



Pak Mun Dam's long term impact on local residents' livelihood

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ABSTRACT

Multidimensional well-being is an important method for understanding the social functioning of communities affected by the Pak Mun Dam, 26 years after its construction. This is the first quantitative research on the well-being of these communities. In six of eight well-being dimensions, the more distant communities are furing better than those in close proximity to the dam. Furthermore, 24 of 40 items which represent each dimension have statistically significant lower means in the affected community. This result shows the long-lasting nature of negative effects on communities and without appropriate policy action negative impacts will linger preventing developmental progress from occurring.

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Introduction

Pak Mun Dam located in Khong Jiam district, Ubon Ratchathani province in northeastern Thailand has a controversial history. The main reasons for constructing the dam were to provide hydropower and irrigation in the district with the goal of assisting in regional economic development efforts. As will be discussed this goal remains elusive. The dam was funded, in part, by the World Bank with a loan of \$25 million, with final construction cost at \$250 million. After the dam's completion in 1994, those who used to live where the dam is located were relocated to a new area with housing and land provided by the government.

The government compensated relocated people for the disruption to their lives and their economic losses during 3 years of construction (Kiguchi, 2016). After the dam's opening in 1994, directly affected residents protested and requested a solution to improve their livelihood. Many qualitative studies examining losses sustained from dam construction and completion have mentioned changes to economic well-being through declining fish production and resulting income losses; for example, fishing production is now only 20–40% of what it once was (Manorom, 2006), and revenue from fishing decreased by about \$1.4 million per year (Amornsakchai, 2000). In addition to economic losses directly affected people were also impacted by socio-cultural changes.

The dam changed the relationships among community members after relocation (Amornsakchai et al., 2000). Working conditions also changed because people lost their livelihoods and had to work in areas that did not match their previous working experience (Kiguchi, 2016). Furthermore, family well-being also changed, since many residents could not find jobs locally and moved to cities to find other income to support their families (Kiguchi, 2016). Regarding cultural well-being, the dam is located where locals and tourists traditionally celebrated the annual Thai New Year or Songkran festival; about 50 rapids were considered sacred by the local communities. After the dam was completed, the local communities lost their character, and the number of festival participants steadily decreased (Amornsakchai, 2000). Finally, in terms of environmental well-being, the dam has changed the nature of the area

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significantly. Since 1994, 96 of 265 species of fish were no longer present in the region, and two have disappeared completely (Manorom, 2006).

After 1994, the livelihoods of people in local communities changed, and those remaining requested the government to improve their cultural and economic life by removing the dam or opening its gate permanently. The government has not acted on these requests. In order to create better policy and respond to local concerns, updated information on local peoples' well-being is needed. The effects on people from dam construction have been mixed. Those directly affected, from the loss of fishing opportunities to the cancellation of cultural events, have been most vocal in opposition to the dam's presence. However, residents in communities located further away from the dam and not dependent on the river for their economic wellbeing have benefitted through the provision of additional irrigation water and increased electrical supply. This is not a situation that can be resolved for the benefit of all. The water supply from Mun River on which Pak Mun Dam is located, has to be kept at the level of 106.7 meters above sea level (masl) for water pumping purpose for the city of Ubon Ratchathani (Baird, Manorom, Phenow, and Gaja-Svasti, 2020). Thus, removing the dam or permanently opening its sluice gates will affect the dam's ability to provide hydroelectric power and irrigation water for one city and region while benefitting another. It is these disparate and uneven impacts affecting resident's wellbeing that are the focus of this study.

Quantitative research on the subject of the dam's long term effects on many aspects of life (i.e. economic, cultural, environmental) has not been conducted before but by doing so more detailed analyses could be used to find the relationships between the aforementioned well-being dimensions and resulting impacts on local residents' overall well-being.

This empirical study uses eight well-being dimensions to compare ancillary communities (control group) and affected communities (study group).

The overall goal of the study reported in this paper was to gain a fuller understanding of the dam's long-lasting impacts on those directly affected by its construction. It is hoped that by doing so better strategies and policies to deal with negative impacts can be formulated and implemented. The long-term affect was not studied so that it is difficult to find the remaining affect.

Literature review

Conceptual Background

Well-Being Analysis

The concept of measuring well-being is based on Sen's (1980) capability approach (CA). Sen's approach focuses directly on quality of life through an individual's ability to function within society. The CA asserts that a high quality of life depends on multiple functions, including personal physiology, environmental factors, social conditions, family relations, and relational perspectives based on the concept of freedom of choice (Sen, 1999). Gasper (2002) criticized Sen for not including other important values that motivate human action, such as feelings for other people and commitment. Following Gasper, Kahneman et al (2004) explained that well-being is comprised of two important aspects: objective well-being and subjective well-being. Cahyat, Gonner, and Haug (2007) defined objective well-being as including basic needs, knowledge, health, environment, and the economic, political, and social spheres. Under subjective well-being, they included emotional well-being, quality of life, and life evaluation. Additionally, Oishi, Diener, Lucas and Suh (1999) used life satisfaction as a measure of subjective well-being.

