CHAPTER 1

INTRODUCTION

Situated in the south-western part of China, Guizhou province, with population of around 32 million, is one of the economically-underdeveloped provinces in China.

Guizhou province is on the slope of Yungui plateau, a mountainous region with diversity of ecological environments, rich biological, physical, and cultural endowments. However, the development of Guizhou economy has long been far behind other provinces and regions, particularly, those coastal provinces in the east and south China.

As an agriculture based economy, agricultural development and its problems are in the center of discussions and hotly debated. Several times' drastic changes in institutions created drastic changes in growth rates of agricultural production. Focusing on the past four decades, Sharp fluctuations can be observed, average growth rates of agricultural production ranged from -7.2% in 1958-1962 period to 13.3% during 1963-1985 time period. Fortunately, negative growth rates in agriculture are not frequently found, from 1950 till 1990, only two times of negative growth were registered, which were in 1958-1962 and 1966-1970, respectively. Most of the time in the past, agricultural production grew at quit high rates, especially in the periods of 1963-1965 and 1981-1983, agriculture had double-digit rates of increase, the respective growth rates were 13.3% and 10%.

In agriculture of Guizhou province, crop production is the most important sector and a crucial component. The average share of crop production in total agricultural output was 69% in 1949-1960, it declined to 66% in the period of 1961-1970. From 1981 to 1990, the weight of crop production was continuing decreasing to 56%. But crop production still remained the biggest contributor to the total agricultural output.

Without any exceptions, like other sectors crop production from 1949 to 1990 also went through fluctuating development processes, however, from the standpoint of the whole time period, crop sector shows up-trend. Total output of grain production rose to 6.4 million tons up from 2.9 million tons, increased by 1.14 times with an annual growth rate of 1.97%. Partial productivity of land went up to 172 kg per mu (1 mu =0.0067 hectares) from 108.5 kg, increased by 58.5% (Liao 1990).

1.1 Rationale

1.1.1 Problem of insufficient food production

Though crop production has been increasing, after the late 1970s, in particular, the increment in crop production still could not cover the increased demand derived from population increase and consumption growth. From 1949 to 1988, for example, total population of Guizhou province increased to 31.3 million, 1.21 times of that in 1949 with an annual growth rate of 2.1%. During the same time period grain production grew only 1.14 times, yearly, 2% more was added to the total output

(Li 1990). Obviously, the increase in crop production failed to match the population increase. For this imbalance situation of grain demand and supply, an effective and easily-found solution to this problem is importation of grain from other provinces and regions. Statistics indicates that a growing amount of grain was imported. In 1966, 17,490 tons was brought in, this figure changed to 1.3 million tons in 1987, after that, some decrease occurred, but the imported grain still at 871000 tons in 1990[1]. This situation certainly has imposed some negative impacts on the economic development, it has not only placed a heavy burden on transportation systems of limited capacity, it also diverted attentions to the development of other sectors in stead of crop production, as well as became more and more dependent on other provinces and regions for food supply.

1.1.2 Obstacles of further boost of crop production

A number of problems are concerning the governments and relevant institutions, however, the major ones among others are as follows:

Shrinking Agricultural Land Area. With the development of economy, urbanization, environmental degradation, soil erosion, etc., agricultural land has been converted to other uses and lost irreversibly. Arable land area in this province has been declining at

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[1] Guizhou Annual Report Editing Committee, *Guizhou Annual Report, 1991*. Guiyang: The People's Press of Guizhou, 1991.

a surprising rate. From 1984 to 1985 agricultural land was decreased by 305 thousand mu (20435 hectares), in 1986-1987, 30 thousand mu (2010 hectares) disappeared. From 1980 to 1987, the average lost rate of agricultural land was 100 thousand mu (6700 hectares) per year. Total arable land declined to 27.9 million mu (1,868,496 hectares) in 1987 down from 28.9 million mu (1933,419 hectares) in the year of 1969. (Shao, 1990). On the other hand, population keeps growing, as a sure result, land resource per capita sharply decreases. In the early 1950s man-land ratio was 1.91 mu, forty years later in 1990, it declined to 0.88 mu (shao, 1990).

Fading Functions of Institutional Reforms. Several times of economic reforms in China have pervasive effects on crop production, which provided very strong incentives to crop producers, contributed to the increase in agricultural production. However, with the time passing by, the advantages for crop production from institutional reform faded. A study by GAAS[2] revealed that, problems in the marketing processes of both agricultural inputs and outputs to a certain extent are jeopardizing crop production. Besides, agricultural technical service system and agricultural output pricing systems are still not in a very good shape for developing crop production.

