THE NEW CHALLENGES AND NEW DEMANDS FACED BY CHINA’S DEVELOPMENT OF IRRIGATION AND DRAINAGE

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ABSTRACT

Ever since the beginning of the 21st century, irrigation and drainage in China has been facing the new challenges. The simultaneous development of information technology, industry, urban areas and agriculture, has brought in new and higher requirements on irrigation and drainage. The new challenges faced by irrigation and drainage include: the increasing population, decreasing farmland; declining irrigation area; and reduced but older rural population. The major problems encountered by irrigation and drainage have been summarized and the causes for these problems have been analysed from the aspects of finance and taxation policy, labour allocation, legal environment, engineering techniques and land operation system. And the policy guidelines of the irrigation and drainage in the New Era have been put forward.

Keywords: irrigation and drainage; situation change; new challenges, existing problems; policy and suggestions.

1. INTRODUCTION

China is a large agricultural country, and agriculture is highly dependent on irrigation. Since the founding of new China, irrigation and water conservancy has made significant progress and has played an important role in ensuring national food security and all round development. But from the beginning of this century, China has been facing many problems with the physical systems and their management. To synchronize agriculture development with those in the other areas, great efforts must be made to conserve and manage water. Facing with the new situation, it is urgently needed to research on the establishment of a new mechanism for irrigation and drainage development. In this paper, the new situation faced by irrigation and drainage is analysed and the policy requirements to ensure development and management of irrigation and drainage in the New Era are put forward.

2. NEW CHALLENGES TO CHINA’S IRRIGATION AND DRAINAGE

2.1 Increasing population and decreasing cultivated land per capita

According to the data by the State Statistical Bureau, at the end of 2013, the population of the mainland China was 13.6072 billion. The increase of 6.68 million indicates that the total population in China continues to grow at a low speed.

Since 1980s, the farmland resource in our country has continued to decrease and has reduced sharply due to ecological restoration after 1999. According to the data by the State Statistical Bureau, between 1996 and now, the area of cultivated land has decreased by 6.4%. The per capita cultivated land in China has decreased from 0.1033 ha in 1978 to 0.0784 ha in 1995. This trend is all but irreversible for a long period of time to come. Hence, it should be the top priority of the nation to develop

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farmland capital and raise the output capacity per unit area of the land resources. To achieve this, irrigation and drainage infrastructure is of prime importance.

2.2. Effective irrigation area of farmland is declining

The problem of decline in the irrigated area has existed for a long time. According to the Ministry of Water Resources, the main reasons for this decline include the aging of the structures, land occupation by construction, water shortage, restoration of farmland to forests, grass and lake, etc. At present, the problem of declining farmland in not under control, and the trend of urbanization encroaching upon the farmland has not abated.

2.3. The declining rural population and aging rural labor force

The rural population including the labour force has shown a remarkable decline, which is in contrast to the urban population. At the national level, the migrant workers increased to 0.242 billion in 2010 and 0.269 billion in 2013. With the speeding up of urbanization, better policies and easier transformation from farmer to townsman, the rural labor force will further decrease.

At the same time, the structure of the rural labour force has changed significantly. The survey on the working outside of the rural labour force in 2009 showed an obvious trend of getting younger in the migrant worker groups working outside. Among the rural labour force who worked outside for more than six months, the number of the total migrant worker of the new generation (born after 1980) reached 84.87 million, accounting for 58.4% of the total migrant workers. In contrast, the structure of locally employed labour force exhibited remarkable aging characteristics. Thus it can be seen that not only does the labour force remaining in rural areas decreased sharply, but also the structure tended to be aging. Such a situation implies that it is very difficult for our country to go in for irrigation and drainage through the policy of “compulsory labours and accumulated labours” once again and the traditional principal status for the framers to construct and manage the irrigation and drainage has lost the manpower support.

3. CHINA’S IRRIGATION AND DRAINAGE: ANALYSIS OF PROBLEMS

3.1 Little input for irrigation and drainage due to reform of the fiscal and taxation system

Before reform, a fiscal system with “unified revenue and expenditure” was applied in China. The national revenue and expenditure had always to be subject to the unified decision-making by the central finance. At the early stage, the first round reform of the fiscal and taxation system was conducted. The philosophy behind this was turning the “unified revenue and expenditure” into “serving meals to different diners from different pots”. In 1994, the second round reform adopted the “system of tax division between central and local governments” to significantly adjust the proportion of revenue distribution between them.