To be able to understand people's well-being, it is necessary to include the multiple dimensions of both subjective and objective well-being in order to cover the important factors that impact their lives. While the concept of well-being and the approaches to assessing it have already been well developed, more multidimensional domains have been introduced to measure it. Many good examples of multidimension well-being indices use multiple dimensions to measure the well-being of a population, such as the UNDP's Human Development Index (HDI), which includes income, health, and education (Decancq & Lugo, 2013). The selected dimensions should be appropriate for the purpose of assessment. The information from the multiple dimensions of well-being can be used to inform governmental policy considerations, private business decision making, and even local residents' quality of life decision making.

Economic well-being is one important aspect of well-being for sustainable development, as economic well-being brings a better quality of life through higher income and good consumption. Being able to access basic needs such as health care, education, food, and shelter is necessary to maintain sufficient funds. There are many indicators used to measure economic well-being, such as income, income sources and income level, and income stability (Summers & Smith, 2012). Moreover, Osberg, and Sharpe (2003) mentioned that stock of wealth is another indicator to measure economic well-being. In addition to these tangible indicators, an individual's emotions about their financial condition can also be considered an important subjective indicator of economic well-being.

Social well-being is an important dimension for achieving sustainable development goals. Social well-being involves many aspects that relate to society, such as community well-being, health, politics, jobs, culture, and family. There are many indicators that have been used to measure well-being in these factors, which are discussed below.

Community well-being is one aspect of social well-being because humans are part of society. Being part of society and being accepted by a community are crucial for humans to achieve their basic social needs. In order to understand community well-being, many

recommended indicators include community relationship, which is the feeling of being part of the community and the feeling of being supported by society. Cahyat, Gonner, and Haug (2007) have noted that involvement in community decision making determines how community members help each other. Moreover, Woolcock (2001) determined that social capital or social networks can have positive effects on social trust. Finally, the feeling of being safe and secure from harm is important to measuring community well-being (Rahman, Mittelhammer, & Wandschneider, 2003).

Although it can be difficult to define government or political well-being, the basis of this relationship is that politics facilitates other factors to support well-being, this means that people should be able to rule, control, and protect their own rights, vote for their own benefits from the government, and have trust in the government (Rahman, Mittelhammer, & Wandschneider, 2003). Knight and Gunatilaka (2012) used government effectiveness, control of corruption, and voice and accountability as indicators for political well-being. Cahyat, Gonner, and Haug (2007) added that basic government services provided to people can also be an important measurement of political well-being.

Human capital is the foundation of national development, so health well-being is also important. In general, a lower quality of human capital would lead to a lower level of production and competitiveness in the world economy. Besides education's positive impact on human capital, health well-being also plays an important role for human well-being. Health well-being is needed to achieve both mental and physical health. Physical health well-being can be measured by annual health checks, or self-reporting on the frequency of exercise and smoking, as well as the amount of fruit and vegetables that are consumed in a certain period of time. Streeten (1995) used quantity and quality of sleep as an indicator of physical health well-being. In terms of mental health, stress, depression, and mood disorders can be measurements for well-being (Keyes, 2006).

Having a job provides many positive mental impacts, such as self-esteem and self-worth. Unemployment negatively impacts well-being, as unemployed persons tend to experience pressure and depression (Mendes & Saad, 2011), and often feel financially insecure and lose their self-esteem. Good working conditions and positive job experiences are crucial indicators for job well-being (Lehmkuhl, 1999). Furthermore, job training to improve job efficiency would also increase job well-being and help integrate the community (Jayaratne, Bradley, & Driscoll, 2009).

While culture may not appear to impact well-being in the way that economic, social, health, and environmental factors do, it nevertheless has a direct and significant effect on well-being, life satisfaction, and happiness (White, 2006). Culture represents the characteristics of a society; it is part of their identity and part of their life. Culture is not only represented by music, language, and traditions, but it is also a combination of behavior patterns, such as the community's values, beliefs, and knowledge that characterize a particular group of people (Novitz & Wilmott, 1989). Culture has been developed over the course of generations, so there are many indicators to measure cultural well-being, such as cultural involvement in events and time spent at events (Salvaris, 2007).

The family is the smallest unit of society but it is the foundation of it; family provides safety, raising children with the support of mental health and physical health, and providing them with food and shelter. Furthermore, family provides people with knowledge regarding the role of society's members, basic rights, laws and regulations, and basic religious knowledge (Baldwin & Moses, 1996). Two family function theories have been used to measure family well-being: the Circumplex Model of Marital and Family Systems and the McMaster Model of Family Functioning. These include indicators of family cohesion, emotional bonding, family flexibility, family relationship, family communication, affective responsiveness, and affective involvement (Olson, 1999).