Governments at different levels in Guizhou province have expressed their deep concerns on agricultural production, grain supply issue is the core in their concerns. In this new economic reform era, with the

[2] Guizhou Academy of Agricultural Sciences.

price liberalization for main agricultural products, farmers are gaining freedom in working out their farming plans and in decision making in many aspects. At this transitional moment, carefulness in government policy formulation is specially needed. From a broad perspective, a further increase in crop production can be achieved by raising land productivity, and further modification of existing economic institutions, as well as more input use in production processes. More material input use will certainly boost total production cost and perhaps lead to pollution of environment. One better way is to improve the existing productive efficiency to increase output without increase input use by adjusting the unsuitable present institutional factors, and to increase crop productivity through improving existing production technology.

However, among institution, input, and technology, which area has the greatest potential, what are the direct solutions to increase crop production, and to what extent institution, technology, and input have contributed to crop production both at the present and in the past, are several policy associated issues remain unclear. This study is making an attempt to address issues on institution, technology, and input use in crop production of Guizhou province. Central issues to be tackled in this study are; 1) How much institution, technology, and input use contributed to crop production growth in different historical periods; 2) what reasons resulting in fluctuations in crop production in different time periods; 3) and finally, the prevailing institutions and its functions in the crop production systems of Guizhou province.

1.2 Objectives

To fulfill the requirements of answering above-raised questions, the overall emphasis is on analysis of the prevailing institutions and identifications of the problems in crop production systems; assessment of impacts of technological change, institutional reform and input use on crop production in different time periods.

Specifically, the objectives are as follows:

(1) To analyze the effects of technological change, input, and institutional reform on crop production in Guizhou province;

(2) To find out the potential of crop production in the agricultural systems of Guizhou province;

(3) To lay out strategies to increase crop production in Guizhou province.

1.3 Review of Literature

1.3.1 Studies on causes of agricultural production growth

Rovfeng Nin and Peter H. Calkins attributed the rapid growth after 1978 to the grassroots reform of the rural economic structure. They stated that after having the economic reform, some serious shortcomings of collective are overcome by the new production unit--individual, people have self-determination and motivation, efforts made by farmers to agricultural production is closely related to their income. After reform the rigid economic structure is transformed into one characterized by diversity of output and income sources. Improvement in the lives of rural people quickly restored their motivation--the main engine of agricultural production growth.

The second reason by Rovfeng is price adjustment of agricultural products. From 1960 to 1978 prices of livestock and crops increased by 107.3%.

The third reason contributing to the growth is increased material input use in agriculture. Their investigation pointed out that from 1979 to 1984, total agricultural horsepower rose from 182 million to 256 million, increased by 45.6%.

Lin 1987 argued that the rapid growth in agricultural production from 1980 to 1984 was because of the household contract responsibility system, he attributed 20% of productivity or 60% of agricultural production growth to institutional reform.

Another study by Mcmillan, Whalley, and Zhu suggested that 22% of the increase in productivity in China's agriculture between 1978 and 1984 resulted from higher prices and 78% from change in the incentive system. They shared the same views with Rovfeng and Peter H. Calkins.

In 1991, Fan analyzed the effects of technological change and institutional reform on agricultural production growth in China's agriculture. His study indicated that 15.7% of the total agricultural production growth was accounted for by technological change, 26.6% contributed by institutional reform, and 57.7% from increase in input use.

For the fluctuations in crop production, Liao states that underinvestment, unsuitable institutions, and the problems of technology diffusion are the main sources. After the adoption of "Household contract production responsibility system ", farm land was allocated to each household, larger plots of land were divided into smaller ones, management became difficult. In addition, conflicts were caused among farmers. Competition for irrigation water, different altitude toward pesticide, insecticide, and fertilizer use are instances.

Decreasing investment in agriculture by collective and governments is another reason. Individual farmer did not invest much on their farm land because of the short-term tenure. Limited investment by farmers mostly was "short-term effect" type by which they could get the profit back in a short time period. To solve this problem, governments have tried to lengthen land contract duration from 2-3 years to minimum 5 years, for fruit, forest growing land and other long-term payoff agricultural activities, land contract even longer, but the investment has not changed much.

In 1989 Terry Sicular stated that decollectivization had led to unequal distributions of land and income which is one of the possible reasons for fluctuating production. Since land distribution was largely based upon the household member and fixed at least 5 years, some land contracts more than 20 years, family population grows at different rates. Therefore, differences in man-land ratios across households were quickly emerging. At the same time the employment opportunities in the cities can not meet the demand by the migrants from rural areas. This unequal land distribution causes unequal income distribution which leads to different access to modern techniques and inputs.

