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Environmental Impact Assessments for Major Construction Projects in Taiwan: Problems and Solutions

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ENVIRONMENTAL IMPACT ASSESSMENTS FOR MAJOR CONSTRUCTION PROJECTS IN TAIWAN: PROBLEMS AND SOLUTIONS

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Abstract: Taiwan's environmental impact assessment (EIA) process offers little opportunity for genuine public participation, lacks systematic decision-making procedures, and inadequately evaluates and communicates perceptions of risk. This article examines EIA models emphasizing public participation, as well as contemporary theories of conflict management and risk communication, in terms of their potential application towards a restructuring of Taiwan's EIA process.

SUMMARY

Taiwan has been conducting environmental impact assessments (EIAs)[1] in conjunction with its major development projects for more than seven years, yet the credibility of these assessments among the scientific and lay communities remains virtually non-existent. As a result of this general mistrust in official assessments of potential environmental impact, a number of major construction projects have been delayed or blocked, some spurring violent public protests.

These widespread misgivings can be traced to several significant shortcomings in Taiwan's EIA process. Currently the assessment process offers little opportunity for genuine public participation, lacks systematic decision-making procedures, and inadequately evaluates and communicates perceptions of risk. To rebuild public confidence in government protection of the environment, Taiwan will have to restructure its EIA procedures to address these problems.

This article offers some suggestions to assist in this badly-needed restructuring. Potential solutions to Taiwan's problems can be found in current theories of conflict management and risk communication, and in EIA models emphasizing public participation. The systematic incorporation of both technical and popular inputs in these models is particularly instructive

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1 Note: this article distinguishes between *EIA* and *EIAs*, the former referring to the generalized process, and the latter referring to specific applications.

in light of Taiwan's recent commitment to give equal weight to science and democracy in making environmental decisions.

Thus, after introducing the theory and history of EIA, this article explores the inherent difficulties of environmental assessments in balancing the certainties of science with the concerns of the many social groups affected by environmental decisions. A discussion of the manifestations of these difficulties in Taiwan's EIA procedures is followed by a review of conflict management strategies, public participation models, and theories of risk communication. Finally, the article offers concrete suggestions for dealing with Taiwan's future environmental conflicts through adoption of successful EIA methodologies.

I. INTRODUCTION TO ENVIRONMENTAL IMPACT ASSESSMENT

One commentator[2] observes that Environmental Impact Assessment (EIA) originated in 1969 as part of the United States' National Environmental Policy Act (NEPA).[3] Under NEPA both human activities and legislative actions are understood to have potentially large environmental effects. Accordingly, both private parties and the government are required to assess environmental impacts during the formulation and implementation of development projects. The process of assessing potential environmental impacts includes reviewing professional and interdisciplinary research, and predicting the results of alternative development plans. Environmental considerations include all aspects of the natural environment, including air, water, soil, and wildlife, as well as all aspects of the socio-economic environment, such as scenery, tourism, society, history, and culture. Environmental Impact Statements (EIS) are the formal written result of these assessments.[4] They give policy makers the ability to make comparatively more rational and logical decisions, thereby helping to avoid major unintended collateral destruction of the environment.

The theory behind Environmental Impact Assessment encompasses two distinct conceptions of the value and function of formal assessments. One portrays the EIA process as a systematization of a "thinking before acting" and "prevention rather than cure" approach. This viewpoint

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2 J.H. BALDWIN, ENVIRONMENTAL PLANNING AND MANAGEMENT 243, 243-45 (1985).

3 42 U.S.C. § 4321 et seq.

4 Under the United States' National Environmental Protection Act (NEPA) regulations, all plans with relation to the federal government, prior to their implementation, must first be analyzed thoroughly, regarding potential impacts on the environment, and EIS forms completed. *See generally* Council on Environmental Quality, 40 C.F.R. § 1501-08 (1992).

emphasizes the role of EIA procedures in ensuring that environmental information is available to public officials and citizens before actions are taken. The other perspective presents EIA as depicting the optimal point in the trade-off between environmental protection and economic development. In this role, EIA takes into consideration the costs and benefits both of maintaining environmental ecosystems and of building development projects, and of their effect on the quality of the environment. By weighing each side of a proposal the best choices can be made.

Taiwan confirmed its commitment to these ideals in 1985 when the Executive Yuan approved the "Project to Strengthen and Promote Environmental Impact Assessments"[5] as part of recent efforts to achieve democratization and economic progress. Yet seven years after the adoption of this program, Taiwan has still not fully realized these goals in its implementation of EIAs. The resulting public discontent and obstruction of major construction projects have focused world attention on Taiwan's environmental conflicts. Such problems will continue to arise in the future unless new approaches are taken.

II. CHARACTERISTICS OF EIA

This section explores the conflicting demands on EIA inherent in Taiwan's recently announced public policy, which stipulates an equal weighting on values of democracy and science.[6] In order to reach satisfactory environmental decisions, EIAs must integrate both objective information and subjective values from a variety of sources. One researcher, using a NEPA EIA model, has identified six characteristics of EIA which create just this kind of tension between multiple scientific and value inputs.[7] A discussion of these characteristics provides a comparative context for the analysis of current Taiwanese problems with EIA which is presented in the next section.

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5 *Jia-chyang Tuei-dong Hwang-jing Ying-sheang Pyng-gu Fang-ann* [The Project of Strengthening and Promoting Environmental Impact Assessments] was promulgated by Hsing-cheng Yuan [Executive Yuan] (Oct. 17, 1985).

6 Chung-hua-ming-kuo [the ROC] Hsing-Cheng Yuan [Executive Yuan] proposed the EIA draft to the Li-fa Yuan [Legislative Yuan] on August 21, 1990, and the connotation of articles 4, 9, 10 and 13 was: an EIA's procedure must respect both survey of public opinion and scientific evaluation. Note: The Executive Yuan proposes the draft which is then examined by the Legislative Yuan after an announcement of public policy is made.

