EIA as a Conflict Mitigation Tool for Wind Farm Projects in Japan

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Abstract

Wind energy should be one of the important options of Japanese renewable energy policy as in other countries. This study aims to demonstrate both effectiveness and ineffectiveness of EIA in terms of a conflict mitigation of wind farm projects in Japan. The result of eight cases shows that the projects with high level of public participation at EIA stage are more likely to be successful, however beyond a certain project difficulty determined by the site characteristics, this is not necessarily the case. And the result also demonstrates two concrete challenges should be addressed in Japan: (1) enhancement of poor public participation and (2) strategic exclusion of sensitive site characteristics by introducing the strategic measure. To be more specific, the following two were identified as the sensitive characteristics: "land-use regulation by Natural Parks Act" and "the disclosed grid habitat for Golden Eagle."

1. Introduction

In Japan, the momentum to shift to renewable energy was enhanced by the Fukushima Dai-ichi Nuclear Accident on March 11, 2011. As in other countries, wind energy should be one of the important renewable energy options in Japan, because of its cost-effectiveness and high potential[1)]. However, environmental conflicts arose from concerns of locals and environmental groups pose a significant barrier to wind farm development[2)]. In response, there has been increasing discussion about measures to address the concerns and ease the conflicts.

EIA could be a tool for conflict mitigation by providing the public with project information and exchanging opinions with the stakeholders to address the concerns. However, in Japan, EIA was not legally required for wind farm projects under the EIA Act until the recent amendment on 2011. Therefore, most of the EIAs have followed the guideline by NEDO[3)] (the organization which promotes renewable energy) and only several cases had followed the ordinance of local governments.

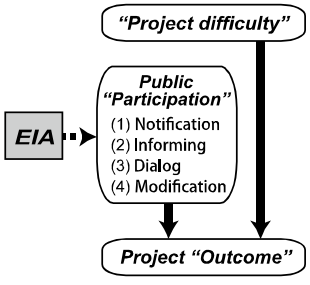

Fig. 1: Hypothesis diagram

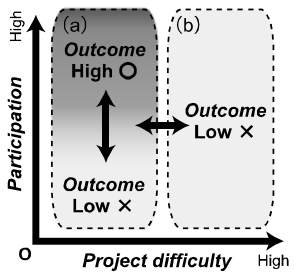

Fig. 2: Hypothesis model

Toward the enforcement of the amended EIA Act, and anticipation of an introduction of strategic measures[4)] (i.e. SEA and land use zoning for wind farm), now it is necessary to demonstrate how and to what extent EIA could help conflict mitigation under the Japanese context. Therefore, this study aims to demonstrate both the effectiveness and ineffectiveness of EIA as a conflict mitigation tool and show its conditions.

2. Analysis Framework

2.1. Focused variables and hypothesis model

Fig. 1 shows three focused variables and a hypothesis on a mechanism how they impact project outcome.

The first variable is "*Participation"*. *Participation* is defined as the level of public participation at EIA stage and it consists of four successive elements[5) 6) 7) 8)]; (1) Notification (2) Informing (3) Dialog (4) Modification (the each definition is shown in Table 1).

Secondly, we defined "degree of project difficulty" (hereinafter referred to as "*Project difficulty*") as a variable which constrain the effectiveness of EIA. *Project difficulty* is defined by a level of the site specific difficulty determined by the site characteristics.

Thirdly, "*Outcome*" is defined as the level of project success determined by whether conflicts arose or not and whether the conflict mitigation was successful or not.

Using these variables, we show following conditional equation as a general effectiveness of public participation.

