Some modalities planned or implemented in Japan in the past may be applied for future dam construction projects in the developing world. For example, some innovative ideas were planned for the Numata Dam, the largest dam construction project ever considered in Japan. The major concern of the planned Numata Dam was the number of resettlers, which was then estimated to be around 3,000 families. No dam built in Japan in the past involved resettlement of more than 1000 families. The resettlement plan developed for the Numata Dam included the following innovative concepts. The plan included such ideas as (a) having resettlers share existing farmland with the present owners provided improvements were made to increase productivity, (b) paying "rent" to resettlers, and (c) establishing the Tone River Development Agency. The idea of (c) stemmed from the cases of the Juntsu Dai 1, 2 and 3 Dams, which were built in early 1950's in the Toyama Prefecture of Japan. While the Numata Dam project was finally discarded in 1972, the resettlement schemes elaborated for the Numata Dam still appear to be innovative. Such schemes may be applied to projects in the developing world.

INTRODUCTION

The concept of the Numata Dam was at first launched in 1959 by the Sangyo Keikaku Kaigi (Industry Planning Board), which was a non-governmental think-tank sort of organization for research and planning under the leadership of the power industry tycoon Mr. Yasuzaemon Matsunaga. The Sangyo Keikaku Kaigi in late 1950's through early 1960's launched several recommendations for the near future. They all were innovative then.

It should be noted that many of these recommendations were later materialized, such as speedway between Tokyo and Nagoya, bridge across the Tokyo Bay, new airport for the Tokyo Metropolitan area, and privatization of the Japanese National Railway (which took place in 1987, about three decades after the recommendation by the Sangyo Keikaku Kaigi). It sounds safe to mention that these recommendations including the Numata Dam appeared all realistic and when these were suggested.

The Tokyo Metropolitan area was mushrooming then, both in terms of population and industrial activities. The demand for water was hence rapidly increasing. The area and the surrounding regions suffered from floods of the Tone River and its tributaries from time to time. Prevention of floods was thus also among the major aims of the Numata Dam project. The Numata Dam was regarded to be the prioritized dam
construction project for alleviation of then anticipated water shortage in the Tokyo Metropolitan area [1].

The purposes of the Numata Dam were (a) provision 45 m$^3$/s of water for municipal and industrial uses in the Tokyo Metropolitan area, particularly during summer season, (b) provision of 30 m$^3$/s of water for irrigated agriculture expansion, (c) hydropower generation of 1,300 MW, and (d) flood control of 3,000 m$^3$/s. Tokyo Metropolitan area was then supposed to require 45 m$^3$/s of municipal and industrial water in future, which was almost twice as much as the amount of water then supplied from existing sources. The anticipated increase of water demand was unable to be met by the traditional source of water for Tokyo, namely the Tama River. Water resources in the Tone River system were thus assumed to become supplementary source, once the Numata Dam was built.

The Numata Dam was, after launch of the concept, assumed to have the highest priority in the field of water resources development in Japan. The Minister of Construction in 1966, at a committee in the Lower House of the Parliament, that the Government intended to build the Numata Dam and that the Prime Minister was in the same opinion [2].

The Numata Dam project experienced fierce opposition from those who would be obliged to resettle, while those in Tokyo and the surrounding metropolitan area welcomed the plan. The major concern of the planned Numata Dam was the number of resettlers, which was then estimated to be around 3,000 families. Dams on the Tone River historically had been planned and constructed in the upstream areas, while the Numata Dam was to be built in the middle-stream area, around Numata City.

Some parts of Numata City and two other local municipalities were to be submerged by the reservoir of the Numata Dam. The local governments of Numata City and surrounding towns and villages thus expressed their opposition to construction of the Numata Dam. Following numerous debates at both the local and national levels, the Numata Dam plan was finally discarded more than a decade after the launch of the proposal through a decision of the Prime Minister in 1972 [3], three years after the death of Mr. Matsunaga who had launched and promoted the concept of the Numata Dam.

The socio-economic conditions of these countries may resemble Japan in the late 1950s to the early 1960s. Construction of a large dam may be planned, not in a remote mountainous region, but in a fairly populated area, as was the case with the Numata Dam. It is thus safe to assume that the resettlement schemes developed for the Numata Dam are applicable for future dam construction projects in some developing countries that are in transition and will sooner or later become developed nations.

This paper thus aims to identify the innovative resettlement and regional development schemes planned for the Numata Dam that are appropriate and applicable for the developing world.
RESETTLEMENT SCHEMES PROPOSED

The largest issue for the development of the Numata Dam was resettlement of about 3,000 families, approximately half of which were engaged in agriculture as the major source their income. The number of families resettled for dam construction projects in Japan at the time (i.e. 1950s and 1960s) was no more than a few hundred families [4].