7 D.M. MCALLISTER, EVALUATION IN ENVIRONMENTAL PLANNING 1-27 (1990).

A. *Multiple Decision Makers*

Environmental policy makers are often confronted by various interest groups when considering decisions with significant environmental consequences. Potential negative environmental impacts may affect, and therefore concern, such varied constituencies as public representatives and government officials, directly affected local residents, society at large, and the factories or companies causing the environmental harms. Environmental policy can easily be made by government officials based on the recommendations they obtain from various experts. However, since individuals' political and economic situations may be significantly altered by these policies, it is essential that affected interest groups be involved in policy formulation along with the policy makers and expert scholars. Announcing or implementing policy without regard for public opinion or public understanding of an issue can result in opposition from affected groups who were not represented or involved in the decision-making process. These considerations provide the basis for the non-traditional environmental management method based on multi-dimensional and holistic analysis advocated by the Swedish environmental scholar, Söderbaum.[8]

B. *Multiple Objectives*

The second major problem associated with EIA is that the primary concerns of each of the groups involved in the decision process are likely to be different. For example, high-ranking officials in the central government are concerned about promotion and development of ecological awareness on a broad range of environmental issues. Their environmental objectives are to educate the people about the need for ecological protection. By contrast, local populations and their political representatives tend to focus on local pollution prevention and treatment. Each of these groups has different concerns, making it difficult for all of the groups to attain simultaneous satisfaction. Inevitably, conflict results. Hence, environmental problems often involve competing interest group objectives and multiple jurisdictional issues.[9]

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[8] P. Söderbaum, *Environmental Management: A Non-Traditional Approach*, 21 J. ECON. ISSUES 139, 144-46 and 162 (1987).

[9] This situation reflects Söderbaum's concept of "many sided analysis." *Id.* at 162. *See also* Ming-shen Wang et al., *Kung-kang-chieh-tseh Chung Ti Chung-tu-kuan-lin Kaohsiung-shih Fu-ting-jing Le-se-ch'ang Fen-fua-lu Ch'ang-chih-hsuan-tse wei-li [A Quasi-experimental Study of Conflict Management in Public Decision-Makings - An Incinerator Siting Example]*, KWAN-LI-KO-HSUEH HSUEH-PAO [J. MGMT.

A hierarchical framework for integrating multiple objectives into the assessment process is seen in Figure 1. This framework simultaneously considers current EIA problem characteristics (multiple decision makers, multiple objectives, multiple values) and the integration of subjective values with objective scientific data. This diagram's legend is as follows:

(A): represents decision alternatives;
(a): stands for attributes required to perform assessments;
(O): indicates case assessment objectives;
(D): represents related decision makers (for example local populations and reviewing authorities for project development plans);
(G): stands for decision problems (such as choosing the optimal industrial location).

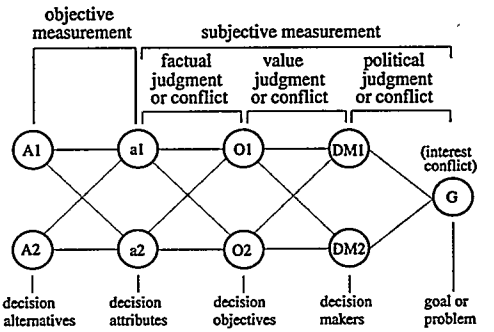

Figure 1. An Analytical Hierarchy for Multiple Criteria Public Decision-Making[10]

SCIENCE], Dec. 1989, at 135-56 (in Chinese). Ming-shen Wang, *Kung-chung-tsan-yu Ti Hwan-jing-ying-sheang Pyng-gu Yu Chi Fong-hsien-chih-chueh Wen-ti [Environmental Impact Assessment - A Public Participation Oriented Approach and the Risk Perception Issue Involved], GONG-CHEN HWAN-JING HUI-KAN* [J. ENGINEERING ENV'T], Dec. 1989, at 57-76 (in Chinese). Ming-shen Wang & Gow-liang Huang, *Kaohsiung-shih Chih-tsao-yeh Lao-chih-wen-ti Chih yen-chiu: She-hui-pan-duann-li-lun Chi Ying-yung [A Survey of Manufacturing Industries Labor Condition for the Kaohsiung City: The Study on Social Judgment Theory], KWAN-LI PYNG-LUN* [MGMT. REV.], 1991, at 1-21 (in Chinese). Ming-shen Wang & Gow-liang Huang, *Basic Research on Environmental Mediation: A Proposal*, 1991 PROC. FOURTH INT'L CONF. COMP. MGMT. 282-86. Ming-shen Wang & Gow-liang Huang, *Hwan-jing Chiu-fen Wen-ti Chih chung-chieh Kuan-li [Environmental Conflict and Mediation Management], TU-TI YU JING-JUNG CHIH-KAN* [Q. LAND & FIN.], 1992, at 71-90 (in Chinese). *See also* D. VON WINTERFELDT & W. EDWARDS, *Patterns of Conflict about Risky Technologies*, 4 RISK ANALYSIS 55, 55-68 (1984) [hereinafter *Patterns*].

10 Ming-shen Wang, *Hwan-jing Chieh-tseh Yu Kuan-li: Wen-ti Yu Fang-fua Lun-wen-chi [Environmental Decision and Management: Proceedings of Problem and Methodology]*, SUN YAT-SEN UNIVERSITY, KAOHSIUNG, TAIWAN, ROC, 317-18 (in Chinese) (1991).

C. *Value Pluralism*

A third difficulty impeding the smooth implementation of EIA is the variety of value perspectives present among affected groups. The thoughts and actions of individuals are affected by their views of their surrounding environment. These views are in turn the result of differences in values and degrees of understanding of existing circumstances.

This multiplicity of values is often evidenced by various interest groups' divergent assessments of the same event. Because each group has a different environmental objective and knowledge level, the significance of any given event is interpreted in different ways. However, democratic philosophy requires that each group has the same opportunity to express its value judgments and opinions. Furthermore, these expressions of values and opinions should not be dependent upon the values of decision makers.[11]

There are several differences among profit-oriented groups which are important in considering the problems of EIAs. First, there are often differences in values among commercial groups, and consequently these groups' views on to how to solve environmental problems may be quite different. From the multiple goals perspective, the way in which these groups are influenced by plan assessments may be quite different. However, the various viewpoints and value judgments should be included in assessments, and each one should receive consideration.

D. *Simultaneous Presence of Subjective and Objective Judgments*

As depicted in Figure 1, both subjective and objective forms of judgment must be utilized in solving environmental problems, and both will be integral to any EIA. Assessment of the relative importance of multiple objectives (for example, economic growth versus environmental protection) can not be solely a subjectively measured value judgment. Instead, assessing how various investment plans will contribute to economic growth and affect levels of environmental pollution is a process which should be informed by objective facts and scientific judgments.[12]

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11 MCALLISTER, *supra* note 7, at 36-37 and 39.

