G-1.2 A Study on a Comprehensive Development Plan for Desertification Areas and the Estimation of Its Input-Output Effect

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Abstract In Xinglonzhao district in Naiman Banner, Inner Mongolian Autonomous Region of China, they constructed wind protection forest to control desertification and to regenerate vegetation following comprehensive development plan phase I. Then, in phase II they planned to improve the conditions for farming and settlement in the protected area. However, only after one year from the beginning of phase II, they created phase III plan which requires seven times more investment than phase II plan. The intention of Naiman Banner government is to draw huge amount of investment from higher governments, but this kind of conduct reduces credibility in the feasibility of the plan. On the other hand, the reason behind this behavior is that in China, unlike in Japan, they have not established a system to grant subsidy and loan: in Japan higher governments grant subsidy or loan to a project as far as the project meets the minimum requirements that the higher governments specify. Because there is no such systematic way, each project plan is required to show originality and novelty. In this situation, it is difficult to present a realistic model plan, and there is little demand for it.

  Consequently the figures of the input-output effect of the plan are quite arbitrary: there is no standard method to measure the effect. For example, in some cases they count only direct economic benefit. This causes low evaluation of the returns from investment in desertification control and low priority for the investment in such project under the constraint of budget. To avoid this, they should show a high expected return to the investment in desertification control project by including social and ecological benefits as a part of the returns to the investment. Hence we recommend to establish a nationally standardized measure to calculate the input-output effect.

  Other problem we found is the increasing labor and material costs due to the recent economic development, which escalates the cost of desertification control project up to five to nine times higher than planned initially. Moreover, it is now difficult to rely on farmers' participation (including unpaid labor contribution) in the implementation of desertification control project, although farmers' participation is the main idea in the project plan.

Key Words Desertification Control, Comprehensive Development of Desertification
       Area, Input-Output Effect, Model Plan, Cost Sharing

1. Introduction

  Desert area has now reached one-forth of total land area of the earth, which affects one-sixth of the world population seriously. In China, particularly, it is an urgent issue to control desertification, because China is feeding 22 percent of the world population with 7 percent of world arable land

Because desertification is affected by natural factors as well as human factors derived from socio-economic conditions, it is necessary not only to identify those factors to control desertification but also to remove those factors and to implement a comprehensive development plan that is consistent with future socio-economic development. Since we already identified natural and human factors that cause desertification in our previous studies, next we should promote a new study on how to make a comprehensive plan for both desertification control and economic development.

2.	Research Objective

In order to control desertification and to regenerate vegetation it is necessary to understand socio-economic conditions as well as natural conditions of areas where desertification has occurred. But moreover we should have a comprehensive development plan that is consistent with future socio-economic development because it is impossible to control desertification and to regenerate vegetation effectively without ensuring the living standard above a certain level for local people. The objectives of this study are (1) to create a model plan for comprehensive development to control desertification and to regenerate vegetation and (2) to develop methods to estimate input-output effect of the model plan.

By creating a model plan for comprehensive development and by developing methods to assess the input-output effect, we will be able to plan a project to control desertification and to regenerate vegetation with more certainty, to encourage people's active participation, to estimate required cost easily, and to provide a certain perspective for Japanese foreign aid project to control desertification.

3.	Research Method
3.1	Study Site

We choose study site among sites where project to control desertification and to regenerate vegetation is carried out in semi-arid China, based on our previous studies and discussion with Chinese researchers.

3.2	Field Survey in Study Site

(a) Understanding the outline, the implementation, the outcome of the implementation, and the problems of comprehensive development plan that has already been carried out.

(b) Clarification of the planning process of the plan mentioned above (who, when, why, points to be taken care of, understanding local people's view, and so on)

(c) Estimation of the cost of the implementation of the plan mentioned above and the share of the cost (total cost, unit cost of each item, cost sharing, public funding including subsidies in the total cost, and so on).

(d) Understanding whether they estimated input-output effect when they made the plan mentioned above and how they did it.

3.3	A Model Plan for Comprehensive Development

Based on not only findings in our field survey but also long-run development plan established by the central government, regional development plan and available documents, we create a model plan for comprehensive development, which will enable a comprehensive development that covers recovering and sustaining ecosystem, improving rural living conditions, as well as promoting agriculture, forestry, fisheries, processing, marketing, and rural industries.

