenges, technical challenges, market challenges, and policy challenges. Financial challenges mainly lie in the lack of sufficient funds for business expansion among practitioners, and the imperfect loan system also makes most practitioners afraid of bearing more debts. The continuous reduction of the labor force and the long transportation distance between production and place of sale have increased the operating costs of the value chain actors. The technical challenges mainly lie in the lack of professional and systematic knowledge among most deer farmers, which leads to low management levels in most farms. There are deficiencies in important fields such as breeding and animal epidemic prevention and control, which affect the production capacity of farms and the quality of velvet antler products. Market challenges include challenges from both international and domestic levels. From the international level, imported velvet antler has more price advantages, and poses a challenge to the market share of the local velvet antler

industry. From the domestic level, the unstable coordination relationships and price wars among small and medium-sized actors have also posed a negative influence on the velvet antler value chain. Policy challenges mainly lie in the imperfect laws and industry standards that make it difficult for Chinese velvet antler products to gain consumers' trust, thereby making it difficult to expand the market.

Despite various challenges, the development prospects of China's velvet antler industry are still full of hope. Firstly, are the opportunities brought by changes in the policy. A more relaxed, comprehensive, and reasonable deer breeding policy and deer product processing and sales policy can reduce the policy pressure faced by the practitioners, while also attracting more investment, which is conducive to the development of the industry. The application of new technologies such as e-commerce and information technology and the improvement of logistic systems have changed traditional sales models and information transmission models, improving the profitability and the ability to gather real-time information of most practitioners. The expansion of the market share of health products and the increase in potential users provide a more optimistic market prospect for the future development of the velvet antler industry. The improvement and popularization of the traceability system for velvet antler products among large and medium-sized enterprises also help to rebuild the credibility of domestic velvet antler products. Although challenges still exist for China's velvet antler industry, the future development direction is already clear.

7.2 Recommendation of the Study

This section provides recommendations for the future development of China's velvet antler industry based on the findings of this study.

7.2.1 Recommendation for Farmers

- This study found that most farmers generally rely on their experience instead of professional knowledge. Therefore, the suggestion for the farmer group is to strengthen their professional level. In addition to attending professional courses or expert lectures, farmers should also make full use of the Internet to learn advanced breeding and management knowledge through the internet.
- This study found that most small and medium-sized farmers pay more attention to yields and less attention to the bloodline of the deer, but consumers generally believe that the quality of hybrid deer velvet antlers is not as good as that of pureblood deer velvet antlers. So, farmers should consider improving the purity of the deer instead of only focusing on the yield. High-quality products can help them enter the high-income market.

7.2.2 Recommendation for Industry

- Consumers distrust local velvet antler products mainly because the product information is missing. They cannot make sure where the velvet antler came from and what kind of deer produced it. Therefore, the whole industry should establish a fully traceable system for the velvet antler products through technology such as Big data and the Internet of Things.
- This study found that the coordination relationship between small and medium-sized practitioners is not stable. Therefore, practitioners should sign legally effective contracts during cooperation, and clarify the responsibilities and rights of both parties in the contract. This helps protect the rights and interests of all parties and form stable relationships.

7.2.3 Recommendation for Policymakers

- The financial issue is a main problem faced by most of the farmers. Other than increasing the financial investment in the field of deer farming, the government should also improve the farmers' loan guarantee mechanism and provide suitable financial products for farmers.
- As mentioned earlier, the standards for China's velvet antler industry have long been in an imperfect state. Therefore, it is necessary to establish a professional technical committee to formulate new standards for the velvet antler industry and improve the construction of the standard system of domestic velvet antler products. This committee’s focus should not be limited to the quality standards of velvet antler products, but also needs to focus on the production, processing, and other fields of the whole deer industry. Ensuring that there are authoritative standards and regulations for the entire process of velvet antler products to reference.
- The phenomenon of selling shoddy products in the market is also a reason why China’s velvet antler products and the industry lost their credibility. Therefore, it is necessary to strengthen market supervision, and control and punish such behavior. Only in this way can ensure the rights and interests of consumers and protect the interests of practitioners of the velvet antler industry.