This was a fundamental turning in the finance distribution pattern between the central and local governments and it resulted in the greatly increasing proportion of central finance and obviously decreasing proportion of local finance (Table 1). The funds for irrigation and drainage construction and management were borne by local governments, forming a mismatch between the administrative rights and financial power among central and local governments.
Table 1. Finance and Revenue Distribution between Central and Local Governments

<table>
<thead>
<tr>
<th>Year</th>
<th>Finance Revenue (100 million Yuan)</th>
<th>Proportion (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Nationwide</td>
<td>Central Government</td>
</tr>
<tr>
<td>1955</td>
<td>249</td>
<td>193</td>
</tr>
<tr>
<td>1960</td>
<td>572</td>
<td>143</td>
</tr>
<tr>
<td>1965</td>
<td>473</td>
<td>156</td>
</tr>
<tr>
<td>1970</td>
<td>663</td>
<td>183</td>
</tr>
<tr>
<td>1975</td>
<td>816</td>
<td>97</td>
</tr>
<tr>
<td>1980</td>
<td>1160</td>
<td>284</td>
</tr>
<tr>
<td>1985</td>
<td>2005</td>
<td>770</td>
</tr>
<tr>
<td>1990</td>
<td>2937</td>
<td>992</td>
</tr>
<tr>
<td>1995</td>
<td>6242</td>
<td>3257</td>
</tr>
<tr>
<td>2000</td>
<td>13395</td>
<td>6989</td>
</tr>
<tr>
<td>2005</td>
<td>31649</td>
<td>16549</td>
</tr>
<tr>
<td>2010</td>
<td>83102</td>
<td>42488</td>
</tr>
<tr>
<td>2011</td>
<td>103874</td>
<td>51327</td>
</tr>
<tr>
<td>2012</td>
<td>117210</td>
<td>56133</td>
</tr>
<tr>
<td>2013</td>
<td>129143</td>
<td>60174</td>
</tr>
</tbody>
</table>

To solve the problem of this mismatch, special subsidies and funds for small irrigation and drainage was established by the central finance in 2005, which was helpful to a certain extent to physically and structurally improve the infrastructure and partially make up the loss due to cancelling "compulsory and accumulated labours". But, the funds proved to be utterly inadequate to meet the funds requirement with so many projects, great quantity and extensive coverage. After cancelling "compulsory and accumulated labours", the labour input to small irrigation and drainage decreased sharply. According to the preliminary statistics, at present, just the labour force and working day put into the basic construction of irrigation and drainage in spring and autumn every year reduced about 10 billion person/day compared with that of the end of the last century. Calculating @ 30 Yuan/day, it equals to 300 billion Yuan that has been reduced every year. As against this, the total fund put into the small irrigation and drainage from central finance, provincial finance and other channels is less than 10 billion Yuan and the total fund put into the construction of irrigation and drainage is less than 90 billion Yuan, leaving a big gap. This accelerates the overall degradation and abandonment of small irrigation and drainage projects.

3.2 Reduced income from agriculture

With constant advancement of the reforms in China, the employment environment of the rural labour force has been improved, the income channels have been extended, the income structure of the farmers has been remarkably changed and the proportion of the income from wage and salary accounting for the farmer's net income has been increasing year by year, from 20.22% in 1990 up to 45.25% in 2013. At the same time, the proportion of agricultural income in the farmer's total income has been decreasing year by year, from 50.21% in 1990 up to 26.61% in 2012 (Table 2). The contribution of agricultural income to the farmer's income has declined to less than

3 1 US dollar = 6.64 Chinese Yuan
30%, of which the contribution of plant production income to the farmer's income is even less. In addition, all the income from wage and salary is hard cash while the agricultural income is more of statistical significance, having a proportion of about 80% cash income with less gold content. The variation of income structure, together with the price fluctuation of agricultural products, leads to the contribution rate of increases in grain production to the farmers' income increase to drop dramatically, whether to irrigate or not, or irrigate more or less, has no significant impact on framers' income, and the enthusiasm for farmers to develop the construction and management of irrigation and drainage has noticeable weakened.