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Table 1: Definition of the four elements of ***participation***

(1) Notification	to notify the stakeholders of information about project outline and planning procedures
(2) Informing	to provide the stakeholders with information about project detail and EIS
(3) Dialog	to provide the stakeholders with opportunities to exchange opinions
(4) Modification	to confirm the concerns of the stakeholders and reflect in the plan modification

Table 2: Case studies

Prefecture	EIA started at	Project name	Total Capacity (MW)	Number of turbine	Condition
Hyogo	DEC/2004	Hyogo	30	12	Aborted
	FEB/2005	Minami-awaji	37.5	15	Operating
	FEB/2006	Awaji-hokubu	24	12	Under construction
Nagano	DEC/2006	Minenohara	26.72	16	Aborted
Gifu	APR/2005	Kamiyahagi	9.6	16	Operating
	APR/2005	Nigorigo	20	10	Aborted
Mie	NOV/2005	Kasatori	40	20	Operating
	NOV/2008	Aoyama	92	46	Planning Consent

*Total capacity and number of turbine are described as the number written in the scoping document.

Table 3: Definition of the parameters for calculation of ***Project difficulty***

Lv.	(1) Natural Parks Act (Ordinance)	(2) Nature Conservation Act (Ordinance)	(3) Wildlife Protection and Hunting Act	(4) Forest Act (Protection Forest)	(5) The disclosed 10km grid habitat for Golden Eagle & Mountain Hawk	(6) Area of land change	(7) Proximity to turbine
2	Special zone	Special zone	Special protection Area	National protection forest OR over 6 turbines applicable	Applicable to grid habitat for Golden Eagle	Above 20ha	Under 500m
1.5	adjacent to the above zone	adjacent to the above zone	adjacent to the above area	adjacent to National protection forest			
1	Ordinal zone	Ordinal zone	Wildlife Protection Area	1-5 turbines applicable	Applicable to grid habitat for Mountain Hawk Eagle	Above 10ha AND Under 20ha	Above 500m AND Under 1000m
0.5	adjacent to the above zone	adjacent to the above zone	adjacent to the above area	adjacent to protection forest			
0	not applicable	not applicable	not applicable	not applicable	not applicable	Under 10ha	Above 1000m

Table 4: Score of ***Project difficulty***

Parameter	Hyogo	Minami-awaji	Awaji-hokubu	Minenohara	Kamiyahagi	Nigorigo	Kasatori	Aoyama
(1) Natural Parks	0	0	0	1.5	0	2	0	2
(2) Nature Conservation	0	0	0	0	0	0	0	0
(3) Wildlife Protection	0	0	1	1.5	1	1.5	0	0
(4) Protection Forest	1	0	0	0.5	1	2	1	2
(5) 10km gird habitat	2	0	1	2	1	2	1	1
Golden Eagle	○ Applicable	× Not	× Not	○ Applicable	× Not	○ Applicable	× Not	× Not
Mountain Hawk Eagle	○	×	○	○	○	○	○	○
(6) Area of land change	1 (12.5 ha)	0 (9.7 ha)	0 (4.55 ha)	0 (4~6 ha)	0 (4.06 ha)	0 (9.33)	2 (42 ha)	2 (64.8 ha)
(7) Proximity to turbine	2 (470 m)	2 (230 m)	2 (240 m)	0 (1130 m)	0 (1410 m)	1 (960 m)	0 (1020 m)	2 (500m)
Project difficulty	**6**	**2**	**4**	**5.5**	**3**	**7.5**	**4**	**9**

$$\begin{cases} \textit{Participation} \text{ (High)} \rightarrow \textit{Outcome} \text{ (High)} \\ \textit{Participation} \text{ (Low)} \rightarrow \textit{Outcome} \text{ (Low)} \end{cases}$$

On the other hand, we assume ineffectiveness of EIA caused by project difficulty is occurred discontinuously.

$$\begin{cases} \text{IF } \textit{project difficulty} > \text{a certain level} \\ \textit{Participation} \text{ (Any)} \rightarrow \textit{Outcome} \text{ (Low)} \end{cases}$$

Beyond a certain level of project difficulty, *outcome* becomes low regardless of the level of *Participation*. This relationship is expressed in Fig. 2 as area (b). And remaining area (a) whose *Project difficulty* is lower than area (b) is subject to the level of *Participation*.