12 These are higher-level assessment factors. They are relevant to what decision makers are directly concerned about and serve as decisions themselves. They include factors such as effects on environmental quality, economic profits, etc. Cognitive conflict involves the discontinuities between factual—and value—oriented assessment. *See generally* Ming-shen Wang & Gow-liang Huang, *Kaohsiung-shih Chih-tsao-yeh Lao-chih-wen-ti Chih Yen-chiu: She-hui-pan-duann-li-lun Chi Ying-yung [A Survey of*

E. Risk and Uncertainty

One group of researchers indicate that there are five sources of uncertainty involved in EIA, which make EIAs contain a certain degree of risk.[13] First, there can be uncertainty about the nature and extent of the development plan's potential affect on the environment. A second source of uncertainty relates to the kinds of environmental management strategies and controls that will be adopted in the future. New technologies that are more effective or cheaper may be developed in the future. Third, uncertainty exists concerning the extent to which controlled emission rates translate into ambient environmental quality. The actual concentration of residuals depends on their residence times in various states of nature and on the timing of the discharges. Fourth, accurate estimates of impacts on receiving sites may be subject to uncertainties regarding any cumulative affects associated with pre-existing pollution. Fifth, there can be uncertainty in the measurement of certain impacts. Thus, when undertaking an EIA one should recognize that its quality will be subject to considerable risk and uncertainty.

F. Feedback Dynamics

The multiple goals associated with environmental concerns often create mutually influencing feedback when development plans are implemented. Thus, over time, actual outcomes may be different than those which were predicted. For example, economic development is likely to cause environmental pollution. Long-term increases in pollution will in turn lead to an increase in pollution control movements, which will in turn influence economic development. Therefore, when assessing goals during EIA implementation, the results of potential feedback as well as long- and short-term impacts should be considered.[14]

This discussion of EIA characteristics makes it clear that distinguishing between the two elements of "analysis" and "synthesis" can

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Manufacturing Industries Labor Conditons for the Kaohsiung City: The Study on Social Judgment Theory], KWAN-LI PYNG-LUN [MNMT. REV.] 1-21 (1991) (in Chinese).

13 E.L. HYMAN ET AL., COMBINING FACTS AND VALUES IN ENVIRONMENTAL IMPACT ASSESSMENT THEORIES AND TECHNIQUES 225, 225-52 (1988).

14 Jen-shou Yang & Shou-yin Yang, *Hwan-jing-kuan-li Ti Hsi-toong-tung-tai Kuan [Environmental Management System Dynamics Perspective]*, 11 *GONG-CHEN HWAN-JING HUI-KAN* [J. ENGINEERING ENVTL.] 77, 87 (1989) (in Chinese).

be helpful in conducting EIAs.[15] (See Figure 2). Analysis uses detailed, heuristic research methods to define and estimate the environmental impact resulting from each investment or development plan. Since these research methods are strict and systematic, their results are both objective and concrete.

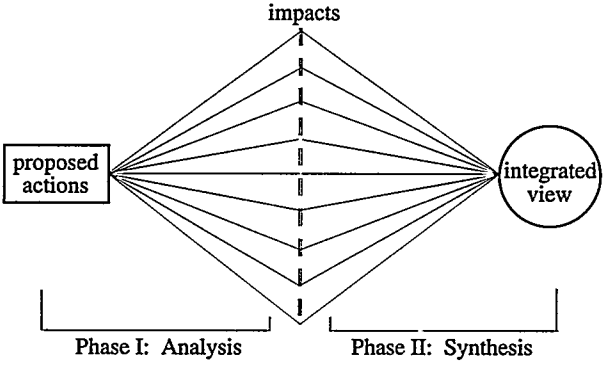

Figure 2. The Two Phases of Evaluation[16]

Synthesis, by contrast, consists of evaluating the different estimates of environmental impact obtained through objective analysis, and consolidating and prioritizing them to form clearly articulated viewpoints and opinions. The relative importance of synthesis depends on its consistency and clarity at the time of assessment; ultimately, it is intrinsically subjective and abstract.

Thus, it is possible to simplify the assessment problem by distinguishing between objective measurements and subjective value determinations. Yet many of Taiwan difficulties with managing current environmental tensions are due to inadequately distinguishing the objective and subjective aspects of the decision process, and arise both from previous scientific and technological shortcomings (in the analysis phase) and from resultant cultural and social conflicts (in the synthesis phase). Further improvement in Taiwan's EIA will depend on both distinguishing between the objectivity of technical analysis and the subjectivity of public-participation, and on the extent to which the two can be integrated in implementation.

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15 *See* MCALLISTER, *supra* note 7, at 6-10.
16 MCALLISTER, *supra* note 7, at 7

III. Implementation of EIA in Taiwan

Increasing dispute over EIA procedures in Taiwan has hampered the development of public trust, as evidenced by numerous public protests over proposed development projects. Several major projects have run into significant economic, planning, and construction obstacles as a result. Examples include the Chinese Petroleum Corporation's plan for a fifth naphtha cracker, Formosa Plastics plan for a sixth naphtha cracker, and Taiwan Power's fourth nuclear power plant and fire powered electrical plant.[17] Suspicion and shock over such incidents have hindered both the improvement of public welfare and the economic growth of Taiwan.

The problems associated with building public trust in the EIA process are analyzed below by discussing Taiwan's experience in terms of standard EIA procedures, and by noting Taiwan's unique difficulties and shortcomings. One important reason why EIA lacks credibility in Taiwan is that in a number of cases EIAs have been implemented only after the determination was made to accept an economic development plan. Furthermore, when performed, these EIAs have focused on only a limited aspect of the potential negative environmental impact of a project. The emphasis of these EIAs has been on improving the efficiency of environmental pollution prevention and testing systems, yet they have not compared the environmental impact of alternative project designs. As a result, the effectiveness of pollution prevention has been significantly reduced.[18] Failing to perform an EIA until after accepting a development project also leads to conflicts over when public participation should occur. Consequently, EIAs in Taiwan are often unable to fully respond to public opinion.

Another reason for public mistrust in Taiwan EIAs is that they generally lack systematic procedures. Because there are no reliable models to use, definitions of assessment attributes and impact predictions are often based upon the subjective decisions of experts, rather than on objective analysis.

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17 According to the GONG-HAY JIOU-FEN CHU-LI BAIR-PYI-SHU [WHITE BOOK OF PUBLIC DISPUTE], which was edited by the Executive Yuan's Environmental Protection Agency, environmental disputes have led to great growth in Taiwan's environmental movement and have increased social costs.

18 Yung-jen Chen, National Science Council, *Taiwan Ti-chi Hwan-jing Ying-sheang Pyng-gu Chih-duh Chih Chien-li [The Establishment of Environmental Impact Assessment System in Taiwan]*, HWAN-BAO KO-CHI TUNG-HSIN [NEWSL. SCI. & TECH. ENVTL. PROTECTION], Vol. 4, No. 4 1992, at 10-14 (in Chinese) [hereinafter *Establishment of EIA*].

