Optimum Environmental Management of Human Settlement : a Case Study of Nam Houng Village Xekatam Hydroelectric Power Project, Lao PDR.

การจัดการด้านสิ่งแวดล้อมอย่างเหมาะสม สำหรับการโยกย้ายถิ่นฐานของประชาชน : กรณีศึกษา บ้านน้ำหุ่ง โครงการเขื่อนไฟฟ้าพลังน้ำเซกาต่ำ ในประเทศ สปป. ลาว

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ABSTRACT

The study of optimum environmental management of human settlement, a case study of Nam Houng village for Xekatam Hydroelectric power project in Champasack province, Lao PDR, is aiming at comparing between the resettlement and the non-resettlement case based on the quality of life which may be affected by the project development and identifying the environmental management plans in order to recommend the optimum alternative. Nam Houng village is one of six villages that are supposed to be severely affected from Xekatam hydroelectric power project due to its location which is about one kilometer away from the proposed main dam site. The population of Nam Houng village is 232 people with 35 households. All of people in Nam Houng village are Nhaheun, one of 49 ethnic groups. The proposed main dam site is located in the Thong Houng area creating a reservoir of 7.6 km^2 or 763 ha (476,875 Rai) in which the agricultural area of Nam Houng village will be inundated with total area of 124 ha (77,500 Rai).

Two alternatives, resettlement and non-resettlement cases are taken into account. The first alternative is to relocate the Nam Houng villagers to a new area which is about 6 kilometers away from their homeland. The second one is to remain the Nam Houng villagers at the original location. The Multi Criteria Analysis (MCA) tool is applied to support the decision making process of whether Nam Houng village should be relocated in the new resettlement area or remained at its original location. Five criteria such as human use values, quality of the environment, quality of life, public health, and community participation and 24 sub- criteria were employed in the MCA.

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The weigh values of the five main criteria given by the MCA were the human use values 27.06 %, the quality of life 26.94 %, the environment 19.30 %, the public health 16.06 % and the community participation 10.63 %. These percentages were used in comparing the two alternatives. The option one for resettlement case represented 56.01 point while the non-resettlement case represented 61.56 point. Therefore the non - resettlement case is better alternative.

Key Words : Environmental management, Human settlement, Xekatam hydroelectric power project.
คำสำคัญ : การจัดการสิ่งแวดล้อม การย้ายถิ่น โครงการเขื่อนไฟฟ้าพลังน้ำเซกาต่ำ

บทคัดย่อ

วัตถุประสงค์ของการศึกษาครั้งนี้เป็นการศึกษาเพื่อการจัดการด้านสิ่งแวดล้อมอย่างเหมาะสม สำหรับการโยกย้ายถิ่นฐานของประชาชน ในกรณีศึกษาหมู่บ้านน้ำหุ่งของการพัฒนาโครงการเขื่อนไฟฟ้าพลังน้ำเซกาต่ำ ซึ่งตั้งอยู่ที่แขวงจำปาสัก ทางตอนใต้ของประเทศ สปป. ลาว เพื่อให้ได้ข้อสรุปที่มีความเหมาะสมว่าควรทำการโยกย้ายหรือไม่โยกย้ายประชาชนออกจากพื้นที่โครงการฯ โดยคำนึงถึงคุณภาพชีวิตและความเป็นอยู่ของประชาชนผู้ที่จะได้รับผลกระทบ และแผนการจัดการด้านสิ่งแวดล้อมเป็นเกณฑ์ประกอบการพิจารณา ทั้งนี้บ้านน้ำหุ่งเป็น 1 ใน 6 หมู่บ้านที่จะได้รับผลกระทบโดยตรงในการก่อสร้างโครงการฯ ที่ตั้งของหมู่บ้านมีระยะห่างจากที่ตั้งเขื่อนตามแผนการก่อสร้างไปทางด้านท้ายน้ำ เป็นระยะทางประมาณ 1 กิโลเมตร มีจำนวนครัวเรือนในหมู่บ้านทั้งหมด 35 ครัวเรือน คิดเป็นจำนวนประชากร 232 คน ชาวบ้านทุกคนเป็นชนเผ่าหย่าเหิน จากทั้งหมด 49 ชนเผ่าที่อาศัยอยู่ใน สปป. ลาว และในการก่อสร้างเขื่อนครั้งนี้ยังส่งผลกระทบต่อพื้นที่ทำการเกษตรของชาวบ้านบริเวณทุ่งหุ่ง รวมมีพื้นที่การเกษตรที่ต้องกลายเป็นพื้นที่ของอ่างเก็บน้ำประมาณ 77,500 ไร่ จากพื้นที่ขอบอ่างเก็บน้ำตามที่ออกแบบ 476,875 ไร่