Environmental well-being is one of three main factors for measuring sustainable development. The environment provides basic human needs, such as water, air, food, and medicine. An imbalance in the ecological system would cause many negative impacts and eventually be harmful to humans. Indicators of environmental well-being can include the quality of the environment, such as the quality of land, water, and air. The change of temperature levels (Rishi & Khuntia, 2012) and pollution levels and noise are also measurements of impacts on the environment (Luechinger, 2009). In addition to environmental changes, the program of improving the environment that is provided by the government is also used to indicate environmental well-being.

Sustainable Community

Sustainable livelihood is a concept that was developed at the 1992 Earth Summit in Brazil. In order to achieve a sustainable community and sustainable livelihoods, there needs to be three pillars of sustainability: economic, social, and environmental. Furthermore, a sustainable community also has a responsibility to maintain resources for future generations after utilizing the current resources for the current needs of community.

Research and Methodology

The Control Group

The control group for this study included villages whose communities, located far from the dam site, were not directly affected by the Pak Mun Dam. They are considered ancillary communities. The control group comprised the villages located next to the Mae Khong River in Na Pho Klang subdistrict. This subdistrict is similar to the Khong Jiam subdistrict, where the study group resides, in terms of population size and the fishing and agricultural way of life. There are eight villages in the Na Pho Klang subdistrict, which encompassed 1,428 households and a total population of 7,261 people.

The Study Group

Two villages in the Khong Jiam subdistrict, Hua Hew village and Hua Hai Pattana village, were selected as the experimental study group because they are located close to the Pak Mun Dam. Hua Hew village, especially, was severely affected by the dam as their life was centered around the river and its pre dam way of life. There are three villages where the main income was from fishing, and where, it appears, they were not willing to adjust themselves to new careers or ways of life.

The three villages comprising the experimental study group are Hua Hew village, Hua Hai Pattana village and Wern Buk village. There were also villages in the district, such as Ban Sapua Tai, Ban Sai Mun, Ban Nam Sang, and Bang Tun lung that were affected by the dam construction in different ways. For example, Ban Kun Nok Hor and Ban Dan Kao are farming villages that were able to adjust the lives and accept new jobs which were provided by the government (Phongam, 2005). This was possible because they were almost totally reliant on employment activities other than those disrupted by the dam construction.

In terms of size Khong Jiam subdistrict has approximately 1,992 households and 6,359 people. In the district the target villages of Hua Hew had 301 households, with a population of 933, and Hua Hai Pattana has 131 households and a population of 505. This study group is called as “affected communities” in this study.

Method

There were two processes that guided the study: The first process was to find the impact on the type of resident (unaffected (i.e. ancillary) and affected (i.e. study group) communities) on each latent variable. (Table 1). Structural equation modeling was used to test the impact on different groups related to the latent variables of eight well-being dimensions. Doing it this way made it possible to process multiple tasks in one model.

The predictor, or independent variable, was a dummy variable representing members of the study group in the affected communities. The dependent variables were all eight latent variables. The second process was to test for statistically significant differences in the means, comparing both types of subjects, for 40 items in the eight well-being dimensions. The questionnaire contained questions based on the items in table 1. The items belonging to each well-being dimensions had been previously tested using factor analysis to determine to which wellbeing dimension they belonged. However before actual data collection began a pilot test was performed on the questionnaire.

The pilot test was used to test the validity and reliability of the questionnaire and to affirm which items belonged to which dimension. Thirty affected (i.e. study group) residents were interviewed in the pilot study and a Cronbach’s alpha test result revealed that all well-being dimensions scored larger than 0.6, (0.639 to 0.826) indicating the internal consistency of the scales constructed were acceptable (Table 1). After the test, all questions for questions had been used to collect data for this study, the data from this pilot test was not included into the study.

Table 1: Cronbach’s alpha for All Well-Being Dimensions

Domain (Construct)	Cronbach’s Alpha
Community well-being (ComWB)	0.793
Environmental well-being (ENWB)	0.765
Political well-being (PWB)	0.826
Health well-being (HWB)	0.787
Job well-being (JWB)	0.713
Cultural well-being (CWB)	0.639
Family well-being (FWB)	0.710

Two hundred fifty affected study group residents and another 250, ancillary group residents were personally interviewed by trained field researchers. The interviews were conducted from December 10-15 in 2014. The questionnaire was set up with Likert-scale type questions with a range of 1-5 which one represents the lowest score of agreement and five represents the highest score of agreement regarding the well-being questions.

SPSS is the software used for this study.