This leads to conflicts among experts, as well as undermining public confidence in EIA results.[19]

A related problem is that evaluations of the relative importance of conflicting objectives are often based solely on the subjective judgments of the assessors. This problem may also lead to conflict between the scientific and lay communities.[20]

A fourth source of public lack of confidence is the failure of Taiwanese EIAs to include sufficient information regarding the opinions expressed by interested groups.[21] This point is often raised in related overseas research.[22] In addition, inadequate attention is given to the possibilities of amending and improving aspects of a project to more fully respond to interest group concerns.

A fifth difficulty is that the information contained in environmental impact statements can be extremely complex, while at the same time lacking an integrated analysis presenting clear options and recommendations. Transmitting such information to the lay public can be very difficult.[23]

Finally, Taiwan EIA procedures do not include environmental risk analysis.[24]

To summarize, Taiwan's problems with EIA exist for three basic reasons. First, EIAs do not incorporate genuine public participation. Second, EISs do not satisfactorily respond to the different subjective value judgments of various groups, resulting in intellectual and social conflicts. And third, a complete lack of risk analysis makes it difficult to perform risk communication planning. The result of these combined difficulties is public mistrust and its concomitant obstacles to further development.

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19 Ching-hsiu Chen, *Hwan-jing Ying-sheang Pyng-gu Kai-lun [Introduction of Environmental Impact Assessment]*, 30 GONG-YEH WU-JAN FANG-CHIH [PREVENTION INDUS. POLLUTION] 20 (1988) (in Chinese) [hereinafter *Introduction to EIA*].

20 Jyang Lan-hung, *She-hui Chin-chi Ying-sheang Pyng-gu [Socio-economic Impact Assessment]*, HWAN-JING YING-SHEANG PYNG-GU LUN-WEN-CHI [PROCEEDINGS OF ENVIRONMENTAL IMPACT ASSESSMENT] (unpublished manuscript, on file with Department of Geography, Taiwan University, ROC) (1987) (in Chinese).

21 *Id.*; *see also Establishment of EIA*, *supra* note 16; Lung-chi Chen, *Hwan-jing ying-sheang pyng-gu chih-duh yu hwan-jing bao-huh [Environmental Impact Assessment System and Environmental Protection]*, 10 GONG-CHEN HWAN-JING HUI-KAN [J. ENGINEERING ENVTL.] 131-41 (1988) (in Chinese) [hereinafter *EIA System*].

22 R.E. Kasperson & H. Kunreuther, *Hazardous Waste Facility Siting in the United States: Challenge and Opportunities. SINO-US Bi-national Conference on Environmental Protection and Social Development, Taipei, Taiwan, ROC, August 20-25, 1989*, 1-24 (1989). *See also* MCALLISTER, *supra* note 7, at 39-40.

23 MCALLISTER, *supra* note 7, at 39-40; *Establishment of EIA*, *supra* note 18; *Introduction to EIA*, *supra* note 19.

24 *EIA System*, *supra* note 21.

This analysis makes it clear that the EIA procedures currently in use in Taiwan suffer significant defects. For the future we must face the question of how to design effective, efficient EIA procedures to ensure the smooth planning and implementation of major construction projects in Taiwan. This issue should be the focus of environmental actors in government, academia and development agencies. Three basic strategies to accomplish this goal are explored below: conflict management, adoption of successful models of public participation, and risk analysis and communication.

IV. CONFLICT MANAGEMENT

Conflict management is the first strategy Taiwan can employ in reducing controversy and dismantling obstacles to development. EIA conflict management should include both pre-action and post-action measures.

A. Pre-Action Conflict Prevention Measures

One important way to reduce conflict is to rely more heavily on legislative mechanisms. For example, giving legal status to the plans resulting from EIAs would lessen controversies associated with EIA implementation and assessment procedures. A second conflict-reduction measure would be to develop more comprehensive planning. For example, national land plans for major development in accordance with EIA standards could be formulated. A national land plan could also be used to make efficient choices regarding economic development. Education of the public about EIAs of major domestic construction projects is a third possible measure. Such education should strive to enhance understanding of the rationale and methods of the EIA process. Finally, prompt implementation of public participation during the planning stages of major development schemes could also decrease associated conflict in later stages.

B. Post-Action Rectification Measures

Even after a project has been approved, there are a number of steps which can be taken to successfully reduce conflict. These include developing and implementing administrative regulations which promote

effective use of mediation and arbitration, and which encourage the use of litigation, if and when appropriate.

While adoption of these measures should reduce the quantity and intensity of conflicts in EIA implementation, they will not provide a panacea. According to one researcher who conducted a comparative study of methods used in the U.S. for systematizing social and economic considerations (i.e., legislative, administrative, litigation and other approaches), the solutions detailed above all have clear faults.[25] For example, it is difficult to find innovative alternatives which benefit all interested parties. Since not every interest group has sufficient money or time to carry out lobbying and legal activities, large expenditures, time delays, and limited contacts often combine to create severe conflicts and no-win situations.

Although all conflict management options have some problems, certain measures can lead to greater systemization of conflict management. Many researchers have concluded that the following factors lead to the gradual systemization of methodologies by which to reduce public environmental conflicts:[26]

1. Increasing opportunities for democratic control of governmental power;
2. Gradually integrating both specialized and multi-disciplinary approaches in policy administration;
3 Expanding EIA standards to include societal impacts, as well as economic, scientific and technological feasibility; and
4. Enhancing detailed knowledge of environmental policy issues among social and commercial interest groups via government promotion of public participation. Implementation of public policy is easier when the concepts behind it are widely acknowledged and publicly accepted.

Thus, conflict management strategies, implemented in combination with certain institutional adjustments, have the potential to significantly improve public satisfaction with EIA in Taiwan.

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25 D.J. AMY, THE POLITICS OF ENVIRONMENTAL MEDIATION 41, 41-66 (1987).

26 *See generally* G.L. CREIGHTON, THE PUBLIC INVOLVEMENT MANUAL 1-42 (1981); *see also* D.J. Fiorino, *Citizen Participation and Environmental Risk: A Survey of Institutional Mechanisms*, 15 J. SCI., TECH. & HUMAN VALUES 224, 224-43. *See also* MCALLISTER, *supra* note 7, at 1-40.