7.3 Study Limitations & Future Research

Firstly, due to time and money constraints, this study only studied the velvet antler value chain in the target area of Jilin Province. Therefore, the results of the study may only apply to Jilin Province and may not represent the entire velvet antler value chain in China. Secondly, due to the impact of past policies, relevant institutions have not conducted systematic statistics on China's velvet antler industry, and some data is missing. Thirdly, due to the lack of authoritative data, the research method adopted by this study is the qualitative method, and therefore, the results of this study may be subjectively influenced by the researcher and

respondents. Finally, the number of respondents is limited, and some respondents may have blurred some of the information due to concerns about company confidentiality.

Based on the limitations of this study, the suggestion for future research is as follows:

- This study only focused on Jilin Province, one of the main velvet antler production areas in China. Therefore, the future study should expand the scope by considering other velvet antler production areas such as Heilongjiang Province and Liaoning Province.
- Due to the lack of authoritative data, the research method adopted by this study is qualitative method. As the government's emphasis on the deer industry increases, relevant data will also become more comprehensive in the future. Therefore, it is recommended that future research adopt quantitative methods, which will help to analyze China's velvet antler value chain more objectively.
- Due to limited time, the size of the respondents in this study is relatively small, and it is recommended to expand the size of the respondents in future research.

This study is an exploratory study aimed at exploring the current situation, opportunities, and challenges of China's velvet antler value chain after the changes in policies and markets. For future research, continuing the research on this project will be meaningful. Especially with the long-term implementation of the new policies, will there be new changes in the future development of China's velvet antler industry is still a problem.

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Appendices

Appendices 1: Questionnaire – Farmers

Part 1 Information

Name

Age

Gender

Education

Experience

Part 2 Farm operation

Could you briefly describe the current situation of your farm? Such as the location of your farm? What is the size of your farm? How many people help you manage or work your deer farm?

What are the agricultural activities on your farm? Do you adopt the mode of captive breeding or free-range breeding Why?

Is this your main source of income? To what extent does this business contribute to your income?

Please briefly describe the number and variety of deer on your farm. How do you get new deer? Is deer raising the main business on your farm? When did you start raising deer?

How much does it cost to raise a deer? What are the main costs of breeding deer? Does the feeding cost change as the feeding quantity changes? What is the annual deer raising cost on your farm? What are the main expenses?

What is the main deer product of your farm? What is the total production of your products? Are you doing any processing? What and why? How much velvet antler does your farm produce per year? Are you selling all of your velvet antlers? Why?

How do you harvest velvet antlers? What should be noted during the harvesting process?

When does the harvest usually start?

How do you transport and store your products? How much does it cost? Please briefly explain.

During your business operation, what problems and challenges do you think have a significant impact on your business? How did you reply to it?

Part 3 Market relationship

About your suppliers? What do you get from them? Why choose them? What price you will provide? What are your relationships (spot/contract)? Do you trust your relationships? How do you share your information? What information do you think is important?

About your buyers? Why them? What are your relationships (spot/contract)? What is the price you receive? Do you trust your relationships? How do you communicate? How do you share your information and what kind of information do you think is important?

What factors do you think will affect the sales of your products?

Do you negotiate the price with your suppliers and buyers? Why or why not? How do you negotiate it?

Do you sell all your products? What is the price you receive for your velvet antler products? Do you know where the product you sold goes to?

Do you know what your buyers usually do with the velvet antler they bought?

Do you think the price of velvet antler products is stable in recent years? Why?

Part 4 Industrial Upgrading

Based on your experience, what strategies do you think can be taken to improve production efficiency or product quality? What strategy have you adopted? Do you think the strategies are effective? What factors make you think this strategy may be beneficial for your business? What are the main challenges you face when implementing these strategies?