Table 2. Income from (Wage+Salary) and Agricultural Income in the Net Income

<table>
<thead>
<tr>
<th>Year</th>
<th>Net income per farmer (Yuan)</th>
<th>Income from wage and salary (Yuan)</th>
<th>Agricultural income (Yuan)</th>
<th>Proportion of income from wage and salary in net income (%)</th>
<th>Proportion of agricultural income in the net income (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1990</td>
<td>686.31</td>
<td>138.8</td>
<td>344.59</td>
<td>20.22</td>
<td>50.21</td>
</tr>
<tr>
<td>1995</td>
<td>1577.74</td>
<td>353.7</td>
<td>799.44</td>
<td>22.42</td>
<td>50.67</td>
</tr>
<tr>
<td>2000</td>
<td>2253.42</td>
<td>702.3</td>
<td>833.93</td>
<td>31.17</td>
<td>37.01</td>
</tr>
<tr>
<td>2005</td>
<td>3254.93</td>
<td>1174.53</td>
<td>1097.71</td>
<td>36.08</td>
<td>33.72</td>
</tr>
<tr>
<td>2010</td>
<td>5919.01</td>
<td>2431.05</td>
<td>1723.49</td>
<td>41.07</td>
<td>29.12</td>
</tr>
<tr>
<td>2011</td>
<td>6977.29</td>
<td>2963.43</td>
<td>1896.67</td>
<td>42.47</td>
<td>27.18</td>
</tr>
<tr>
<td>2012</td>
<td>7916.6</td>
<td>3447.5</td>
<td>2106.8</td>
<td>43.55</td>
<td>26.61</td>
</tr>
<tr>
<td>2013</td>
<td>8895.9</td>
<td>4025.4</td>
<td>-</td>
<td>45.25</td>
<td>-</td>
</tr>
</tbody>
</table>

Source: China Statistical yearbook 2013. Agricultural income includes the income from plant production and other incomes, but excludes the income from forestry, animal husbandry and fishery etc.

3.3 Changing legal environment and weakened local governments

Before cancelling the “compulsory labours and accumulated labours”, the governments at all levels organized the framers to participate in the construction and management of irrigation and drainage. This was a feasible and practical measure. After cancelling the "compulsory labours and accumulated labours", there are no laws to abide by when organizing the farmers to participate in the construction and management of irrigation and drainage without compensation. The capability of the local governments in mobilizing and organizing has been weakening. It is more difficult to collect water fee, and the practical and effective countermeasures are still under exploration. At the same time when cancelling the "compulsory labours and accumulated labours", the expenses of taxation such as the agricultural tax, the fees paid by farmers for overall township planning and village reserve have been cancelled during the rural tax-fee reform. But, the governments at all levels still fail to take effective countermeasures to eliminate the impact of the reform on irrigation and drainage and the input gap has not been made up effectively for a long time. In such cases of no laws to abide by, insufficient financing investment and the difficulty in collection water fee, it is extremely difficult to develop irrigation and drainage.

3.4 Striking contradictions between scattered and collective land management

After reform, a fundamental change has taken place in China's rural land system; from previous collective operation into the scattered operation taking family as the unit. The land area run by every household is too limited when adopting the household contract responsibility system. According to statistics, the cultivated land
(including orchard and pot garden) per household in our country is under 6 mu\(^4\), yet operated by plot, which results in the contradictions growing up between such a land operating model and the characteristic that irrigation and drainage projects benefit everyone. In the case of imperfection of irrigation and drainage projects and facilities, the utilization of the irrigation and drainage is not exclusive and it is common to get a “free riding”, which leads ultimately to the fact that farmers lack the enthusiasm to invest.

In fact, such a contradiction between the irrigation-drainage and rural land management system appeared earlier also and not just when entering this century. At that time, to solve this problem, the Central Committee and the State Council released a policy of "compulsory labours and accumulated labours" to require that every rural household within the irrigation and drainage benefited area must input a certain quantity of "accumulated labours" to engage in the project construction and maintenance every year and this was effective in removing such a contradiction and guaranteed the irrigation and drainage projects to operate in working order. When entering this century and cancelling the "compulsory labours and accumulated labours", this contradiction appeared once again. Therefore, the governments at all levels must take effective measures to respond to and address this contradiction.

In recent years, aiming at the above-mentioned contradictions, all localities have explored to establish rural household water cooperation organizations to address the scattered operation and mitigate the degradation of irrigation and drainage projects. However, there are lots of problems restricting the survival and development of these rural household water cooperation organizations and they need policy support.

4. DEMANDS FOR POLICY FROM IRRIGATION AND DRAINAGE IN THE NEW ERA

4.1 Government’s working policy, executed by the farmers and supported by the society

The irrigation and drainage is a systems engineering giving priority to the public welfare. Society’s wellbeing depends on its success. Therefore, the government must play a leading role to fulfill her obligatory responsibility. But, no government can handle such a large activity area, as it has to assume many other responsibilities. For a successful and efficient irrigation drainage system, it is necessary to establish a working policy for the irrigation and drainage, led by the government, engaged in by the farmers and supported by the society as soon as possible.

4.2 Central administration, assisted by provincial & county level governments

To carry out the above working policy, it is necessary to reasonably define the responsibilities between the government and the farmers, and clearly carve up the administrative power of the governments at all levels. Considering the practical possibility and the rationality, the farmers should be responsible for the engineering construction and management within the contracted responsibility fields and those beyond the contracted responsibility field should be the responsibility of the governments at all levels. The suggestions on division of the administrative power for the governments at all levels are as follows:

Central government: Provides unified leadership and invest in the construction and administration of the irrigation and drainage. It should undertake performance

\(^{4}\) 1 ha = 15 mu
appraisal on construction and administration of the irrigation and drainage as well as their functioning.