Moreover, the decreasing number of extension agencies is one suspected reason leading to fluctuating production. After 1978, agricultural technical diffusion stations attached to lower government levels decomposed and disappeared by various reasons. Technology stocked in academic institutions is difficult to reach farmers. In addition, increased risk is another factor after reform which could slow the diffusion of new technologies. Collective had large area which was better able to reduce technology adoption risk by diversifying cropping techniques. Besides, the risk was shared across a large number of households. In the present situation risk is borne primarily by the decision making household.

1.3.2 Estimation models for measuring the effects of technological change and institutional factor

There are two consistent methods to define technological change. One is productivity index, the other is production function. The former is defined as the production of a greater output with a given quantity of resource (Hayami et al., 1977). In this definition technological change leads to the increase in the output per unit of input. Kawage and Hayami used this definition in their study on comparisons of agricultural efficiency in different countries at different economic development stages. In their study the ratios of output to individual input and aggregated input are used as a criterion to compare the differences in agricultural productivity in different countries at different economic stages. Various inputs are aggregated geometrically to a total index by using the estimates of production elasticities as weights. The authors assure the existence of Cobb-Douglas type of production and this production is conceived representation of a specific technology actually being used in each country, the total production index measures agricultural production efficiency in terms of distance of each country´s input-output position from the surface of the production function.

The method of production function views technological change in a production context and defines it as a change in the parameters of the production function or a creation of a new production function (Peterson and Hayami, 1977).

Regarding the first methodology to measure the technological change, according to Peterson and Hayami, the ratio of output to individual input, called partial productivity index, is a biased measure of technological change in general, because it includes the effects of factor substitution together with the effect of advance in production techniques, then total production index was developed to separate the effects of technological change and factor substitution.

In 1957, Solow developed a theoretic basis for measurement of neutral technology change, a general form to measure technical change. He applied this theory to analyze US economy from 1909 to 1949 without using any specified production model. In his theory, neutral technical change was treated as multiplicative factor measuring the shift of production over time.

Intriligator exploited Solow's theory further in Cobb-Douglas production function framework, his model mainly deals with neutral technical change (Intriligator, 1978).

Later, in 1957 and 1967 Solow and Intriligator used vintage model to measure the embodied technical change. Because of the embodied technological change, progress in quality of inputs occurs, vintage model measured this change by weighing capital and labor input indices, i.e., using effective factor inputs.

In 1991, Fan investigated the effects of technological change on agricultural production in China's agriculture, he considered both neutral and biased technical change. Together with neutral technical change, biased technical change was treated as residual in separation of effects of different factors in his study.

Many studies have been conducted on technical and allocative efficiency by different approaches (Mark M. Pitt and Lee, W D. Setiz, L J. Lau, and David Holland, Fan).

A method was presented by Setiz for estimating a frontier production function allowing economies and diseconomies of scale using linear programming techniques. This model was initially developed by Farrel. Efficiency indices were employed in this method. This estimation approach has some weakness, when types of inputs increase, calculation becomes very complicate. Another obvious weakness is producers of some production efficiency may have different technical efficiency indices in some special cases. One additional disadvantage is the inability to describe a stochastic universe by Farrel's deterministic process. Farrel's pessimistic isoquant is extremely sensitive to "outlier" (Lau and Yotopoulos).

Lau and Yotopoulos (1972) tested relative efficiency of small and larger farmers in Indian by estimating profit function. The basic principle used is: A firm is considered more technically efficient than the other, if, given the same quantities of measurable inputs, it constantly produces a larger amount of output. A firm is price-efficient, if it maximizes profits, i.e., it equates the value of the marginal product of each variable input to its price.

Lee and Tyler in 1978, based on the procedure suggested by Aigner, Lovell, and Schmidt (1977), provided an empirical study of mean technical efficiency through the estimation of a stochastic frontier Cobb-Douglas production function from cross-section data of Brizilian manufacturing firms. Lee and Pitt in 1981 used almost the same approach to measure the technical efficiency and its sources in the Indonesian weaving industry. The time effect on technical efficiency was considered in the study.

In 1991, Fan employed frontier Restricted Translog function to estimate the technical efficiency for each region of China by using panel data.

Ali and Flinn (1989) estimated the firm-specific profit efficiency among Basmati rice producers in Pakistan Punjab through frontier profit function estimation.

In terms of measurement of institutional effects, very few papers are available. In Fan´s study (1991) **technical efficiency improvement was used as the proxy of institutional effect on agricultural production.**