Table 2: Well-being dimensions

Well-being dimension	Items
Economic (EWB)	<ol style="list-style-type: none"> 1) Level of financial stress 2) Satisfaction with financial situation 3) Feeling about the current financial condition 4) Cannot afford to go out 5) Living paycheck to paycheck 6) Worry about living expenses 7) Confidence regarding financial emergency (finding 1,000 baht) 8) Stress about finances in general
Community (ComWB)	<ol style="list-style-type: none"> 1) Social acceptance 2) Social integration 3) Social assistance 4) Safety of the community 5) Satisfaction with community well-being
Environmental (ENWB)	<ol style="list-style-type: none"> 1) Water purchasing 2) Availability of water 3) Fish quality (taste) 4) Crowdedness 5) Environmental satisfaction based on water quality 6) Environmental satisfaction based on fish quality
Political (PWB)	<ol style="list-style-type: none"> 1) Trust in central government 2) Trust in local government 3) Satisfaction with government services 4) Satisfaction with local government services 5) Government respect for the voices of the local residents
Health (HWB)	<ol style="list-style-type: none"> 1) Number of hospital visits 2) Stress and pressure 3) Full of energy 4) Sleeping difficulty 5) Health satisfaction
Job (JWB)	<ol style="list-style-type: none"> 1) Hours of work (workload) 2) Proud of current job 3) Job fit 4) Job satisfaction
Cultural (CWB)	<ol style="list-style-type: none"> 1) Children's understanding of local culture 2) Community integration 3) Self-understanding
Family (FWB)	<ol style="list-style-type: none"> 1) Time spent with family 2) Family help 3) Emotional support 4) Overall family relation

Results

There were 15 outliers that needed to be eliminated in both the ancillary group and the affected group. Thus, there were 235 participants in each group whose data were used.

Description of Samples

This section presents the differences and similarities between the affected and ancillary communities.

Table 3 shows the socioeconomic differences and similarities of the affected and ancillary communities.

Table 3: Demographic Characteristics of Sample for Impacted and Non-impacted Communities

Variable	Pooled Sample (N = 470)	Affected community Sample (N = 235)	Ancillary community sample (N = 235)
	Mean (SE)	Mean (SE)	Mean (SE)
Income (Baht/month)	%	%	%
<500	1.9	2.6	1.3
500-1,000	11.3	13.2	9.4
1,000-1,500	7.7	6.4	8.9
1,500-2,000	5.7	7.7	3.8
2,000-2,500	2.8	2.1	3.4
2,500-3,000	5.3	5.5	5.1
3,000-3,500	3.2	3.4	3.0
3,500-4,000	3.2	3.0	3.4
4,000-4,500	2.1	1.3	3.0
4,500-5,000	6.6	8.9	4.3
5,000-5,500	3.6	4.7	2.6
5,500-6,000	8.7	8.1	9.4
6,000-6,500	3.2	2.6	3.8
6,500-7,000	2.8	2.1	3.4
7,000-7,500	2.3	2.6	2.1
7,500-8,000	3.4	2.6	4.3
8,000-8,500	2.6	2.1	3.0
8,500-9,000	1.3	1.3	1.3
9,000-9,500	1.3	2.1	0.4
9,500-10,000	3.8	3.4	4.3
>10,000	17.2	14.5	20.0
	100.0	100.0	100.0
Education	%	%	%
<Grade 6	58.7	65.5	51.9
Grade 7-9	17.7	16.6	18.7
Grade 10-12	16.0	11.9	20.0
2-year degree	1.3	1.7	0.9
Bachelor degree	4.5	4.3	4.7
Graduate work or advanced/professional degree	1.9	0.0	3.4
	100.0	100.0	100.0
Number of jobs	%	%	%
0	1.3	0.9	1.7
1	52.8	53.6	51.9
2	30.9	30.2	31.5
3	11.3	10.6	11.9
4	2.1	1.7	2.6
5	1.5	2.6	0.4
6	0.2	0.4	0.0
7	0.0	0.0	0.0
8	0.0	0.0	0.0
	100.0	100.0	100.0
Number of people in household	%	%	%
1	3.0	3.0	3.0
2	10.9	13.2	8.5
3	15.3	13.2	17.4
4	24.3	24.7	23.8
4	6.4	0.0	12.8
5	15.7	16.2	15.3
6	12.8	14.9	10.6
7	5.7	6.8	4.7
8	3.4	4.7	2.1
9	0.9	0.4	1.3
10	1.1	1.7	0.4
11	0.2	0.4	0.0
12	0.4	0.9	0.0
	100.0	100.0	100.0

Education. About 65.5% of the residents of the affected community have an education level lower than grade 6, which is considered basic education in Thailand, while 16.6% have an education level of grades 7–9. Only 4.3% have a bachelor’s degree.

For the ancillary community, about 51.9% of residents have an education level of lower than grade 6, and 18.7% of this community has an education level of grades 7–9. Approximately 20% of residents in the ancillary community have an average of grade 10–12. The percentage of college graduates in this group is 4.7%, which is higher than that of the affected community, which is only 4.3%. Moreover, 3.4% of the ancillary community residents have a graduate degree, whereas none of the residents in the affected community do. These results show that the ancillary community seems to have a greater number of people with a higher education level.