3.4	Methods to Estimate Input-Output Effect

We develop methods to estimate input-output effect based on the findings in our field survey mentioned in section 3.2 above, economic forecast of the central government, and available documents.

3.5 Total Cost of Desertification Control and Regeneration

Using the methods mentioned in section 3.4 above, we calculate the total cost to control desertification and to regenerate vegetation on land under desertification, and estimate the share of public funding, especially from the central government.

4. Result and Discussion

4.1 Study Site

We selected Xinglonzhao district in Naiman Banner, Inner Mongolian Autonomous Region as our study site. The district is in the north-east of Naiman Banner and located between two rivers, Xiliao River and Jiaolai River. The shape of this area is almost oval with 48.5 km (east-west) and 17.5 km (north-south) diameters. Total area is 52,636 hectares. There are seven villages and five state farms in this district.

4.2 Desertification Control Project Phase I

Naiman Banner government developed the plan for desertification control project in 1976, and started the project in 1978 (phase I). Before the project, farmers had been practicing depletory agriculture and livestock husbandry for many years and as a result desert area had been constantly increasing and grass land had deteriorated. In 1973, the area of liquid and semi-liquid dune reached 7797 hectares, which is 15 percent of the total land area. And since the vegetation on fixed dune had also become very scarce, the productivity was so low that they called it "barren hills." The outline and the outcome of the project phase I is as follows:

(a) They constructed major bands of protection forest crosswise to form 32 major blocks between bands. The width of each band is 500 meters, and the distance between two bands is 4000 meters. Out of 16 bands they planned, 14 have been constructed by now.

(b) They constructed minor bands of protection forest within the major blocks to form minor blocks. Each minor band has 50 meters width and 1000 meters length. The size of each minor block is 100 hectares, and 261 minor blocks have been constructed by now out of 391 minor blocks planned initially (71.7 percent of initial plan).

(c) Afforestation area has reached 13,566 hectares in total including the protection forest bands explained in (a) and (b). The afforestation area is 96.2 percent of the area initially planned, and 25.8 percent of the total district area).

(d) By the construction of the bands of protection forest, they have provided this district with facilities to control desertification. As of 1994, their implementation of the project is highly evaluated by the central government and the autonomous government as well as international organizations.

(e) In the phase I project they did not invest in infrastructure such as transportation and communication and they did not have a farming plan in the minor blocks. That is, the phase I project emphasized only physical structure to control desertification.

4.3 Desertification Control Project Phase II

Based on the achievement of Phase I project, Naiman Banner government developed phase II plan, which aims to improve the conditions for farming and settlement in the protected area. They started the planning at the end of 1994, and established it as an official plan of the banner government in 1995. The banner people's congress approved the plan, too.

The outline of the phase II plan is as follows:

(a) Period: for 10 years, from 1995 to 2004.

(b) Area under the plan: 48,198 hectares with 364 minor blocks. The area is under 6 villages and 4 national farms.

(c) Forest cover will increase from 30.1 % to 49 % or more.

(d) 600 garden farms will be constructed. Each has 10 hectare land.

(e) Road construction: 10 km of major road, 78 km of inter-village road, and 284 km of inter-field road.

(f) Net annual revenue per farmer is estimated to increase from 1120 yen to more than 2000 yen at the end of the planning period.

(g) Total investment is 50.25 million yen: 27.25 million yen will be provided locally and 23 million yen will be supported by non-local fund.

The main objective of the phase II plan is to develop the minor block constructed in phase I by establishing 600 garden farms. Its average size is 10 hectares, which requires private investment of 13,000 yen. There will be three types of farm. (1) agriculture farm (annual income will be above 30,000 yen), (2) livestock farms (annual income will be above 40,000 yen), and (3) forestry household (annual income will be above 30,000 yen). But the plan does not specify the percentage of each type of farm.