2.2. Method of demonstration by the hypothesis model

The effectiveness and ineffectiveness could be demonstrated by confirming whether a result of distribution of multi case studies could be explained by the model (Fig. 2). For this, firstly we calculated *Project difficulty*, *Participation* and *Outcome* for each case study. Secondly, we plotted all the cases to the same plane as in Fig. 2 and verify the hypothesis by comparing between the plot distribution and the hypothesis model. In addition, we shall discuss the specific barriers which constrain the effectiveness of EIA by comparing the cases in area (a) and area (b) in Fig. 2.

2.3. Case studies and data collection

For this study, 8 wind farm projects in Japan were analyzed (Table 2). These are all the cases whereby EIA ordinances of local governments had been applied, excluding 3 cases in Fukushima prefecture because of

radioactive contamination cause by the nuclear accident. For data collection, semi-structured interviews were conducted with a variety of stakeholders, including: local government officers, developers, environmental groups and local residents, involved in each case study. In addition, the planning documents, particularly EIA documents were used to the analysis.

Table 5: Definition of the parameters for calculation of ***Participation***

	Parameter	Lv.2	Lv.1	Lv.0
(1) Notification	Timing	Widely publicized before scoping procedure	Publicized in a limited way before scoping procedure	Publicized at scoping procedure
	Area	Wide range of stakeholders were included	Most of stakeholders were included, but some are not included	Only limited stakeholders were included
(2) Informing	Accessibility	Available on the internet	Not available on the internet, but accessible in many place (prefecture, city and local level).	Not available on the internet, and accessibility was very limited.
	Learning	Extensive measures for stakeholder's learning were taken including multiple wind farm visit	Reasonable measures were taken (between Lv.2 and Lv.0)	Poor measures were taken and there were complaints from stakeholders
	Adequacy	**[Noise]** Assessment using maximum noise level of the turbine **[Raptors]** Survey longer than one and half year including two breeding seasons **[Landscape/Visual]** Assessment using seasonal short/middle/long distance views	Additional surveys were taken to meet the Lv.2 definition by administrative advices	Not meet the Lv.2 definition
(3) Dialog	Consult opportunity	Extensive opportunities were provided	Reasonable opportunities were provided	Opportunities were very limited
	Sufficiency of reply	Multiple OR meaningful reply were observed	Single OR formal reply were observed	Comments were observed only on scoping document & draft EIS
(4) Modification	Plan Modification	Number/layout/capacity of turbine was modified OR no issues of concern	Operation control/route of access track was modified	No specific modification
	Stakeholder's satisfaction	Stakeholders were almost satisfied the modification OR no issues of concern	Stakeholders were partially satisfied the modification	Stakeholders were unsatisfied OR they did not recognized the modification at the time

*"Adequacy" focuses on three measure issues, noise, Raptores and landscape/visual. Evaluation points were selected by the issues of each case study.

Table 6: Score of ***Participation***

		Hyogo	Minami-awaji	Awaji-hokubu	Minenohara	Kamiyahagi	Nigorigo	Kasatori	Aoyama
Main issues of concern		Golden Eagle/ Mountain Hawk (Bird-strike.etc)	[In operation] Noise, Infrasound, Shadow flicker	Noise, Infrasound, Hawk migration	Hydrology, Mudslide, Golden Eagle, Landscape/Visual	No issues of concerns	Hawk migration, Raptores, Landscape/Visual, Animal	Mountain Hawk [In operation] Noise, Hydrology	Mountain Hawk, Landscape/Visual, Noise, Wildlife nuisance
Representative Stakeholders (Opposition)		local &national env groups	local residents, leisure home owners	local residents	local resident, local env groups, tourism group	(local residents)	national env groups	local residents, local env groups	local residents, local env groups
(1)	Timing	0	0	1	2	2	0	1	2
	Area	0	0	1	2	2	1	1	1
(2)	Accessibility	0	0	0	2	1	1	2	2
	Learning	1	0	0	2	2	0	1	1
	Adequacy	1	0	1	1	0	0	1	1
(3)	Consult	2	0	2	2	2	0	1	1
	Reply	0	0	0	2	2	1	1	1
(4)	Modification	2	1	2	0	2	0	2	2
	Satisfaction	0	0	2	0	2	0	1	0
Participation		**6**	**1**	**9**	**13**	**15**	**3**	**11**	**11**