ในการศึกษาวิเคราะห์ ได้แบ่งทางเลือกออกเป็นสองแนวทาง คือ กรณีที่ต้องทำการโยกย้ายและกรณีที่ไม่ต้องโยกย้าย โดยในกรณีที่ต้องทำการโยกย้ายได้เลือกสถานที่สำหรับการตั้งถิ่นฐานใหม่ไว้แล้ว ซึ่งอยู่ห่างจากที่ตั้งเดิมไปทางด้านทิศตะวันตกเฉียงใต้ประมาณ 6 กิโลเมตร ส่วนกรณีที่ไม่โยกย้ายให้คงสภาพที่ตั้งของหมู่บ้านไว้ที่เดิม แต่อาจจะมีการปรับปรุงหรือปรับเปลี่ยนบ้างในบางส่วน สำหรับการพิจารณาคัดเลือกแนวทางทั้งสอง ได้ใช้หลักการวิเคราะห์แบบหลากหลาย (MCA) เป็นลำดับขั้น ซึ่งได้ประยุกต์โปรแกรม MCA ให้เหมาะสมต่อการนำมาใช้ในการคัดเลือกและตัดสินใจว่าควรทำการโยกย้ายหรือไม่ควรทำการโยกย้ายประชาชนออกจากพื้นที่โครงการฯ โดยใช้หลักเกณฑ์ในการวิเคราะห์จำนวน 5 เกณฑ์หลัก ได้แก่ ด้านการใช้ประโยชน์ของมนุษย์ ด้านคุณภาพสิ่งแวดล้อม ด้านคุณภาพชีวิต ด้านสาธารณสุขและด้านการมีส่วนร่วมของประชาชน และแยกย่อยเป็นเกณฑ์รอง 24 เกณฑ์

สำหรับน้ำหนักถ่วงของแต่ละเกณฑ์หลัก จากการวิเคราะห์แบบหลากหลาย (MCA) พบว่า ด้านการใช้ประโยชน์ของมนุษย์มีค่าน้ำหนักถ่วงร้อยละ 27.06 ด้านคุณภาพชีวิตร้อยละ 26.94 ด้านคุณภาพสิ่งแวดล้อมร้อยละ 19.30 ด้านสาธารณสุขร้อยละ 16.06 และด้านการมีส่วนร่วมของประชาชนมีค่าน้ำหนักถ่วงประมาณร้อยละ 10.63 ตามลำดับ ซึ่งค่าน้ำหนักถ่วงเหล่านี้ได้นำไปใช้ในการเปรียบเทียบทางเลือกทั้งสองทาง โดยสรุปผลได้ว่าในทางเลือกที่หนึ่ง คือ กรณีที่ต้องทำการโยกย้ายได้คะแนนจากการพิจารณา 56.01 และทางเลือกที่สอง คือ กรณีที่ไม่ต้องโยกย้ายได้คะแนนอยู่ที่ 61.56 จากคะแนนเต็ม 100 คะแนน ดังนั้นผลการพิจารณาทางเลือกที่เหมาะสมด้วยวิธีการวิเคราะห์แบบหลากหลายเห็นควรว่า ทางเลือกที่สอง คือ ไม่ต้องโยกย้าย เป็นทางเลือกที่เหมาะสม