In the phase II plan, they estimate inputs and outputs. Total input is 50.25 million yen, which consists of agriculture (10.545 million yen), forestry (5.956 million yen), livestock (1.69 million yen), chemicals (2.3 million yen), power facilities (14.619 million yen), road (10.24 million yen), agricultural machine (4.5 million yen), and others (0.4 million yen). On the other hand, total gross output per year is 90.11 million yen, which consists of agriculture (28.08 million yen), forestry (33.14 million yen), livestock (22 million yen), medicinal plants (3.88 million yen), and others (3 million yen). Thus, they claim that input/output ratio is 1:1.79.

For the total input, 50.25 million yen, higher governments (the central government and the autonomous region government) are expected to contribute 23 million yen and the banner government and farmers are to contribute 27.25 million yen. However, the plan does not specify how to share the cost among the higher governments and between the banner governments and farmers.

There are several problems in the phase II plan:

(a) Their calculation of input and output is very rough. Particularly, that they are using gross output after the completion of the project is a problematic. In addition, they count only direct economic effect for estimating output but do not include social and ecological effects. They seem to know that they should include indirect effects because they mention about it in the phase II plan.

(b) The district government expects that higher governments will contribute 23.00 million yen, but they have not obtained any approval about it. In addition, the banner government can afford only a little share of the remaining 27.50 million yen and expects farmers to pay most of it. However, farmers are not so rich to afford it. Thus, the plan may not be implemented properly due to the financial problem.

(c) The banner government have not disclosed the whole picture of the phase II plan to the public. Because not all residents will be benefited from the plan and because local people's cooperation is necessary for implementing the plan smoothly, the government should disclose and explain the plan.

(d) Number of settlers in the garden farm is assigned to each village. But the criteria to select settlers is not determined, and probably those who can afford a share of input cost will be selected. Thus, settlers will be selected not based on the management ability but based on the wealth. Moreover, the selection may be biased by private preferences of government officials. In order to establish a settlement that will be stable in the long-run to contribute to desertification control, they should have strict criteria for the selection of settlers.

4.4   Desertification Control Project Phase III

Although phase II plan started in 1995 as explained above, they seem to have already begun to create a new plan for desertification control in Xinglonzhao district in the latter half of 1996, which is evidenced by the fact that they completed a report on feasibility study in October 1996. "A Plan for the Development of Ecological Agriculture in Xinglonzhao district" in the report is now implemented as phase III project. The report lists the following three reasons why they need to have the phase III project.

(a) National policies have now become favorable to their project: First, the central government has shifted the target zone for economic development from the coastal zone to the central and western zones (note that Inner Mongolian Autonomous Region is located in the central zone), and as a result more fund, technology, and human resource are allocated to the central and western zones. Second, Naiman Banner has been categorized as a very poor prefecture that needs special assistance in the national poverty eradication campaign (one of 592 designated poor prefectures), and consequently they expect a political support to the comprehensive development plan of Naiman Banner. Third, because the central government is now emphasizing agriculture and food production, a large scale plan for agricultural development is welcome. Fourth, the fifth meeting in the fourteenth period of the central committee of Chinese Communists' Party requests a shift from extensive agriculture to intensive agriculture for Chinese economic development, which political environment is favorable to the implementation of their project.

(b) The justification of the project is based on the following three points: First, sustainable development, preservation of biodiversity, and modern environmental consciousness are crucial. Second, the construction of 20,000 hectares of ecological agriculture must be emphasized, which has already been the core in phase II plan. Third, the desertification control project of Xinglonzhao district should be a part of "the ninth five-year plan" and the "long-term plan for 2010" of Naiman Banner.

(c) Because they already have a good result in a small scale trial of garden farms, they can extend the garden farms in large scale: one hundred garden farms that have already settled in the protected area in the phase II project are now achieving a good economic outcome, that is, the annual income of 30 farms is in the range from 50,000 to 100,000 yen, that of 50 farms is in the range from 30,000 to 50,000 yen, and that of 20 farms is under 30,000 yen. This figure justifies the large scale construction of garden farms.

The outline of the phase III plan is as follows:

(a) Planning period is four years: from 1997 to 2001.

(b) Area under the plan is 20,000 hectares out of 23,301 hectares of protected area. Note that total area of Xinglonzhao district is 52,363 hectares, from which after subtracting agricultural field (24,041 ha), river and lake (290 ha), residential area and road (616 ha), forest (19,000 ha), and liquid and semi-liquid dune (7797 ha) they have 23,301 hectares.