The expenditure for resettlement was not expected to account for a major share of the budget for the Numata Dam project. The highest priority in developing the resettlement scheme was given to securing agreement from the residents to be relocated, not reducing the cost of resettlement. Three innovative resettlement schemes were proposed. These methods have seldom been implemented in Japan, as well as other parts of the world.

Sharing of existing farmland with existing owners
Out of 26.11 km² (2,611 ha) of area to have been submerged in the Numata Dam project, 1,192 ha was farmland, of which 651 ha was paddy rice fields [5]. Securing the same area of rice fields, to substitute for the land lost by the resettlers seemed almost impossible, for the plains around the dam site had been fairly well developed for rice cropping and little room existed for further development of paddy rice fields.

It was anticipated that an existing owner of farmland might share the land with a resettler, if productivity of the land could be increased and the existing owner would enjoy at least the same degree of productivity as before (even with less farmland). The project area of the Numata Dam was surrounded by a large area of rain-fed farmland on the slopes of the mountains.

While cultivating rice in paddy fields was a most profitable way of using farmland, rice cultivation consumes a lot of water. The farmland on mountain slopes suffered from a paucity of water for paddy rice farming. Conversion from rain-fed farming (for vegetables etc.) to paddy rice implied increases of income from the same area of farmland by more than 100%. The scheme developed for resettlers of the Numata Dam was to increase the (financial) productivity of the existing farmland by converting them into paddy rice fields with the introduction of irrigation. In doing so, the farmland owner would be able to share his farmland with a resettler, provided the cost of installing irrigation systems would be met by the constructor of the Numata Dam.

The Numata Dam project required 840 ha of paddy rice fields for the resettlers [6]. This was apparently more than the paddy rice field owned in their original locations. The bottom line is that the resettlement scheme should be so generous that a family may be given twice as much farmland as held before and that some farmers may choose to become "pensioners" (discussed below) or change occupations. The resettlement plan of the Numata Dam aimed at converting 1,500 ha of dry farmland on the slope of the Mount Akagi into paddy rice field by irrigation. A reservoir was to be newly developed for this irrigation scheme. The plan called for purchasing 500 ha of the farmland (which was to be converted into paddy rice fields) from the owners (who owned a total of 1,500 ha) of
the dry farmland. Additionally, 340 ha of paddy rice field should be newly developed in the same area, to meet requirements for the paddy rice fields of resettlers.

In highly populated regions of the developing world (e.g. Java island of Indonesia), securing farmland for resettlers (as substitute of what they owned before relocation) is simply not possible. Sharing farmlands between existing farmers and resettlers may be a possibility in such cases.

**Paying "rent" to resettlers**

Paying "rent" to resettlers for the land to be submerged was envisioned. This idea was in fact based on precedent. The "rent" scheme was adopted for the Jintsuujigawa Dai-ni dam (Jintsuujii River Dam Number Two) constructed in the early 1950s. The district electric power company (Hokuriku Denryoku) constructed a dam on the Jintsuujii River in the Toyama district in 1953 to generate a maximum 40 MW of power (Nihon Damu Kyokai, 2002). An area of 175.3 ha was submerged, including 8.3 ha of paddy fields, 0.6 ha of dry farmland, 158.7 ha of residential plots, 6.2 ha of forests, and 1.5 ha of land with miscellaneous uses. A total of 21 families were obliged to relocate [7]. The "rent" for the submerged land was calculated in the following manner:

(i) For paddy fields, the "governmental purchase" price and the average yield became the basis of the "rent". At that time, the government purchased all rice crops.

(ii) For dry farm land, 70% of the "rent" of paddy fields was paid.

(iii) For forest, 10-15% of the "rent" of paddy fields was paid.

In addition, a "one time payment" or "gratitude" was paid per ha of paddy field and dry farmland, respectively. For residential plots, a "one time payment" was paid per square meter. New houses were given to the resettlers free of charge [7].

The advantage of the "rent" scheme of compensation for the dam builder (the district power company, in this case) was that the initial cost of dam construction could be reduced because the land owned by the resettlers would not be purchased. The price of land in Japan at that time was rapidly increasing, and it had become a major obstacle to the development of infrastructure through public investment. The district power company was supposed to find this as the major advantage to adopt the "rent" scheme [7]. For the resettlers, this scheme should have the merit of securing a very reliable source of income.