Introduction

Lao PDR is rich in water resources having a large unexploited potential hydropower generation of about 30,000 MW. At present, 11 major hydropower plants and at least 36 smaller ones generate energy for both domestic and export markets. The total electricity generation is 686 MW of which 669 MW from hydropower accounting for 98 % and 2 % or about 17 MW from diesel generator. The 3.5 billion kwh per year is generated, of which 2.2 billion kwh is export to Thailand. The power generation is one of main source of national income for economic sectors of Lao PDR. Lao government has set strategic goal to turn Laos to be a battery of Southeast Asia in the near future. However the hydropower development has more or less impacts on the environment and human settlement. Therefore, many guidelines and measures for water resource management and environment protection have been set forth to minimize impacts from hydropower development. From the past lessons, the number of hydropower projects have been developed in Lao PDR and paved their ways to some future problems causing long term impacts on society and the environment. The improvement of quality of life of the affected people can not reach in a sustainable way due to the enforcement of the relevant law and regulation towards the compensation for human settlement have not been implemented effectively and the developers is to minimize the long term budget providing for affected people or community development as much as possible. Moreover, the contribution of local community, the participated environmental management and coordination of concerned line agencies have not been concentrated strongly as it should be due to many factors such as budget constraints, less awareness of environment protection promotion, inefficient coordinating body, ineffective management, some disadvantages of the concession agreement. The budget contribution for long term operation of the environmental management is hardly to come up, most of the developers will consider for short term financial assistance during construction period and shortly afterward the construction. So, in the long run, the people who are affected from hydropower development projects are still suffering from receiving low income, insufficient agricultural area, rice starving, water shortage causing social problems, migrations, culture diversities and as a consequences, destroy of surrounding environment for survival and these will be overburden for Lao government that has already limited budget to manage the issues and to carry out poverty reduction.

Study Area

The study area locates in the southern of Lao PDR. A case study of Nam Houng village, Paksong district, Champasak province which is located about 1 km downstream of the proposed main dam of the Xekatam hydroelectric project, a memorandum of understanding (MOU) between the government of the Lao PDR and the KANSAI for the development of the Xekatam Hydroelectric Project which singed and executed in September 2004, represents the overview of the environmental status of Nam Houng village of pre-construction of Xekatam Hydroelectric project, the potential impacts on the Nam Houng

village and the surrounding environment after the construction of XeKatam Hydroelectric project.

General Description of Xekatam Hydroelectric Power Project

The Xekatam Hydroelectric Power Project is located at Latitude 15° 10' and Longtitude 106° 35'. Creation of dam will form a reservoir and will inundate 7.6 km^2 of land at a full water supply level elevation of 910 m above sea level (asl). The reservoir is referred to as the Thong Houng Reservoir. The proposed rock-fill dam will have a crest length of 420 m, crest width of 8 m and an approximate height of 37.5 m. The storage capacity of this facility will be 126.2 MCM and an active storage capacity of 115.2 MCM.

The proposed supply water level of the intake weir is 770 m (asl) with a rated discharge of 16 m3/s going through the headrace tunnel and the penstock with the total length of 5,580 m and 1,295 m respectively. The powerhouse will be located externally at the base of the escarpment at the confluence of the Xekatam and Xenamnoy Rivers, about 9 km far away from intake weir or about 19 km away from the main dam. Water will be conveyed from the powerhouse into the Xenamnoy River via Xekong River and then finally discharge into the Mekong River. The gross head from the intake weir to the powerhouse is about 465 m.

The Affected Villages in the Project Area

There are six villages are supposed to be impacted from Xekatam hydroelectric power project, one of these is Nam Houng village which is selected for this case study . Nam Houng Village (*Ban Nam Houng*) is located about one km away from the proposed main dam site, near the downstream channel. It is anticipated that the proposed reservoir, the Thong Houng area in the site of the proposed reservoir, will inundate a total of 7.6 km^2 or 763 ha of land and resource use areas including the agricultural area of Nam Hong village, lowland rice field 23 ha (14,375 Rai), coffee garden 43 ha (26,875 Rai),, upland rice field 49 ha (30,625 Rai) and orchard 9 ha. (5,625 Rai), The population of Nam Houng village is 232 with total 35 households. All of people in Nam Houng village are Nhaheun, one of 49 ethnic groups.

Materials and Methods

This study towards the quality of life which has been affected by the hydroelectric power project development, comparing between the resettlement and the non-resettlement; using Nam Houng village, identify environmental management plans, comparing between the resettlement and the non-resettlement, and to recommend the optimum alternative for Xekatam hydroelectric power project as a case study. The Multi Criteria Analysis program (MCA) will be adopted for selecting optimum environmental management of human settlement.

Identify the optimum alternatives.

The Nam Houng village is supposed to be affected from Xekatam hydroelectric project development. Multi Criteria Analysis (MCA) tool is applied to identify various factors for consideration and decision making process on resettlement case and non- resettlement case. During the site visit and public consultation with the people in Nam Houng village, the two cases were addressed for discussion and to reflect the attitude of affected people and concerned parties.