Income. Approximately 2.6% of the residents of the affected community have an income of less than 500 Baht per month, which is larger than that of the ancillary community. About 13.2% of affected community residents have an income in the range of 500–1,000 Baht per month. Around 14.5% of the affected community residents have an income larger than 10,000 Baht per month, but this number is still lower than that of the ancillary community, where 20.0% of the residents earn more than 10,000 Baht per month.

In comparison, only 1.3% of the ancillary community residents earn an income lower than 500 Baht per month, which is half that of the affected community (2.6%). Only 9.4% of residents in the ancillary community earn an income in the range of 500–1,000 Baht, which is significantly lower than that of the affected community (13.2%). Approximately 20.0% of ancillary community residents earn more than 10,000 Baht per month, which is larger than that of the affected community (14.5%). The ancillary community has a smaller group with a low income and a larger group with higher income.

Number of jobs. In the affected community, 53.6% of the residents have one job, 30.2% have two jobs, 10.6% have three jobs, 1.7% have four jobs, 2.6% have five jobs, and 0.4% have to work six jobs to earn enough income.

Results in the ancillary community are quite different: 51.9% of ancillary community residents have only one job and 31.5% have two jobs. About 11.9% have three jobs and 2.6% have to work four jobs. Only 0.4% have to work five jobs, and no one works more than five jobs. This shows that unaffected community residents do not have to work as many jobs as those in the affected community in order to earn a sufficient income.

Number of family members. Approximately 13.2% of residents in the affected community have only two persons in their households, which is a much larger percentage than that of the ancillary community. In the affected community, most households generally have four persons (24.7%), while some families have households of 10 people (1.7%), 11 people (0.4%), and 12 people (0.9%). There are not nearly as many large families in the ancillary community.

In the ancillary community, about 23.8% of residents have a family size of four, which is similar to the percentage in the affected community. The percentage of ancillary community residents decreases as the family size increases; only 0.4% have a family size of 10 people.

Table 4 shows that the ancillary communities had a statistically significant at $p < 0.05$, positive impact on six latent variables—economic, community, environmental, political, health, and family well-being.

The only negative impact was on Cultural well-being, but it was not statistically significant. The result shows that in general, six areas of well-being were better for the ancillary communities than for the affected communities after the dam was completed.

Table 4: Standardized factor loadings for indicators of the seven well-being dimensions in the CFA model.

Dimension	Indicator	Loading	SE	t-value
EWB	Feeling about current financial condition	0.722**	0.096	9.951
EWB	Level of financial stress	0.759**	0.105	10.305
EWB	Worry about living expenses	0.603**	0.093	8.411
EWB	Stress about finances in general	0.771	1.000	1.000
ComWB	Community participation	0.535	1.000	1.000
ComWB	Help from community members	0.662**	0.214	5.046
ENWB	Level of satisfaction with the water quality of Mun River and Mae Khong River.	0.710	1.000	1.000
ENWB	Level of satisfaction with the fish quality in the Mun and Mae Khong Rivers.	0.738	1.000	1.000
Political	Overall satisfaction with local government	0.876	1.000	1.000
Political	Trust in the local government	0.742**	0.120	7.265
Working	Pride in one's job	0.696**	0.055	12.005
Working	Job fit with skills, knowledge, and experience	0.852**	0.063	15.266
Working	Satisfaction level with job	0.922	1.000	1.000
Culture	Children's understanding of the importance of visiting the temple	0.646**	0.143	8.357
Culture	Feeling of closeness with the community	0.753	1.000	1.000
Culture	Understanding of the importance of visiting the temple	0.747**	0.112	9.105
Family	Increased time spent with family during the past 10 years	0.671**	0.161	7.877
Family	Willingness of individuals to turn to one another for help when something is troubling them	0.644**	0.133	7.656
Family	Ability to seek emotional support from family members when it is needed	0.727**	0.146	8.262
Family	Overall score of family relationship	0.638	1.000	1.000

**p < .01

Table 5: Impact of type of resident group on each latent variable (each well-being dimension)

	Standardized estimate	S.E.	C.R.	p-value
Economic←resident group	0.188***	0.188	3.698	***
Community ←resident group	0.201**	0.036	2.507	0.012
Environmental←resident group	0.160***	0.075	2.972	0.003
Political←resident group	0.112**	0.035	2.054	0.040
Health←resident group	0.348***	0.062	5.249	***
Job←resident group	0.092*	0.061	1.875	0.061
Cultural← resident group	-0.047	0.058	-0.866	0.386
Family←resident group	0.141***	0.045	2.630	0.009

Note. * $p \leq .10$. ** $p \leq .05$. *** $p \leq .01$

Each of the wellbeing dimensions was then subjected to item by item analysis. By doing this we were able to identify how each specific variable, for each group (i.e. ancillary and affected communities), included in that dimension was affected by the construction of the dam. The results shown in table 4, show that six items in the EWB dimension were statistically significant at $p < 0.05$, and for all six of them the affected communities had a lower mean: “Level of financial stress”, “Satisfaction with financial situation”, “Feeling about current financial condition”, “Worry about living expenses”, “Confidence regarding financial emergency”, and “Stress about finances in general”.