V. THE NEED TO INCORPORATE PUBLIC PARTICIPATION IN TAIWAN EIA: A COMPARISON OF TAIWAN ENGINEERING TECHNOLOGY EIAS AND PUBLIC PARTICIPATION EIA MODELS

From our review of current problems with Taiwanese EIA it is clear that public participation is necessary to resolve conflicts in public environmental affairs. The shortcomings of Taiwan EIA for major engineering projects are illustrative.

The EIAs used in major engineering projects have primarily an engineering technology orientation. Public participation in these EIAs is plagued by the problems discussed in Section III. The orientation of engineering technology minimizes subjective analysis, while completely neglecting the use of analytical hierarchies for multiple-criteria public decision making (Figure 3). Furthermore it recognizes only select expert judgments and may not consider the judgments of other experts and people at all. Often this results in a lack of confidence among the general public and other experts toward such EIAs.

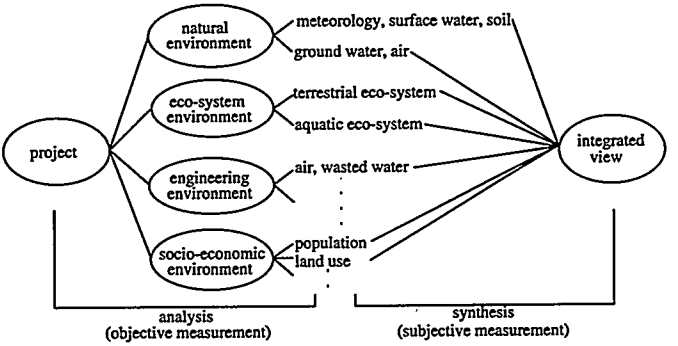

Figure 3. The Framework of Engineering Technology Oriented EIA

In contrast, the subjective component of the EIA process in public participation models is regulated by a hierarchical analysis which determines which interest groups and decision makers are to participate, as well as what matters these parties will be most concerned about and might best understand. Using hierarchical methods, objective and subjective measurements and judgments can be integrated (Figure 1 and Figure 4). Such integration assists in both analysis and synthesis of conflicts associated with EIA procedures. Thus, the public participation approach should be

viewed as being the best means of enhancing the credibility of Taiwan's EIAs, and as a way of promoting the spirit of NEPA and assisting in the effort to develop more effective conflict management.

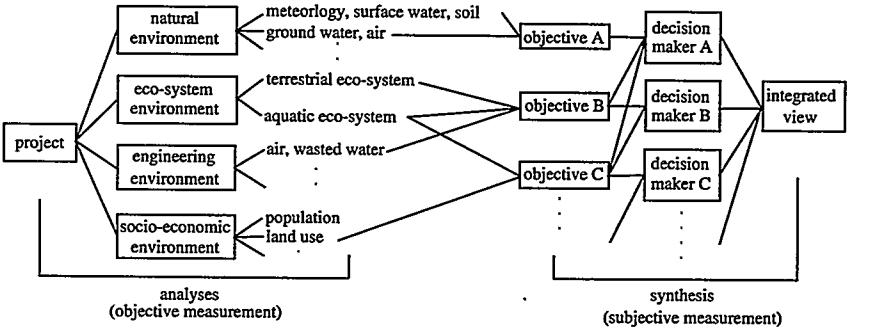

Figure 4. The Framework of Public Participatory Oriented EIA

VI. MODELS OF PUBLIC PARTICIPATION IN THE EIA PROCESS

The conclusion that Taiwan's engineering project assessments could benefit from increased opportunities for public participation leads to our second recommended strategy for strengthening public trust in official impact assessments: adopting successful aspects of foreign models for public participation in EIAs. Two such recently developed models which provide potential solutions to some of Taiwan problems are the Social Judgment Theory (SJT) and Social Judgment Capturing Adaptive Goals Achievement Environmental Assessment (SAGE).

A. Social Judgment Theory

SJT is a fundamental theory regarding assessment, decision-making and measuring methods. SJT is introduced by examining its underlying theoretical component, the lens model of decision-making.

1. The Lens Model

The basis of SJT is the "lens model," which uses the concept of a lens as an analogy for the cognitive, psychological process of interaction and

filtering experiences.[27] A basic concept underlying the lens model is that when decision makers need to make an assessment or judgment involving unknown or uncertain variables, they often review or adopt those variables which are already known or certain (cues).

There are two related systems used in the lens model to make better decisions. The first involves decision makers' cognitive systems. Its decision path involves:

1. Cues—decision makers review known variables, or cues (X_n in Figure 5);
2. Judgments—decision makers then make subjective judgments (Ys in Figure 5); and
3. Cue Utilization—decision makers cognitively connect the X_n and Ys variables (Figure 5's cue utilization).

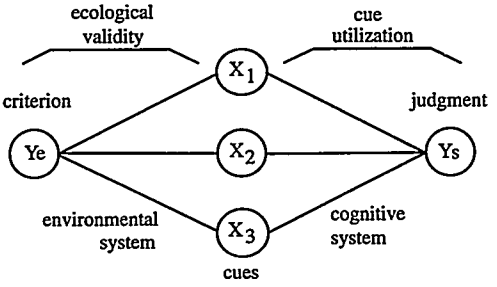

Figure 5[28]

The second system is the objective environmental system. This system involves:

1. Cues—decision makers use the environmental system to review known and certain variables (X_n in Figure 5);
2. Criterion—determining those variables (called criterion, and denoted by Ye in the figure) which decision makers intend to use; and
3. Ecological Validity—connecting the X_n and Ye variables to complete the system (Figure 5's ecological validity).

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27 E. BRUNSWICK, THE CONCEPTUAL FRAMEWORK OF PSYCHOLOGY 16-21 (1952).
28 H. ARKES & K.R. HAMMOND, JUDGMENT AND DECISION MAKING 58 (1986).

In these two systems, known and certain cues can be considered as one interface. Thus, within the context of decision-making, the subjective and objective systems can be united. Due to humankind's cognitive limits, various distortions of reality result when this interface is used to make decisions.

2. *Cognitive Conflict*

The SJT lens model has been used to analyze the cognitive side of conflict.[29] In the lens model framework, cognitive conflict is considered to occur among decision-makers when they do one or more of the following:

1. Perceive the potential for different possible outcomes or criteria;
2. Prefer the use of different cues;
3. Weigh cue variables differently;
4. Employ different functional forms (e.g. linear or non-linear) with regard to cues and judgments;
5. Use different organizing principles to combine cues;
6. Execute their decision policies inconsistently. [30]

Cognitive conflicts are caused by ambiguity and inconsistency in the subjective aspects of human decision-making. Thus, analysis of the cognitive side of conflict can contribute materially to the reduction of conflict.[31]

Social Judgment Theory also utilizes various methods measuring cognitive conflict. These methods generally include two processes: (1) identifying the decision problem, criterion and cues used in the elements which constitute an environmental system (Figure 5); (2) designing a series of hypothetical cases which apply objective measurement or data

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29 K.R. HAMMOND & J. GRASSIA, *The Cognitive Sides of Conflict: Form Theory Resolution of Policy Disputes, in* 6 APPLIED SOC. PSYCHOL. ANN. 233, 239 (S. Oskamp ed., 1985). For a general discussion of kinds of conflict, including cognitive conflict, see generally G.L. Creighton, *A Tutorial: Acting as a Conflict Conciliator*, 2 ENVTL. PROF. 119, 120-21 (1980).