(c) Area under construction is 20,000, the same as planned.

(d) Two thousand garden farms with 10 hectares of land holding on average will be constructed.

(e) Total investment is 361.68 million yen.

(f) Local contribution will be 175.23 million yen, and the remaining 186.45 million yen will come from outside, including loans.

The most distinguishing point of phase III plan is that only the construction of 2000 garden farms is emphasized: other tasks necessary for the comprehensive development of this district, such as the construction of road, are not included at all. That is, the objective is only to construct 2000 garden farms as soon as possible. As a result, the planning period is only four years. On the other hand, the total investment is 361.68 million yen, which is seven times higher than the phase II plan. In addition, the phase III plan does not specify how to operate

and manage the garden farms, in other words settlement is the only concern.

They estimate total input and total output in the phase III plan, too. The total output is the net revenue, i.e., total sales less total cost of production. Total input is 361.68 million yen, which consists of capital investment (agriculture: 107.67 million yen, forestry: 26.91 million yen, livestock 51.90 million yen) and variable cost (agriculture: 62.536 million yen, forestry: 37.775 million yen, livestock: 74.92 million yen), while annual total output (net revenue) is 141.457 million yen, which is from agriculture (80.676 million yen), forestry (45.378 million yen), and livestock (15.403 million yen). Input/output ratio is based on annual sales (932.850 million yen) and annual production cost including depreciation and interest (206.6185 million yen). This calculation is different from the case of the phase II plan. Thus, in the phase III plan the input/output ratio is 1.00 : 1.59. However, no social effect or no ecological effect is mentioned at all. In this sense, the phase III plan is inferior to the phase II plan.

As mentioned, the total input (361.68 million yen) consists of capital investment (186.45 million yen) and variable cost (175.23 million yen). All the variable cost is supposed to be paid by farmers themselves, while all capital investment is expected to come from the higher governments in loans (loan to assist the poor area: 50 million yen with annual interest of 0.6%, loan to assist desertification control: 50 million yen with annual interest of 1.035 %, loan for agricultural development: 50 million yen with annual interest of 0.98 %, and investment by the central government: 36.45 million yen). But they all are just planned on the desk, and nothing has been determined yet. The variable coast is shared by 2000 garden farms, and consequently 8762 yen per household. It is doubtful that there are 2000 farmers who can afford that much money at once. If they do not have enough savings, they will have to rely on loans, which will increase total amount of loans the phase III project requires.

There are several problems in the phase III plan as follows:
(a) The scale of the plan is too large. In the phase II plan, 600 garden farms are planned to constructed in 10 years, while in the phase III plan, 2000 garden farms are to be constructed in only 4 years. Furthermore, estimated total input has increased from 50 million yen in the phase II to 360 million yen in the phase III. Although the political environment is favorable to large-scale agricultural development plans, it is not so favorable as to support this much large-scale plan.
(b) The plan emphasizes 2000 garden farms too much. Road conditions in the area under the plan is very bad, and it is quite difficult to transport agricultural products and agricultural inputs. However, the phase III plan does not mention anything about road. Even if they successfully construct 2000 garden farms, the poor infrastructure will be a problem and they will need to have another project to develop infrastructure.
(c) Their estimation of output is not reliable. In their calculation of output, the highest share is from medicinal plants. But it is suspected that those minor products will continue to be very profitable in the future. In the case of crops that do not require any special skills to grow, a lot of followers will enter the market if they are profitable and excess production will easily happens, which will cause a deficit to growers.
(e) As is the case of the phase II plan, the phase III plan also relies on farmers and the higher governments for funding sources. Since even in the phase II plan, the higher governments did not promise any financial support, it will be difficult to obtain financial support for this seven-times larger plan. In fact, higher government officials expressed little interest in this plan when we interviewed them. In the eighth five-year plan (1991-95), Naiman Banner's investment in the control of desertification and the conservation of soil and water resource is total 35.00 million yen, which consists of higher government fund (14 million yen), and Naiman Banner government itself (8 million yen), and farmers' labor contribution (13 million yen). That is,

only 14 million yen was invested by the higher governments in the five years.