The Community well-being, dimension analysis revealed that four items were statistically significant at $p < 0.05$, and three of these had a lower mean for affected communities than for ancillary ones: “Social acceptance”, “Social assistance”, and “Safety of community”.

The Environmental Well-being dimension analysis revealed that, two items were statistically significant at $p < 0.05$, with affected communities recording lower means: “Shortage of water” and “Level of satisfaction with the water quality of the Mun River and the Mae Khong River”.

The political well-being (PWB) dimension analysis revealed that, three items for which affected communities had a statistically significantly lower mean than ancillary communities at $p < 0.05$: “Trust in the local government”, “Overall satisfaction with the local government”, and “Central government respects the local people’s voices”.

The health well-b(HWB) dimension analysis revealed that all five of the items were statistically significant at $p < 0.05$, and affected communities had lower means for all of them: “Number of hospital visits”, “Stress level”, “Feeling full of energy”, “Sleeping difficulty”, and “Health satisfaction”.

The Job well-being (JWB) dimension analysis revealed that two items had a statistically significantly lower mean in affected communities at $p < 0.05$: “Number of working hours per week” and “Job fits their skills, knowledge, and experience”.

The Family well-being (FWB) dimension revealed two items that were statistically significant at $p < 0.05$, and affected communities had lower means for both: “Individuals turn to each other for help when something is troubling them” and “Emotional support can be gained from family members when it is needed”.

The above results show consistency across the wellbeing dimensions. For every dimension the ancillary communities recorded higher scores although not all the items in each dimension contributed to their overall better wellbeing. Still enough of them revealed that across the board the dam has had long lasting and continuing effects on wellbeing for the affected communities. The ancillary communities may be receiving benefits from the dam including increased electrical output but that would be the same outcome for the affected communities. Statistics show that the country of Thailand has grown with Gross national product (GNP) of 141.15 billion dollars in 1994 to 505.19 billion dollars in 2019. (World bank, 2019) in the last 26 years so it would be natural to expect each of the subdistricts to also show output increases over the same time period. The results showing the ancillary communities are better off in terms of tested wellbeing dimensions could be a result of this overall country growth. But if this is the case the negative wellbeing results in the affected communities reveal that these communities have not shared in the overall country growth, at least to the same level as those in unaffected communities, and therefore there must be a reason for this. The most obvious cause is the disruption in the rhythms of life brought into these communities by the construction of the Pak Mun dam.

Discussion

The research question guiding this study was, “How is wellbeing different between the control group (ancillary community) and the study group (affected community) and is this a result of the construction of Pak Mun dam?” has been partially answered. Residents of the control group of ancillary communities, with no significant developmental changes in the last 26 years, apart from what was happening in the country as a whole, indicates they are better off than those in the study group. The study group which included residents of communities affected by the dam construction indicated they were worse off than 26 years ago and this was supported

by the results reported above. It appears that residents of the affected communities perceived themselves as worse off, even after 26 years, as a result of the dam construction for all tested wellbeing dimensions (Table 6).