30 *See generally* K.R. Hammond et al., *Social Judgment Theory, in* HUMAN JUDGMENT AND DECISION PROCESS (M.F. Kaplan & S. Schwartz eds., 1975) (regarding the sixth issue enumerated).

31 *See generally* Hammond & Grassia, *supra* note 27, at 252; *see also* T.C. EARLE & G. CVETKOVICH, *Risk Judgment, Risk Communication and Conflict Management, in* HUMAN JUDGMENT: THE SJT VIEW, 361-400 (Berndt Brehmer & C.R.B. Joyce eds., 1988) (taking into account the concepts of rationality in SJT, Earle and Cvetkovich define risk communication as the establishment or revision of social communications of risk judgments (encompassing risk perception judgments and risk management judgments), in hope that so doing will assist in environmental conflict management).

simulations. These processes aid evaluation of the subjective judgments of decision makers, making clear how subjective judgments result in cognitive conflict among the different groups involved in the implementation of EIAs.

B. SAGE

A new process which applies SJT concepts to cognitive conflict dynamics raises new possibilities for resolving Taiwan environmental controversies. This process, known as Social Judgment Capturing Adaptive Goals Achievement Environmental Assessment, or SAGE, is an EIA model which was recently developed in the United States and incorporates public participation.[32] It is composed of fundamental assessment and decision theories, and is used in multiple objective assessment frameworks. The model emphasizes the consideration and integration of objective and subjective information, appropriate public participation, and communication among differing value groups. By systematically incorporating these informational inputs, the model assists in the resolution of EIA conflicts.

SAGE has been described as having four phases:[33]

1. Identifying the scientific attributes of alternative actions, (including physical, chemical and biological impacts);
2. Sorting and weighting attributes according to their beneficial or adverse effects on the objective;
3. Determining the relative weight that relevant parties attach to each objective; and
4. Presenting the findings in a form useful to decision makers.

Phases (1) and (2) involve evaluations of scientific facts and factual judgments. Scientific facts are objective measurements about the existence, magnitude and timing of impacts on environmental systems. With such facts, experts can make any preliminary judgments regarding objective conflicts.

In contrast, phase (3) refers to the evaluation of value judgments using SJT.[34] This phase consists of examining subjective information about

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32 Ming-shen Wang & Jen-shou Yang, *An Experimental Validation for SAGE's Value Assessment Procedure*, 34 J. ENVTL. MNGT. 267, 270 (1992).

33 HYMAN, *supra* note 13.

34 K.R. Hammond, *The Cognitive Conflict Paradigm, in* HUMAN JUDGMENT AND SOCIAL INTERACTION 193-98 (L. Rappoport & D.A. Summers eds., 1973). *See also* L. RAPPOPORT & D.A. SUMMERS, HUMAN JUDGMENT AND SOCIAL INTERACTION 1, 3-9 (1973).

whether an impact is good or bad and how important it is relative to other effects. Judgments on values can be obtained via direct public participation.

Finally, phase (4) emphasizes the presentation and communication of findings in order to assist decision makers. Such findings should not rely exclusively on values rooted solely in any one discipline, whether social, political, economic, psychological, or ecological.

The value of the SAGE model is that it offers a multiple-objective framework for incorporating diverse values while facilitating a clear distinction between, and integration of, objective and subjective judgments. This process facilitates greater participation by both experts and the public in resolving EIA conflicts.

VII. RISK PERCEPTION AND COMMUNICATIONS

Although use of the SAGE model may eliminate some of the controversies among different interest groups, other measures may also be necessary to improve public acceptance of major development projects. Since conflicts often result from the different perceptions of risk held by various interest groups, successful communication of risk to relevant interest groups and decision-makers is critical in conflict prevention and resolution programs.

Thus, we now turn to the final strategy for rebuilding public confidence in Taiwan EIA: risk perception and communication. In this analysis, first the relationship between risk perception and cognitive conflict is explored through a review of current thought on the definition and communication of risk perception. This is followed by an overview of methods of improving risk perception and communication in Taiwan EIAs. Following a conclusion, a typology of risk communication tasks and tables depicting four models of risk communication strategies are presented in the Appendix.

A. Defining and Communicating Risk Perception in EIA Disputes

1. Risk Perception

There has been a great deal of research on how differing perceptions of risk affects conflict dynamics. Various scholars have defined risk perception. One group emphasizes the importance of parties' perceptions of

potential relative gains and losses resulting from the available options.[35] They list six different formal definitions of risk:

1. The probability of a loss;
2. The likely magnitude of a loss;
3. The expected loss; i.e. the product of the probability and the magnitude of a possible loss;
4. The variance of the probability distribution over the values (or utilities) of all possible relevant outcomes;
5. A semi-variance; e.g. the variance of the distribution of all negatively valued outcomes about the average expected loss (their common mean); and
6. A linear function of the expected value and the variance of the total distribution of all possible outcomes.

Other scholars argue that defining risk perception is not so easily accomplished. One group, after performing a strict empirical study, submitted two perspectives with regard to risk-defined complexities:

1. There exists no specific definition of risk which is appropriate with regard to all problems. This is true in terms of both the scientific community and the general public; and
2. The choice of risk definitions by individuals is very politicized. This choice is also an expression of the level of effects associated with such risk.[36]

After analyzing the above multidimensional definitions of risk, that paper concluded that risk may be more appropriately characterized as "latent risk." Thus, environmental risk cognition may be defined as "perceived latent damage of the environment (encompassing nature, ecology, engineering, society and economics)."

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35 C. Vlek, H. Kuyper & H. Boer, *Large-scale Risk as a Problem of Technological, Psychological and Political Judgment, in* ENVIRONMENTAL IMPACT ASSESSMENT, TECHNOLOGY ASSESSMENT, AND RISK ANALYSIS 157-210 (V.T. Covello et al. eds., 1985).