Results

1. Non- Resettlement Case

The results from the public consultation meeting with Nam Houng villagers and their comments and attitude towards the Xekatam hydroelectric power project in case of non- resettlement can be summarized as follows:

- Upgrade the access road to Nam Houng village for all year round
- There are not enough classrooms for the students for grades 1 to 5 in the resettlement village. The villagers want the authorities to build more schools with tables, benches and teachers
- There is no medicine available at the health centre or dispensary. The villagers urged the developer to provide this.
- Assist to extend agricultural land for lowland rice filed and irrigation system
- On the job training to improve the agricultural products
- Fish pond or public lake of the village. Fishing activities in the Thong Houng reservoir area should be approved.
- Building toilets.
- Providing clean and drinking water during and after dam construction
- Providing jar, water container
- Providing water supply for consumption and agriculture use
- Supply electricity for each households

2. Resettlement Case

The public consultation meeting and discussion had reflected the Nam Houng villagers' opinion and here are the recommendations of Nam Houng villagers on resettlement case.

- The villagers are not sure that they will be look after in a good state or condition if they have moved to the new resettlement area during the project operation and after the completion of the project.
- The agricultural land in the new resettlement area may be limited and not enough for affected people.
- Arrangement the plantation area at least as same as they used to have, and also encourages the agriculture promotion and improves the soil quality for rice and coffee plantation.
- Good access road for all year round
- Providing electricity for new resettlement site and for each moved households
- Compensation for land loss and affected houses
- Compensation for agricultural products for the first three years.
- Providing public health facilities, health care center, dispensary etc.
- New school, grade 1-5 with education material
- Providing sufficient supply of water for the people and adequate access to clean water.

All comments are very useful information to support the optimum environmental management and development planning for Nam Houng village in case of resettlement and non-resettlement case.

Setting Criteria on Human Settlement

The selection of involved multi criteria for water power development projects is so import

and confusion can arise if logical well- structured decision- making process is not followed. Each criterion relative to the decision being made must be evaluated. Gaining compliance on the relative importance of different Criteria can be a complex and difficult task. For this case study, optimum environmental management of human resettlement used a multi- criterion analysis to ensure appropriate elements towards the quality of life as the following aspects:

1) Option for Social: The numbers of problems will be calculated and analyzed. For the quality of life and socio- economic aspects, it will be necessary to implement the reasons to a level that are acceptable. The indicators to be used in the comparison are included social, culture, and aesthetical aspects.

2) Environmental Impact: Environmental impact assessment of the project includes water quality, forestry, water allocation, forest degradation, and resetlement.

3) Regulation/ Economics Indicator: The measurement towards the changes on the effects of the project being undertaken was considered as an economic value.

4) Regulation of Social Impact of the life Pattern: Income loss and instability benefit, occupation alerting are considered for the opportunity for community development.

5) Regulation of Public Participation: The measurement that the people need is the cooperation and project supports.

Relative Weight of Indicators

To calculate the relative weight of the indicators using the pairwise comparison method, the expert team was asked to give respond to compare each indicator to the other indicators relevant. The pairwise comparison measures both ordinal and cardinal importance of the different indicators. The responses of the expert team will be more specific as they have to consider each indicator's importance in relation to all the other indicators. The pairwise comparison method can be analyzed for consistency. This consistency index can indicate when there is a great inconsistency among the responses, and help to pin point where the inconsistencies have occurred. This can help make the analysis more reliable and accurate.

Table 1 Relative Weight of Criteria

Main Criteria	A	B	C	D	E
Human Uses Values (A)	1	1	4/3	2/1	2/1
Quality of Life (B)	1	1	4/3	2/1	2/1
Public Health (C)	3/4	3/4	1	3/2	3/2
Environment (D)	1/2	1/2	2/3	1	1
Community Participation (E)	1/2	1/2	2/3	1	1

The example of relative weight interpretation of the value of human uses (A), compared with public health (C)

- The horizontal line of human uses values in column C, the number 4/3 means the value of human uses be more significant than public health in the average.
- The horizontal line of public health in column A, the number is 3/4 means public health is less significant than the value of human uses.