3. Calculation of *Project difficulty*

Table 3 shows definition of 7 parameters and 3-level evaluation criteria for each parameter. These were developed basically from literature reviews[9)10)] and interviews. The parameters can be divided into two categories: regulation of land use (1)-(4) and non regulatory factors (5)-(7).

The calculation result of *Project difficulty* is shown in Table 4. In this study, the score of *Project difficulty* was calculated by the sum total of all 7 parameters.

4. Calculation of *Participation*

Table 5 shows definition of 9 parameters and 3-level evaluation criteria for each parameters developed according to literature reviews[6)7)9)12)13)] and interviews. Each parameter is corresponding to either the four successive elements of participation (see Table 1).

Table 7: Definition of 4-level evaluation for ***Outcome***

			Conflict after construction		
			None or NA	Arisen (Continued)	
				Small-scale	Large-scale
Conflict before construction	None		Lv.3	Lv.2	Lv.0
	Arisen	Resolved	Lv.2	Lv.1	Lv.0
		Continued	Lv.1	Lv.1	Lv.0
		Aborted	Lv.0		

The score of ***Participation*** (the sum total of all 9 parameters) is shown in Table 6. In addition, Table 6 shows the main issues of concerns and stakeholders.

5. Calculation of *Outcome*

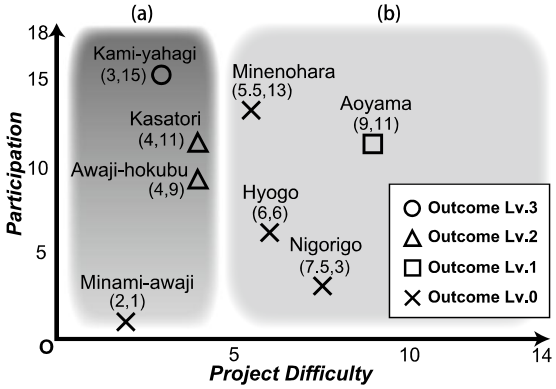

Fig.3: Demonstration by the multi case studies

Table 7 shows the definition of the 4-level evaluation for *Outcome* calculation. *Outcome* was evaluated mainly by two aspects: before construction and after construction, to consider the difference between the conflicts arisen by the concerns before construction and the conflicts resulting from actual impact after construction.

Table 8: Score of ***Outcome***

	Hyogo	Minami-awaji	Awaji-hokubu	Mine-nohara	Kami-yahagi	Nigo-rigo	Kasatori	Aoyama
before construct	aborted	none	arose (resolv.)	aborted	none	aborted	none	arose (cont.)
after construct		arose (large)	NA		None		arose (small)	NA
Outcome	0	0	2	0	3	0	2	1

The score of *Outcome* is shown in Table 8. Only 1 out of 8 cases was evaluated as Lv.3, on the other hand, half of the cases were evaluated as Lv.0.

6. Demonstration by the multi case studies

The results of all 8 cases plotted as shown in Fig. 3.