Have you considered expending or changing your business to the other part of the industry chain, such as setting up a velvet antler process workshop of your own? If so, what do you think you are going to do? Could you please briefly explain your plan? What are the main challenges you face when trying to achieve the goal?

Do you think joining some associations or groups can improve your business position in the

market or reduce the cost? Why or why not?

Except for the above upgrading strategies, what other measures do you think can be taken to improve your profitability? Could you please briefly explain? What are the main challenges you face when trying to achieve your goal?

Part 5 Opportunities and challenges

What opportunity and challenge do you think your business is facing right now?

What opportunities do you think there will be for the velvet antler industry in the future?

What challenges do you think there will be in the future?

What is your future development plan for your business?

In your business process, what systematic deficiencies do you think the industry has?

Appendices 2: Questionnaire – Collectors

Part 1 Information

Name

Age

Gender

Education

Experience

Part 2 Business operation

Could you please briefly describe your main business? What are the main tasks of your job? What is the main cost of your business? What are the main challenges you will face? How long have you been doing this?

Normally, where do you usually purchase fresh/frozen velvet antlers? Besides locally produced velvet antlers, will you purchase imported velvet antlers? How do you collect the velvet antlers from the market? How many fresh velvet antlers can you trade per year?

Would you rate the quality of the velvet antler? What is your rating standard? Does it have a significant impact on the price of deer antlers? What is the general price of various fresh velvet antlers under stable market conditions?

Besides this business, do you also engage in any other business related to velvet antlers?

Is your business highly seasonal? What do you think is the main cost of your business activities?

Part 3. Market relationships

About your suppliers? What do you get from them? Why choose them? What price you will provide? What are your relationships (spot/contract)? Do you trust your relationships? How do you share your information? What information do you think is important?

About your buyers? Why them? What are your relationships (spot/contract)? What is the price

you receive? Do you trust your relationships? How do you communicate? How do you share your information and what kind of information do you think is important?

What factors do you think will affect the sales of your products?

Do you negotiate the price with your suppliers and buyers? Why or why not? How do you negotiate it?

Do you sell all your products? Do you know where the product you sold goes to?

Do you think the price of velvet antlers has been stable in recent years? Why?

Part 4 Infrastructure and transportation

How do you transport and store the fresh/frozen velvet antler? What are the difficulties you face when doing these? What did you do to solve these problems?

Part 5 Industrial upgrading

What measures do you think can be taken to improve your profitability? Could you please briefly explain? What are the main challenges you face when trying to achieve your goal?

Part 6 Opportunities and challenges

What opportunity and challenge do you think your business is facing right now?

What opportunities do you think there will be for the velvet antler industry in the future?

What challenges do you think there will be in the future?

What is your future development plan for your business?

In your business process, what systematic deficiencies do you think the industry has?

Appendices 3: Questionnaire – Processors

Part 1 Information

Name

Age

Gender

Education

Experience

Part 2 Business operations

Could you please explain about your processing business? Is there a unified processing standard? How long have you been doing this? What are the main challenges and difficulties you face in this business?

Is this your main source of income? To what extent does this business contribute to your income? What is the main cost? Would you mind talking about the benefits of this business?

How big is your business in this market? How well-known is you're your product?

Part 3 Market relationship

About your suppliers? What do you get from them? Why them? Why choose them? What price you will provide? What are your relationships (spot/contract)? Do you trust your relationships? How do you share your information? What information do you think is important?

About your buyers? Why them? What are your relationships (spot/contract)? What is the price you receive? Do you trust your relationships? How do you communicate? How do you share your information and what kind of information do you think is important?

Do you sell all your products? Do you know where the product you sold goes to?

How is the quality of your products in the market? What are the comments of your customers? Are you familiar with the market requirements? Do you think the price of velvet antler

products is stable in recent years? Why?

Part 4. Industry upgrading

Based on your experience, what strategies do you think can be taken to improve production efficiency, product quality or income? What strategy have you adopted? Do you think the strategies are effective? What factors make you think this strategy may be beneficial for your business? What are the main challenges you face when implementing these strategies?