The relative weight value is relative to each other. This can be calculated by weighting values as shown in the table 2

Table 2 Relative Weight Values The relative weight values to adjust by the 24 sub-criteria

Main Criteria (Row)	Criteria component					Average relative Weight
	A	B	C	D	E	
Human Uses Values (A)	1.63	1.26	1.03	1.80	1.05	27.06%
Quality of Life (B)	1.25	1.60	1.03	1.80	1.05	26.94%
Public Health (C)	0.75	0.75	0.80	1.08	0.63	16.06%
Environment (D)	0.87	0.88	0.72	1.61	0.74	19.30%
Community Participation (E)	0.50	0.50	0.41	0.72	0.52	10.63%
						100%

For example of the relative weight values between A-A=1.63.

Table 3 The relative weight of the indicators using the pairwise comparison for sub criteria.

Sub-criteria (Row)	Supplementary Criteria (Row)	A1	A2	A3	A4	A5
A1	Water supply	0.054	0.098	0.136	0.118	0.021
A2	Fishery or reservoir fishing	0.027	0.049	0.091	0.118	0.021
A3	Transportation	0,018	0.025	0.045	0.078	0.031
A4	Floods and flood control	0.018	0.016	0.023	0.039	0.021
A5	Land use	0.161	0.148	0.091	0.118	0.063

The main criteria in Table 2; Human Uses Values (A-A) = sum A1 –A4 = 1.63

Ranking of the Priority Option

Weight value of the 24 sub-criteria is multiplied by combining the scoring of each criterion of each option bringing about the total points of all 5 aspects of the main criteria. The details of data analysis using the Multi Criteria Analysis (MCA) Program are shown in Table 4. The total scoring of option for the resettlement and non resettlement case are obtained. The ranking of the priority of each criterion is shown in the table 5

Table 4 Show the score of each sub criteria.

Sub-criteria (Row)	Supplementary Criteria (Row)	Score	
		New resettlement	No resettlement
A1	Water supply	4.07	3.49
A2	Fishery or reservoir fishing	3.55	4.44
A3	Transportation	3.43	3.43
A4	Floods and flood control	3.36	3.66
A5	Land Use	3.22	3.86
B1	Socio-economy	3.85	3.37
B2	Resettlement	4.12	1.83
B3	People's attitudes toward project	2.34	3.51
B4	Supporting plans and initial career promotion	6.19	2.48
B5	Assets and public asset assessment	1.10	2.21
C1	Effects on public health	1.89	3.30
C2	Sanitation	2.85	2.14
C3	Effects on new comers' and old folks' mental health	0.76	2.27
C4	Public Health	3.60	2.80
D1	Affects on natural streams	0.85	1.97
D2	Affects on ecology	1.00	1.49
D3	Affects on forests and types of reservation	1.06	2.12
D4	Affects on scenery and tourist attractions	1.88	1.41
D5	Affects on the watershed area	1.27	1.90
D6	Affects on transportation routes	1.03	1.55
D7	Affects on shrines and temples	0.94	1.42
E1	Acceptance of local population in concepts and project developing methods	0.59	1.77
E2	Acceptance of land return for project construction	1.07	2.14
E3	Readiness to share labor for maintenance	0.94	1.42
E4	Education level or knowledge of people for development projects	1.06	1.59
	Total	56.01	61.56

Table 5 Weighting value of criteria and scoring of option

Main criteria	Weight value	Scoring of options	
		Resettlement case	**Non –Resettlement case**
Human use values	27.06	17.63	18.89
Quality of life	26.94	17.60	13.39
Public Health	16.06	9.09	10.51
Environment	19.30	8.03	11.86
Community Participation	10.63	3.66	6.91
Total	**100**	56.01	61.56
Ranking of Selection		**2**	**1**

Conclusion

As refer to the results, the non- resettlement case represents 61.56 higher than the resettlement case. Therefore, the optimum one for environmental management of human settlement is a non resettlement case. The results of the comparison of resettlement and non-resettlement case for other main criteria such as public health, environment and community participation are very similar, except the quality of life that seems obvious altering. The relocation of Nam Houng village or resettlement has better good quality of life. The resettlement case get 17.60 points and non resettlement case is 13.39 points which is different obviously. However the total points of every path together has differed. The results showed that non- resettlement case gets more points than resettlement case. Therefore the optimum environmental management of human settlement for this study is non- resettlement case.

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