4.5   Other Examples of Input/Output Estimation
        As described above, in both phase II and phase III of comprehensive desertification control project in Xinglonzhao district of Naiman Banner, Inner Mongolian Autonomous Region, they calculate only direct economic effect of desertification control, but they do not provide any evaluation of ecological effect or social effect. However, because the government of Inner Mongolian Autonomous Region estimates not only economic effect but also ecological and social effects in "Phase II Plan of the Construction of Protection Forests in Three North Regions," we quote their calculation here as a reference.
        The estimation by Forestry Department of Inner Mongolian Autonomous Region is as follows: total input (total expenditure) is 2,473.61 million yen, and total output is 11,342.36 million yen, which consists of economic effect (3,562.14 million yen), ecological effect (6,754.33 million yen), and social effect (1,025.89 million yen). Thus, input/output ratio will be 1:4.59. If only economic effect is counted, input/output ratio will be 1:1.44. They make this estimation public, but they decline to show the methods and their basic assumptions because they are instructed by the higher authority. Several points should be noted regarding the estimation: first, the economic effect is gross output including production cost, and therefore it is not a pure economic effect; second, the ecological effect is the incremented output owing to improved ecological condition due to the construction of protection forests, and it is a net effect excluding production cost; third, the social effect is increased income from newly created job opportunities by the construction of protection forests, including tourism.
        Another example is from "Desertification Control Plan of China 1991-2000" of the Central Government. According to the plan, total input is estimated as 7,800 million yen, which is shared by the central government (1,320 million yen, 16.92%), local governments at different levels (1,320 million yen, 16.92%), and imputed labor input by farmers (5,160 million yen, 66.16%). This estimation assumes that daily wage rate is 1.5 yen/man/day. If we use the current wage rate, the estimation will be as follows:
If wage rate is 20 yen/man/day:
Total input = 1,320 (central government) + 1,320 (central government)
                    + 5,160*20/1.5 (farmers) =71,270 million yen
If wage rate is 10 yen/man/day:
Total input = 1,320 (central government) + 1,320 (central government)
                    + 5,160*10/1.5 (farmers) =37,210 million yen
Thus, in the first case the total input is 9.1 times higher than the original plan, and even in the second case the total input is 4.8 times higher than the original plan. This increased cost is only from labor cost. If we take an increase in other material costs into account, total input will be much higher. In addition, the government assumes that the farmers' labor is free. However, it is getting difficult to utilize farmers' free labor contribution. Hence, the government's share has to be increased. This will be a serious problem in the future.

5.   Conclusion
(a) In the study site, Xinglonzhao district of Naiman Banner, Inner Mongolian Autonomous Region, the government realized that the construction of protection forest is not enough to control desertification, and made a comprehensive development plan. But because China does not have a systematic governmental process to evaluate a project and to grant a subsidy, they need to distinguish their plan by emphasizing more uniqueness and novelty than feasibility.
(b) The phase III plan for the development of Xinglonzhao district is affected by the idea described above, and as a result it is inferior to the phase II plan and cannot be a model plan

for comprehensive development of other desertification area.

(c) It is recognized that not only economic effect but also social and ecological effects should be included in the estimation of input-output effect of desertification control. However, the methodology is not established. It is necessary to establish a nationally standardized method to estimate economic effect as well as social and ecological effects, which will make the government be able to show the magnitude of total outcome from the desertification control projects and to persuade people of the favorably-biased spending to desertification control. In fact as shown above, in the case of Forest Department of Inner Mongolian Autonomous Region government, after including social and ecological effects, the input/output ratio increases from 1:1.44 to 1:4.59.

(d) The policy for desertification control and the policy for poor areas should be coordinated and consistent. But in reality governments are implementing projects for desertification control, while poor farmers are causing desertification due to the poverty.

(e) How to share the cost of desertification control need to be reconsidered. Because of the transition to market economy, farmers' free labor has become scarce and participatory labor has become less available than before. In addition, desertification areas are also poor areas, and farmers and herders in poor areas cannot afford the cost of desertification control.

(f) The cost of desertification control has been increasing due to the increase in labor and material costs. Considering the fact described in (e), the central government will have to expend much more than it expected initially.