Have you considered expanding or changing your business to the other part of the industry chain, such as building a deer farm of your own? If so, what do you think you are going to do? Could you please briefly explain your plan? What are the main challenges you face when trying to achieve the goal?

Except for the above upgrading strategies, what other measures do you think can be taken to improve your profitability? Could you please briefly explain? What are the main challenges you face when trying to achieve the goal?

Part 5. Opportunities and challenges

What opportunity and challenge do you think your business is facing right now?

What opportunities do you think there will be for the velvet antler industry in the future?

What challenges do you think there will be in the future?

What is your future development plan for your business?

In your business process, what systematic deficiencies do you think the industry has?

Appendices 4: Questionnaire – Distributors

Part 1 Information

Name

Age

Gender

Education

Experience

Part 2 Business operation

Could you please briefly describe your main business? What are the main tasks of your job? What is the main cost of your business? What are the main challenges you will face? How long have you been doing this?

Normally, where do you usually purchase processed velvet antlers? How do you collect the velvet antlers from the market? How many velvet antlers can you trade per year?

Would you rate the quality of the velvet antler? What is your rating standard? Does it have a significant impact on the price of velvet antlers? What is the general price of the velvet antlers under stable market conditions?

Would you choose to further package your products, why? How did you package the products? Is the packaging of products of different levels the same or different, why? Does packaging have a significant impact on the final price of the product?

Part 3. Market relationships

About your suppliers? What do you get from them? Why choose them? What price you will provide? What are your relationships (spot/contract)? Do you trust your relationships? How do you share your information? What information do you think is important?

About your buyers? Why them? What are your relationships (spot/contract)? What is the price you receive? Do you trust your relationships? How do you communicate? How do you share your information and what kind of information do you think is important?

Do you know where the product you sold goes to?

What factors do you think will affect the sales of your products?

Do you negotiate the price with your suppliers and buyers? Why or why not? How do you negotiate it?

Do you think the price of velvet antlers is stable in recent years? Why?

Part 4 Industrial upgrading

Based on your experience, what strategies do you think can be taken to improve production efficiency, product quality, or income? What strategy have you adopted? Do you think the strategies are effective? What factors make you think this strategy may be beneficial for your business? What are the main challenges you face when implementing these strategies?

Have you considered expanding or changing your business to the other part of the industry chain, such as building a deer farm or workshop of your own? If so, what do you think you are going to do? Could you please briefly explain your plan? What are the main challenges you face when trying to achieve the goal?

Except for the above upgrading strategies, what other measures do you think can be taken to improve your profitability? Could you please briefly explain? What are the main challenges you face when trying to achieve the goal?

Part 5 Opportunities and challenges

What opportunity and challenge do you think your business is facing right now?

What opportunities do you think there will be for the velvet antler industry in the future?

What challenges do you think there will be in the future?

What is your future development plan for your business?

In your business process, what systematic deficiencies do you think the industry has?

Appendices 5: Questionnaire – Retailers

Part 1 Information

Name

Age

Gender

Education

Experience

Part 2 Business operations

Is selling velvet antlers your main business？ What is the proportion of this business to the turnover？

How many velvet antler products do you or your company trade each year? What type of products?

How do you buy the velvet antler products? Do you have strong control over product prices?

What is your target customer group? Do you know the purpose of customers purchasing velvet antlers?

Do you have any professional knowledge about velvet antlers? Do you think this knowledge can help you with promoting the product?

How do you usually display and promote velvet antler products to consumers? Is the impact on customers significant? In your opinion, what factors will influence the consumer to buy velvet antler?

During your business operation, what problems and challenges do you think have a significant impact on your business? How did you deal with it?

Part 3. Market relationships

About your suppliers. Why choose them? What do you get from them? What price you will

provide? What are your relationships (spot/contract)? Do you trust your relationships? How do you share your information? What information do you think is important?

About your consumers. What type of product do they generally prefer? Do you know what will they do with the velvet antler product they buy? What factors make them tend to purchase velvet antler products?