The merit of saving on the initial cost might not have been an issue for the Numata Dam project. However, a major advantage of this scheme for the Numata Dam was to reduce the need to secure farmland to substitute for the land to be submerged [6]. In other words, this scheme aimed at making some portion of resettlers "pensioners", to whom provisions of substitute farmland was not required.

**Establishing river development agency**
The Numata Dam plan suggested establishing of the "Tone River Development Agency" as the sole institute for integrated management of water resources of the Tone River. At
the time, the idea of a "Development Agency" for a particular region was not new in Japan. The Hokkaido Development Agency and the Okinawa Development Agency then existed under the Cabinet of the Central Government. Hokkaido, the northernmost of Japan's four main islands represents about 22% of its total area, and the Development Agency was responsible for all the development work in Hokkaido including the planning and execution of comprehensive government plans for public works related to roads, rivers, agriculture, airports, and others. The Okinawa Development Agency was later established for economic development of Okinawa, Japan's southernmost prefecture with the unique circumstances due to its geographical location and also the fact that it had been under the United States rule during 1945-1972. The Okinawa Development Agency aimed at promoting various policies such as expanding the infrastructure in Okinawa. The advantages of having a Development Agency for resettlement schemes are as follows.

(a) Seamless assistance for resettlers from planning through follow-up stages of a project

A problem often observed in dam construction projects is the very weak or lack of responsibility in the follow-up period of the projects, i.e. after completion of the dam. For resettlers, re-establishing their livelihood after relocation is in general difficult and brings with it many uncertainties. For example, unexpected expenditures may be incurred after completion of a dam for taking additional and corrective measures for resettlers who fail to re-establish their livelihood at their new location.

(b) Built-in mechanism of benefit sharing among upstream and downstream areas

Establishment of "funds", financed by downstream administrations for the sake of upstream regions, has been practiced in several major river basins Japan only since early 1970s. It stemmed from the prevailing recognition in upstream areas during the 1950s through the 1960s that only those in downstream regions enjoyed the benefits created by dams [8]. Laws and regulations for establishing funds were enacted in the early 1970s. In the Japanese cases, funds have been regarded as a mechanism to share the benefits of a dam, which are enjoyed by those in downstream areas, among people in both upstream and downstream regions. Aims of such funds have been: (a) meeting the operation and maintenance cost of the infrastructure (e.g. roads, public utility buildings, etc.) built in accordance with dam construction projects, as well as promoting rural development of the dam site region, and (b) paying the interest of the money borrowed by the resettlers who purchased land before receiving their indemnity. The latter is unique in Japanese cases; it generally takes years to have a compensation scheme established [9].

CONCLUSION

The Numata Dam project failed to be realized, despite the needs felt by those in the Tokyo Metropolitan Area and other potential beneficiaries. This does not imply that no
useful lesson may be learned by examining the project in detail. The author believes that the resettlement schemes elaborated for the Numata Dam are still innovative and that the schemes may be applied to developing countries, in particular for the nations about to take off with economic development. The application of these schemes might have reduced problems for some projects implemented in the past in the developing world.

One of the major differences between dam construction projects implemented in Japan in the past and those implemented or being planned in the developing world is the number of resettlers. With relatively fewer resettlers, the compensation schemes applied in Japan tended to be much more generous compared with those previously implemented in the developing world. For this reason, it may superficially seem that the wisdom secured in Japan is neither applicable nor relevant in other countries, let alone in the developing countries.

However, the resettlement schemes planned for the Numata dam were elaborated as a solution for the same sort of issues, including a large number of resettlers and a paucity of substitute farmland, which the developing countries now face in planning and implementing dam construction projects. The knowledge secured through the planning of the Numata Dam ought to be applicable and useful for dam construction projects in the future in the developing world, even though the schemes elaborated were not practiced for the Numata Dam itself.

ACKNOWLEDGEMENTS

The research carried out for this paper was partly funded by the New Research Initiatives in Humanities and Social Sciences of the Japan Society for the Promotion of Science (JSPS), the Core Research for Evolutonal Science and Technology (CREST) of the Japan Science and Technology Corporation (JST), and the Ministry of Education, Science, Sports and Culture, Grant-in-Aid for Scientific Research (P), 03811, 2003. It was also partially supported by the 21st Century COE Program of the Tokyo University of Agriculture and Technology "Development of New Energy-Conscious Metabolic Systems and the Concept of Science for Evolution and Survival of the Technology based Civilization". This paper is based on an earlier paper about the resettlement plan for the planned Numata Dam, published as [10].

REFERENCES