Firstly, we focus on an area which *Project difficulty* is 5.5 and more. There are 4 cases in the area: Minenohara [5.5], Hyogo [6], Nigorigo [7.5] and Aoyama [9]. As shown in the following expression, all *Outcome* were low (Lv.0-1), regardless of *Participation* (e.g. *Participation* of Minenohara and Aoyama are equal or higher than Kasatori, both the *Outcome* are lower than Kasatori).

$$\begin{cases} \textit{Project difficulty} > 5.5 \\ \textit{Participation}\ (3, 6, 11, 13) \rightarrow \textit{Outcome}\ (\text{Lv.0 or 1}) \end{cases}$$

Secondly, we focus on remaining area whose *Project difficulty* is 4 or less. There are also 4 cases: Kamiyahagi [3], Kasatori [4], Awaji-hokubu [4] and Minami-awaji [2]. In the cases, the relationships between *Participation* and *Outcome* were summarized as the following expressions.

$$\begin{cases} \textit{Participation}\ (15) \rightarrow \textit{Outcome}\ (\text{Lv.3}) \\ \textit{Participation}\ (9, 11) \rightarrow \textit{Outcome}\ (\text{Lv.2}) \\ \textit{Participation}\ (1) \rightarrow \textit{Outcome}\ (\text{Lv.0}) \end{cases}$$

These expressions show that higher level of *Participation* is related with a higher level of *Outcome*.

From the above, 4 cases whose *Project difficulty* are 5.5 or more are corresponding to the area (b) in Fig.2 (i.e. ineffectiveness of EIA caused by project difficulty). And the remaining 4 cases whose *Project difficulty* are 4 or less corresponding to the area (a) in Fig.2 (i.e. effectiveness of public participation). Therefore, the all plot distribution could be explained by the hypothesis model (Fig. 2).

Table 9: No. of cases with particular issues in area (b) / (a)

Representative issues of concerns	# of cases in area (b)	# of cases in area (a)
Landscape/Visual	3 /4cases	0 /4cases
Hawk migration	1	1
Hydrology	2	1
Golden Eagle	2	0
Mountain Hawk Eagle	2	1
Noise/Infrasound	1	3

Table 10: Assumptions of the linkage for analysis

Site characteristics (see Table 3)	→	Emerged issues
Natural Parks Act (Ordinance)	→	Landscape/Visual
Wildlife Protection and Hunting Act	→	Hawk Migration
Forest Act (Protection Forest)	→	Hydrology
10km grid habitat for Golden Eagle	→	Golden Eagle
10km grid habitat for Mountain Hawk	→	Mountain Hawk
Area of land change	→	Hydrology
Proximity to turbine	→	Noise/Infrasound

This result shows that the projects with a high level of *Participation* at the EIA stage are more likely to be successful in terms of conflict mitigation, beyond a certain *Project difficulty* (i.e. around 5), this is not necessarily the case. And more important, the result demonstrates there are two concrete challenges should be addressed in Japan. First one is enhancement of poor public participation (in cases of Minami-awaji). Second is strategic exclusion of sensitive site characteristics (in cases of Minenohara, Aoyama, Hyogo and Nigorigo) by introducing the strategic measure.

7. Discussion: which factor makes EIA ineffective as a conflict mitigation tool?

7.1. The critical issues

We used a following subtraction to identify critical issues difficult to be solved at EIA stage among the multiple issues of concerns of ease case (see Table 6).

[Issues in area (b) cases] – [Issues in area (a) cases]

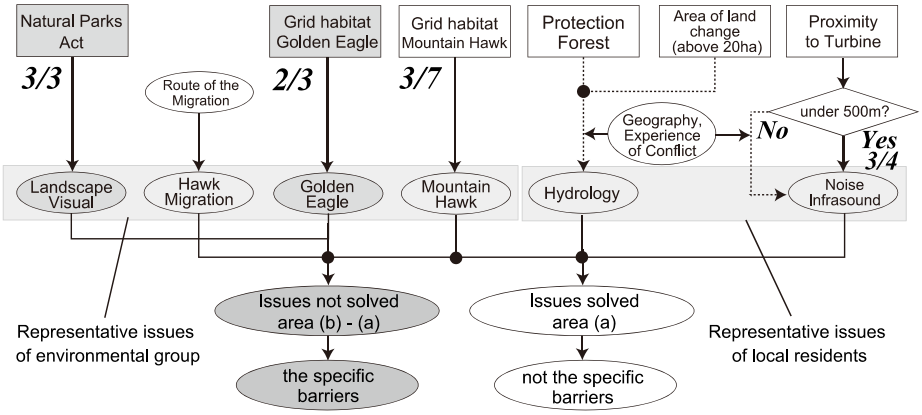

Fig.4: Clarification of the specific barriers

We assumed each 4 case in area (b) (Fig. 3) includes at least one critical issue. Therefore the cases include both "issues solved" and "issues not solved". On the other hand, 4 cases in area (a) include only "issues solved." Thus, the subtraction identifies "issues not solved," and this study defines these as the critical issues.