What factors do you think will affect the sales of your products?

Do you negotiate the price with your suppliers and consumers? Why or why not? How do you negotiate it?

Do you think the price of velvet antlers has been stable in recent years? Why?

Part 4 Industrial Upgrading

What measures do you think can be taken to improve your profitability? Could you please briefly explain? What are the main challenges you face when trying to achieve the goal?

Part 5 Opportunities and challenges

What opportunity and challenge do you think the velvet antler business is facing right now?

What opportunities do you think there will be for the velvet antler industry in the future?

What challenges do you think there will be in the future?

What is your future development plan for your business?

In your business process, what systematic deficiencies do you think the velvet industry has?

Appendices 6: Ethical Approval

MASSEY UNIVERSITY
TE KUNENGA KI PŪREHUROA
UNIVERSITY OF NEW ZEALAND

9/12/2022

Dear: Zhaowei Zhang

Re: Low Risk Notification - 4000026721 - A Case Study of China's Velvet Antler Value Chain

Thank you for your notification which you have assessed as Low Risk.

Your project has been recorded in our database for inclusion in the Annual Report of the Massey University Human Ethics Committee.

The low risk notification for this project is valid for a maximum of three years.

If situations subsequently occur which cause you to reconsider your ethical analysis, please contact a Research Ethics Administrator.

Please note that travel undertaken by students must be approved by the supervisor and the relevant Pro Vice-Chancellor and be in accordance with the Policy and Procedures for Course-Related Student Travel Overseas. In addition, the supervisor must advise the University's Insurance Officer.

A reminder to include the following statement on all public documents:

"This project has been evaluated by peer review and judged to be low risk. Consequently, it has not been reviewed by one of the University's Human Ethics Committees. The researcher(s) named in this document are responsible for the ethical conduct of this research.

If you have any concerns about the conduct of this research that you want to raise with someone other than the researcher(s), please contact Professor Craig Johnson, Director - Ethics, telephone 06 3569099 ext 85271, email humanethics@massey.ac.nz."

Please note, if a sponsoring organisation, funding authority or a journal in which you wish to publish requires evidence of committee approval (with an approval number), you will have to complete the application form again, answering "yes" to the publication question to provide more information for one of the University's Human Ethics Committees. You should also note that such an approval can only be provided prior to the commencement of the research.

Yours sincerely

Professor Craig Johnson
Chair, Human Ethics Chairs' Committee and Director (Research Ethics)

Research Ethics Office, Research and Enterprise
Massey University, Private Bag 11 222, Palmerston North, 4442, New Zealand T 06 951 6841; 06 95106840
E humanethics@massey.ac.nz; animalethics@massey.ac.nz; gtc@massey.ac.nz

Appendices 7: Research Information & Participant Consent Form

RESEARCH INFORMATION & PARTICIPANT CONSENT FORM

Dear Sir/Madam

The velvet antler industry is a characteristic industry in Jilin Province and a pillar industry in some regions. For many families, the production, processing, and sales of velvet antler products have already become an important source of income. The goal of this study is to gain a deeper understanding of the current situation of the value chain of China's velvet antler industry, understand the relationships among members of the value chain, and further analyze the future opportunities and challenges that this industry may face.

Your participation in this research interview is important for us to achieve the goals of this research. If you feel uncomfortable or unwilling to answer any questions during the interview, you have the full right to refuse to answer or request to withdraw from the interview, your rights will be fully guaranteed. If you have any further questions, you can always raise them before or during the interview process.

We will take all necessary measures to ensure the security of your data and your privacy. Our data collection, management, and confidentiality processes and procedures have been approved by Massey University's Human Ethics Committee. Please rest assured.

PARTICIPANT CONSENT FORM

I have read the above information and understood the details of this study. My questions have been answered to my satisfaction. and I know that I may ask any further questions at any time.

I agree/do not agree to be interviewed on tape.

I agree to participate in this study under the conditions set out in the research information mentioned above.

Signature