36 *See* B. Fischhoff et al., *Defining Risk*, 17 POL'Y SCI. 123, 123-31 (1984).

2. *Risk Communication*

Not only is it important to define risk, it is also essential to communicate understandings of risk. Because each person's perspective is unique, misunderstandings can easily develop when perceptions are inadequately communicated. For example, most specialists spend their lives dealing with the world of theory, information and models, and therefore view events from a technical perspective. As a result, they are often comparatively unskilled at adopting organizational and/or individualistic perspectives. Not surprisingly, these specialists often experience communication problems with those in other disciplines, and with the lay public. Thus, strengthening risk communication is critical to risk and conflict management.

Several scholars have discussed the dynamics of risk perception and conflict, pointing out issues relevant to risk communication. One argues that it is difficult to avoid divergence in intuitive perceptions of risk among experts as well as the general public, because risk perception is inherently subjective.[37] Two other groups have likewise identified six areas where disagreements may arise in scientific and technological risk assessment, and participants' subjective perceptions.[38] These are disagreements about:

1. Data and statistics;
2. Risk estimates and probabilities;
3. Assumptions and definitions;
4. Risk/cost/benefit tradeoffs;
5. The distribution of risks, costs, and benefits; and
6. Basic values and ideologies.

Similarly, another analyst has identified five discrepancies in the treatment of technological risk by technical experts and the lay public (as shown in Table 1).[39] These constitute important areas for enhanced risk communications, and include:

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[37] P. Slovic, *Perception of Risk/Behavior Perspective*, 140 AM. J. ROENTGENOLOGY 601, 601-02 (1983); *see also* P. Slovic, *Perception of Risk*, 236 SCIENCE 280, 280-87 (1987); P. Slovic et. al., *Why Study Risk Perception?*, 2 RISK ANALYSIS 82-93; *see generally* P. SLOVIC & S. LICHTENSTEIN, *Comparison of Bayesian and Regression Approaches to the Study of Information Processing in the Judgment, in* HUMAN JUDGMENT AND SOCIAL INTERACTION 16-108 (Rappoport & Summers eds., 1973).

[38] *See generally* H.J. Otway & D. von Winterfeldt, *Beyond Acceptable Risk: On the Social Acceptability of Technologies*, 14 POL'Y SCI. 247 (1982); *see generally Patterns, supra* note 9.

[39] M.B. Spangler, *Policy Issues Related to Worst Case Risk Analysis and the Establishment of Acceptable Standards of De Minis Risk, in* UNCERTAINTY IN RISK ASSESSMENT, RISK MANAGEMENT, AND DECISION MAKING 7-9 (V.T. Collevo et al. eds., 1987).

1. Decision criteria for acceptance/rejection;
2. Risk assessment methods;
3. Basis for trusting information;
4. Risk attribute evaluation; and
5. Technological considerations.

B. Improving Risk Perception and Communication in Taiwan's EIA

Taiwan's engineering and technology-oriented EIAs do not include discussions of risk perception, and thus are more likely to cause conflicts than are EIA models in which discrepancies in risk perception are addressed directly through public participation (refer to the schematic illustration in Figure 6). If the decision problem is defined as the public acceptance level of the engineering project in question at the time of hypothesis, then a fairer method of approaching the decision problem would be to:

1. Estimate perceived environmental risks, allowing for possible compensatory feedback;
2. Investigate the type and extent of compensatory feedback and any resultant risk substitutions, and present the methodology used in the investigation; and
3. Prepare formal comparisons of levels of public acceptance of each feasible alternative plan.

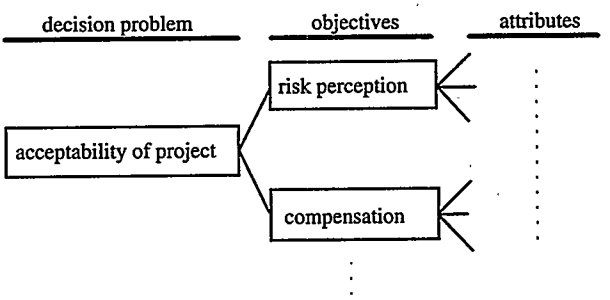

Figure 6. The Framework of EIA of Risk Perception[40]

40 *Id.* at 8.

In addition, those entities initiating engineering developments should both focus on problems associated with risk perception and discuss and review the analysis of risk in the EIA framework. The purpose of these activities is to develop a systematic and efficient plan which encompasses successful risk communication methods. By so doing, the discrepancies in risk analysis among interested policy groups may be reduced and EIA credibility increased.

Specifically, Taiwan authorities should take the following steps:

1. Establish a systematic and rational decision-making model relying on publicly available assessment criteria, and public and explicit discussion of the functional forms and subjective judgments associated with the known variables (cues) involved in each decision. This should assist decision makers in understanding more fully their own policy judgments and requirements, as well as in determining the needs of other affected groups. The result will be the formulation of an appropriate communications strategy.
2. Prepare formal EISs for proposed major construction projects. EISs are important in that they increase discussion of perceived risks among interested parties, and serve as a key tool in risk communication.[41]
3. Allow the leaders of targeted groups to participate in debates on underlying conflicts in order to analyze quasi-rationally the various decision problems which are encountered.
4. Utilize theories of cognitive structures and implement training in creative problem-solving in order to orient the decision-making models of authorities towards articulated reasoning, and to reduce the incidence of non-rational judgments resulting from cognitive conflicts.

The risk communication strategy detailed above is founded on consideration of all participants' value judgments, improvement in participants' ability to use rational analysis to improve risk perception judgments, and the use of a systematic and efficient decision-making model to enhance the consistency and clarity of each participant's risk judgments.

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41 K.R. Hammond & L. Adelman, *Science and Human Judgment*, 194 SCIENCE 389, 389-96. *See generally* Wang, *supra* note 9, at 317-18.

VIII. CONCLUSION: FUTURE PROSPECTS

The three strategies outlined in this article, namely conflict management, public participation-oriented EIA models, and risk communication schemes, should in principle prevent or solve many EIA conflicts. However, a more rigorously scientific approach and further rationalization and democratization of the entire EIA process will be necessary to meet the expectations of Taiwan's people for reliable environmental assessments. This article offers the following suggestions for the systematization of Taiwan's EIAs.

A. Formulate Stronger and More Comprehensive Environmental Impact Assessment Laws

Governmental organizations with authority over EIA should engage in an overall review of each of the existing EIA laws and regulations. In so doing, these agencies should actively promote legislation incorporating systematic public participation in EIA, and research and design various alternative EIA methodologies and implementation schemes. In order to formulate rational, appropriate development projects, regulations should ensure that solutions to major engineering problems rely upon the opinions and knowledge of improved, integrated planning agencies, local residents, higher level officials of government agencies (such as the Ministries of Economic Affairs and Communications) environmental authorities, and other interested parties. With improved and more comprehensive EIA laws and regulations, government organizations should face fewer obstacles in implementing the newly rationalized legal framework.