Table 6: Well-being Score and Items

Economic well-being (EWB)				
Variable	Pooled Sample (N = 470) Mean (SE)	Affected communities (N = 235) Mean (SE)	Ancillary communities (N = 235) Mean (SE)	T-value
Level of financial stress	6.13(0.138)	5.74(0.180)	6.53(0.206)	-2.88***
Satisfaction with financial situation	5.35(0.125)	5.02(0.174)	5.68(0.183)	-2.61***
Feeling about current financial condition	5.53(0.117)	5.15(0.167)	5.92(0.159)	-3.32***
Can't afford to go out	6.99(0.156)	6.99(0.215)	6.99(0.228)	-0.19
Living paycheck to paycheck	3.64(0.125)	3.57(0.169)	3.72(0.183)	-0.609
Worry about living expenses	4.36(0.122)	4.01(0.164)	4.70(0.178)	-2.85***
Confidence regarding financial emergency (finding 1,000 Baht)	5.07(0.161)	4.54(0.219)	5.60(0.232)	-3.30***
Stress about finances in general	5.09(0.118)	4.77(0.164)	5.41(0.168)	-2.73***
Community well-being (ComWB)				
Community listens to your idea, advice, or complaints	3.081(0.048)	2.94(0.068)	3.21(0.068)	-2.89***
Community participation	3.52(0.057)	3.45(0.084)	3.59(0.077)	-1.25
Help from other community members	3.59(0.05)	3.41(0.073)	3.76(0.065)	-3.60***
Community safety among members of community	4.51(0.035)	4.40(0.057)	4.61(0.041)	-2.96***
Community safety when there are visitors	3.45(0.057)	3.63(0.077)	3.26(0.082)	3.247***
Environmental well-being (ENWB)				
Buying water to consume	2.62(0.076)	2.53(0.107)	2.71(0.108)	-1.16
Short of water	4.01(0.049)	3.81(0.075)	4.2(0.059)	-4.05***
Taste of local fish	4.05(0.038)	4.10(0.058)	4.00(0.05)	1.28
The population of the community is about the right amount for the community	3.810(0.036)	3.84(0.050)	3.77(0.051)	0.914
Level of satisfaction with the water quality of the Mun River and the MaKhong River	3.46(0.044)	3.29(0.069)	3.63(0.054)	-3.81***
Level of satisfaction with the fish quality in the Mun River and the Makhong River	3.70(0.043)	3.62(0.065)	3.78(0.056)	-1.81
Political well-being (PWB)				
Trust of the central government	3.31(0.039)	3.33(0.051)	3.30(0.058)	0.460
Trust of the local government	3.4(0.039)	3.31(0.053)	3.48(0.056)	-2.27**
Overall satisfaction with the central government	3.63(0.04)	3.64(0.054)	3.62(0.058)	0.267
Overall satisfaction with the local government	3.31(0.036)	3.24(0.051)	3.38(0.049)	-2.00**
Central government respects the local people's voices	2.56(0.047)	2.35(0.067)	2.77(0.063)	-4.56***
Health well-being (HWB)				
Number of hospital visits last year	2.59(0.065)	2.31(0.083)	2.88(0.096)	-4.49***
Current stress level	3.77(0.047)	3.56(0.064)	3.97(0.066)	-4.46***
Feeling full of energy	2.99(0.047)	2.86(0.063)	3.12(0.068)	-2.82***
Sleeping problems	3.97(0.057)	3.77(0.084)	4.18(0.075)	-3.64***
Satisfaction level of their own health condition	3.72(0.043)	3.60(0.064)	3.83(0.057)	-2.73***
Job well-being (JWB)				
Numbers of working hours per week	2.73(0.068)	2.44(0.092)	3.02(0.096)	-4.3***
Being proud of their job	4.000(0.029)	3.97(0.044)	4.03(0.038)	-1.18
Job fits their skills, knowledge, and experience	3.85(0.034)	3.780(0.053)	3.92(0.044)	-2.00**
Satisfaction level of their job	3.91(0.033)	3.86(0.051)	3.95(0.041)	-1.41

Table Cont'd

Cultural well-being (CWB)				
Their children's understanding of the importance of visiting the temple	3.83(0.046)	3.82(0.065)	3.83(0.064)	-0.187
Feeling close to the community	4.32(0.034)	4.34(0.047)	4.30(0.049)	0.564
They understand the importance of visiting the temple	4.27(0.034)	4.32(0.048)	4.22(0.047)	1.476
Family well-being (FWB)				
Time spent with family has increased in the past 10 years	3.88(0.039)	3.82(0.059)	3.94(0.051)	-1.53**
Individuals turn to each other for help when something is troubling them	3.99(0.032)	3.92(0.049)	4.06(0.04)	-2.28***
Emotional support can be gained from family members when it is needed	4.29(0.034)	4.2(0.052)	4.38(0.043)	-2.68***
Overall score of family relationship	4.32(0.033)	4.29(0.049)	4.36(0.044)	-1.11

Note. A t-test was used to test for differences between the two samples. * $p \leq .10$. ** $p \leq .05$. *** $p \leq .01$

Based on the information obtained from residents of the affected and ancillary communities on eight dimensions of well-being, the results showed that the average well-being for residents of the affected communities was much lower than the average well-being for residents in the ancillary communities. Among 40 items within the eight well-being dimensions, 31 items recorded mean scores that were lower for residents of the affected communities than for those in the ancillary communities. Furthermore, 24 of the 31 items for these eight dimensions were statistically significant, and these results support the expectation that the ancillary communities would be quite different from the affected communities. These quantitative outcomes, based on eight dimensions, show that residents of the affected communities' had their livelihood negatively impacted by construction of the dam; which supports the qualitative results of many earlier studies including Monorom et al (2006), Amornsakchai(2000), and Kiguchi(2016).

Some of the findings revealed in Table 4 show that people in the affected communities revealed subjective feelings of worry and concern regarding their financial condition (EWB). In addition to lost income from fishing—which was their main income source—they now had to buy fish for their own consumption.

Social well-being related dimensions also revealed negative outcomes for the affected communities. Especially concerning was the outcome for Political Well Being (PWB) which shows that both the local government and the central government are not well respected and received by local residents: Local residents had low trust in the local government, were not satisfied with their local government, and had a low level of satisfaction regarding whether the central government had listened to their voices. This could be explained by the fact that the government's solution to the problems caused by building the dam involved a job training program that was not considered suitable and the decision not to open the dam's gates for as long as the residents have requested. During interviews with respondents, many residents complained that most of the government's interventions and policies had not been discussed with the local residents. This result is especially concerning as it shows that residents of affected communities have essentially lost faith in both local and national governments to address their concerns. They feel abandoned by government.