**Provincial government:** Coordinates the construction and administration of the irrigation and drainage within its region, reviews progress, allocates the special funds for different activities and evaluates the construction situation of the irrigation and drainage conducted by the county-level governments under its jurisdiction.

**County-level government:** Mainly responsible for organizing relevant departments to prepare for the master planning at county level, determines, submits the annual schemes and organizes the construction and administration of the projects.

### 4.3 Partitioning investment among Central and local government and the farmers

On the basis of the responsibility that should be taken by the governments at all levels and the farmers, the responsibility for investment taken by every main body should be determined. The central government should take the main input responsibility (more than 55%), and establish special funds to gradually make up the input gap caused by cancelling the “compulsory labours and accumulated labours”. According to the fiscal revenue sharing proportion (more than 25%), provincial government should take the input responsibility at a certain extent. According to the requirements as defined in 2009 Document NO.1 of the Central Government, the input responsibility of supporting funds taken by the county-level governments in middle and western regions is cancelled while the county-level governments with stronger financial power in eastern regions should allocate a certain amount of funds for the construction and administration activities. Farmers should take the input responsibility for the engineering construction and management within the contracted responsibility fields, for those beyond the farmers’ bearing capacity, the government should give rewards in place of subsidies.

When the input responsibility is specified, the governments at all levels should earnestly fulfil their duties. The 1\textsuperscript{st} is to give more finance support, the 2\textsuperscript{nd} is to adjust the investment structure in water conservancy, the 3\textsuperscript{rd} is to adjust the investing orientation of the funds for irrigation and drainage and the 4\textsuperscript{th} is to establish a comprehensive compensation and subsidizing institution for the irrigation and drainage. Focuses should be on the establishment of the compensation mechanism for public welfare task of small irrigation and drainage projects, the direct subsidy mechanism for electric charge for pumping water, and the subsidy mechanism for the building materials and equipment of irrigation and drainage projects.

### 4.4 Integration of the projects and the funds at county level

It is suggested that the county-level government should organize relevant departments to prepare the master plan for irrigation and drainage construction at their level; formulate measures for integration of projects and funds and establish departmental consultative mechanism.

### 4.5 Promotion of rural household water cooperation organizations

Great changes have taken place in the external environment for the work of irrigation and drainage at current stage, and the traditional organizational model is no longer suitable for the demands of current situation. Under this background, the role of rural household water cooperation organizations is becoming more important in the construction and administration of the irrigation and drainage. But due to many reasons, their speed of work is slow, the construction model is diverse, the elaboration of function doesn’t work well, and the reserve strength for progress is
weak. It is suggested that the governments at all levels put forward the supporting policies for rural household water cooperation organizations in clear terms. The first is to clearly define that the rural household water cooperation organization is to manage and consume water jointly and voluntarily. The second is to make it clear that the rural household water cooperation organization mainly takes the working functions for the construction and management of the small water conservancy projects and the end-canal system of large-middle-scale irrigated area. The third is to establish a stable expenses guarantee mechanism. Financial departments at all levels should set up special subsides and funds to support the rural household water cooperation organizations, and other operation expenses should be included into the terminal water price of the water users for unified calculation to ensure the normal operation.

4.6 Strengthening the legislation of irrigation and drainage

Strengthening the legislation of irrigation and drainage is the most pressing task in the work of irrigation and drainage and filling up the legal vacancy in this area. For this end, the laws and regulations on the irrigation and drainage must be published as soon as possible to establish the working policies for the irrigation and drainage in the New Era, to improve the system of the construction and administration of the irrigation and drainage, to clearly define the investment responsibility, to set up the long-term and effective management and maintenance mechanism and to make the work of irrigation and drainage follow a legal track.

4.7 Establishment of the control red line for farmland effective irrigation area

Drawing on the experiences of the establishment of the system for cultivated land protection red line, the control red line for farmland effective irrigation area may be published. The system should further elaborate on, or provide for:

(a) The supporting systems with regard to the irrigation and drainage planning.
(b) Examination and approval of the occupied irrigation area.
(c) Legal guarantee for the establishment and implementation of the red line.
(d) Master Planning for National Irrigation Development.
(e) Considerations of population size, level of development and food security.
(f) Specifying the indicators of the red line of each province at various levels.
(g) Prohibiting illegal occupation of farmland effective irrigation area.

The accountability system should be strictly applied to the units that fail to accomplish the duty target of the control red line for farmland effective irrigation area and an investigation will be conducted to look into the responsibility of the leaders and personnel concerned.