Table 9 shows the number of cases in which particular issues were emerged in both area (b) and area (a) with reference to "Main issues of concern" shown in Table 6. And the subtraction indicates Landscape/Visual and Golden Eagle are critical issues, and others are not critical.

Table 11: Example of the linkage analysis

Landscape/ Visual	emerged		1 case	2 cases
	none	5 cases		
		Lv.0 - 0.5	Lv.1 - 1.5	Lv.2
		Natural Parks Act (Ordinance)		

7.2. Linkage site characteristics and emerged issues

Next we analyze causal linkages between the site characteristics and the emerged issues. For this, we made 7 assumptions of the linkages shown in Table 10.

Table 11 shows a result of the linkage analysis in a case of "Natural Parks Act → Landscape/Visual." The matrix shows the number of cases that falls into each box, thus "Landscape/Visual" has emerged in 3 of 3 cases which were classified under land-use regulation as Natural Parks Act (i.e. Lv.1 - 2). On the other hand, the issue has not emerged in 5 of 5 cases which were not classified under this regulation (i.e. Lv.0 - 0.5).

Same analyses for each assumption were conducted and the result is summarized in Fig. 4. It indicates there are 4 relatively strong causal linkages between the site characteristics and the emerged issues, (1) Natural Parks Act (Ordinance) → landscape/visual (the issue has emerged in 3 of 3 cases applicable), (2) 10km grid habitat for Golden Eagle → Golden Eagle (2 of 3 cases), (3) 10km grid habitat for Mountain Hawk → Mountain Hawk (3 of 7 cases), (4) proximity to turbine (under 500m) → noise/infrasound (3 of 4 cases).

7.3. The specific barriers

At section 7.1, we discuss the critical issues which are difficult to be solved at the EIA stage, therefore it could be the direct cause of the unsuccessful. The result indicates Landscape/Visual and Golden Eagle are critical issues, and others are not critical (see lower half part of Fig. 4). And next section 7.2, we indicate the 4 relatively strong causal linkages between the site characteristics and the emerged issues (see upper half part of Fig. 4).

Therefore, the integration of the above two indicates following two specific barriers which make the EIA ineffective as a conflict mitigation tool: "designated areas regulated by Natural Parks Act" and "the disclosed 10km grid habitat for Golden Eagle." These two should be excluded at an earlier stage than the EIA (i.e. strategic stage). On the other hand, other site characteristics were found as not critical barriers in this research, namely 10km grid habitat for mountain hawk eagle, protection forest, area of land use change and proximity to turbine.

8. Conclusion

This study aims to demonstrate both the effectiveness and ineffectiveness of EIA as a conflict mitigation tool.

By summing up the result of 8 case studies, it is shown that the projects with high level of public participation at EIA stage are more likely to be successful, however beyond a certain project difficulty, this is not necessarily the case. And the result also demonstrates two concrete challenges should be addressed in Japan: enhancement of poor public participation and strategic exclusion of sensitive site characteristics by introducing the strategic

measure. To be more specific, the following two were identified as the sensitive characteristics: “land-use regulation by Natural Parks Act” and “the disclosed grid habitat for Golden Eagle.”

9. Limitation of the analysis methodology

This study showed the macro and quantitative analysis method to demonstrate empirically the effectiveness and challenges of EIA in Japan. However, the method didn’t consider the weight and cumulative effects of each parameter in the numeric scheme. These are the challenges for future research.

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