For the Health Well-Being (HWB) dimension, all five items related to personal health had a lower mean for residents of affected communities than for those in the ancillary communities. Gyasi et al. (2018) earlier revealed the negative health impacts caused by the large dam, which have mainly resulted from changes in water quality for drinking, and in food security (i.e. fishing) were of utmost importance. Additionally, malnutrition is a significant issue for the residents of the affected communities, as fish is their main food source. A decreased number of fish able to be caught and lower incomes from fewer fishing being sold have caused a food supply shortage (Scudder, 1999). The results of this study support the findings from these earlier studies and again reveal that the problems of the last 26 years have not been resolved.

For Job well-being (JWB), the result shows that two items had lower means: the number of working hours per week and the number of jobs that match their skills, knowledge, and experience. These items show that the affected communities had fewer jobs available. This is one of the main issues: they lost their fishing jobs but could not work in other occupations for which they lacked expertise and skills. Although the central government tried to introduce new job opportunities with training provisions it was not successful. Some skills, even with retraining, are not substitutable. The findings regarding JWB found in this study support the results of Kiguchi (2016).

Cultural well-being (CWB) is one of the concerns that the local residents had regarding the livelihood that they had lost as a result of the dam. They claimed the loss of identity and tradition, as they could not continue holding their spiritual ceremony and Thai New Year event along the Mun River. However, the results do not indicate a statistically significant difference in the means between the two community groups, affected and ancillary. This is the only dimension where the results are not clear and consistent with those for the other dimensions. Although the mean scores showed that the affected community residents were worse off than the ancillary community residents with respect to CWB this could not be supported by a statistically significant difference finding.

Finally, there are two subjective well-being items of family well-being (FWB) that had negative effects on the local community. This result shows that family well-being has changed because of the dam: young people have had to move to Bangkok or other big cities in order to find jobs to support their families. Since the income from fish products has been decreasing, member of the affected communities cannot even catch enough fish for personal consumption. Young people are most affected by this as they have to move to find employment. Spending time together and caring for family members, an important relational aspect of Thai society, has been altered. The relationship to family, instead of increasing, has been fading away (Kiguchi, 2016)

The result has been supported that social well-being dimensions and EWB have statistically significant toward OWB (Chaiyamart et al, 2021).

Finally overall well-being (OWB), an amalgamation of all the wellbeing dimensions studied shows that members of the ancillary communities is better than that of the affected communities. Once the construction of the dam was completed there were benefits that were provided to many people in the Khong Jiam district (i.e. affected communities). But as was shown these benefits did not enhance the residents' feelings of well-being across numerous dimensions. On the other hand, the ancillary communities did not suffer negative impacts from the dam; indeed, those residents gained benefits from the dam, as it provides them with a steady water supply, low electricity prices, basic infrastructure, and, as the government later claimed, irrigation for farming around the area. The affected communities, however, did not actively participate in receiving these benefits, since farming was not their primary source of income. Instead their livelihoods have worsened. The findings discussed in this paper support that argument. Even though the ancillary communities gained the aforementioned benefits, the affected residents suffered losses regarding their land, jobs, families, health, livelihoods, environmental conditions, incomes, and way of life, which led to decreases in all of the well-being dimensions as well as a lower OWB. The livelihood of the affected communities, if it was to be supported by directed policy, also has to recognize that one community's loss (i.e. affected community) must be balanced against another (i.e. ancillary affected) community's gains. Improving the well-being of residents in the affected communities should not come at the expense of decreasing the well-being of those residents in the ancillary communities.

Limitation; to understand the long term impact, none of longitudinal documents has never been collected in small scale. Only the document with macro level had been collected which is not providing enough information regarding the impact of the community in long term. The survey has focused mostly on subjective well-being which were based on only opinion.

Future study; it is important to understand the important of each dimension to overall well-being and the relationship of each dimension based on the sustainable development concept.

Conclusions

Since the Pak Mun Dam was opened in 1994, this study has shown that there have occurred statistically significant negative changes in many well-being dimensions in the affected communities. At the macro level, there are six well-being dimensions in which affected communities had experienced less favorable impacts compared to ancillary communities: economic, community, political, environmental, health, and family. Considering each item in each well-being dimension, out of 40 items, 24 of them were statistically significant, and 23 of them recorded lower means than in the ancillary communities. There have been many negative impacts on the affected communities, but the dam also provided benefits to many surrounding communities. Any future dam impact mitigation and coping strategies must concern both sides. The question that comes to mind then is: Does a pareto optimal solution exist? or is there another way to allocate resources such that life for both groups can be enhanced? That is the current dilemma facing residents and government entities in the Khong Jiam district of Thailand.

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