B. Actively Promote Public Participation in EIA

The lack of credibility of EIA procedures resulting from problems with public participation is the primary reason for the delays and difficulties Taiwan has experienced in solving current EIA conflicts. Thus, prior to legal systematization of public participation procedures, authorities should immediately develop methods in Taiwan for evaluating public opinion, and construct a model for solving EIA conflicts which incorporates these opinions. The positive experience resulting from these actions should lead to greater credibility for EIAs.

The Environmental Protection Administration of Taiwan should also play a role in this process. For example, the EPA could cooperate with environmental scholars and experts in focusing on a specially chosen engineering construction development project. Throughout the various stages of this project the EPA could provide appropriate financial support, informational assistance and so on, to guide the actualization of procedures for public participation. The EPA could also assist in enhancing public participation by soliciting the cooperation of the media so as to make sure that the public understands and supports these measures.

Additionally, the following concrete steps should be taken to implement enhanced public participation:

1. Cultivate more specialists in public participatory environmental assessment, and emphasize the training of EIA management personnel so as to guarantee participation opportunities, organizations, and mechanisms for responding to public opinion.
2. Educate the public in the issues involved in environmental impact assessment in order to emphasize consensus in public participation procedures and promotion of legal systematization.
3. Encourage experts and scholars to disseminate their views on public participation in EIAs through various publications, journals and magazines.
4. Actively encourage hiring people who possess foreign experience and expertise. For example, this could be accomplished by providing scholarships to encourage domestic scholars and students to go to other countries to obtain expertise in public participation. In addition, foreign specialists in public participation could be invited to Taiwan to lecture and provide consulting services.

C. *Advocate Risk Communication and Risk Management Concepts and Methodologies*

Differences in risk perception are one significant source of conflict in gaining public acceptance of EIAs. Therefore, in those steps of the EIA process which involve public participation, risk communication and management procedures should be designed and implemented, with the intent of

lessening cognitive conflict associated with risk cognition differences. This will result in improvements in openness, fairness and thoroughness of inter-group communication.

If such a systematization of EIA procedures can be successfully promoted and effectively executed, most value judgment conflicts should eventually be resolved. However, because such controversies are complex and hard to clarify, traditional methods of resolving them are insufficient. Accordingly, it is urgent that third party mediation be introduced to environmental dispute settlement.[42] Expansion and enhancement of such mediation efforts should be of assistance in not only current, but also future Taiwanese environmental conflict management, realization of reliable environmental impact assessment, and environmental education.

42 Wang & Huang 1992, *supra* note 9; *see also* V.T. Covello et al., *Communicating Scientific Information about Health and Environment Risk: Problems and Opportunities from a Social and Behavioral Perspective, in* 4 RISK ASSESSMENT, RISK MANAGEMENT AND DECISION MAKING 224-33 (V.T. Covello et al. eds., 1987) [hereinafter *Communicating*].

APPENDIX: THE STRATEGY AND PRACTICE OF RISK COMMUNICATION

The following substantive concepts relate to the grouping of risk communication ideas and methods. Covello's typology of risk communication tasks is presented, and also four types of contingency strategies of risk communication are presented in table format.

Table 1: Gaps in the Treatment of Technological Risks by Technical Experts and the Lay Public (Some Generalizations Having Notable Exceptions)*

Approach	Treatment common to experts	Treatment common to public
1. Decision criteria for risk acceptance/rejection		
a. Absolute vs. relative risk	Risk judged in both absolute and relative terms	Greater tendency to judge risk in absolute terms
b. Risk-cost trade-offs	Essential to sound decision making because of finite societal resources for risk reduction and impractability of achieving zero risk; tends to ignore non dollar costs in such trade-offs	Since human life is priceless, criteria involving risk-cost trade-offs are immoral; ignores risks of no-action alternatives to rejected technology; gives greater weight to non-dollar costs
c. Equity considerations	Tends to treat shallowly without explicit decision criteria and structured analyses	Tends to distort equity considerations in favor of personal interests to the neglect of the interests of opposing parties or the common good of society
2. Risk assessment methods		
a. Expression mode	Quantitative	Qualitative
b. Logic mode	Computational • Risk = consequence * probability • Fault trees/event trees • Statistical correlation	Intuitive • Incomplete rationale • Emotional input to value judgments
c. Learning mode	Experimental • Laboratory animals • Clinical data for humans • Engineering test equipment and simulators	Impressionistic • Personal experience/ memory • Media accounts • Cultural exchange
3. Basis for trusting information		
a. Source preference	Established institutions	Non-"establishment" sources
b. Source reliability	Qualification of experts	Limited ability to judge qualifications

* Some of the descriptors in this table unintentionally reflect the image that the "experts are always right." Experts, of course, are not without emotions and sources of bias. Indeed, experts could benefit from improved information and scientific advances in reducing uncertainties in assessing technologies and their societal impacts as well as wider appreciation of public attitudes and changing social values.

c. Accuracy of information	Robustness/uncertainty of scientific knowledge	Minimal understanding of strengths and limitations of scientific knowledge
4. Risk attribute evaluation		
a. Low frequency risk	Objective assessment using conservatisms	Tends to exaggerate or ignore risk
b. Newness of risk	Broad range of high and low estimates	Tends to exaggerate or ignore risk
c. Catastrophic vs. dispersed deaths	Gives equal weight	Gives greater weight to catastrophic deaths
d. Immediate vs. delayed deaths	Diverse views over treatment of incommensurables and discount rate	Gives greater weight to immediate deaths except for known exposure to cancer-producing agents
e. Statistical vs. known deaths	Gives equal weight	Gives greater weight to known deaths
f. Dreadness of risk	Generally ignores	Gives greater weight to dreaded risk
g. Voluntary vs. involuntary risk	Gives equal weight	Gives greater weight to involuntary risk
5. Technological considerations		
a. Murphy's Law (if anything can go wrong, it will)	Stimulus for redundancy and defense-in-depth in systems design and operating procedures; margins of conservatism in design; quality assurance programs.	Stimulus for "what-if" syndromes and distrust of technologies and technocrats; source of exaggerated views on risk levels using worst case assumptions
b. Reports of technological failures/accidents	Valued source of data for technological fixes and prioritizing research; increased attention to consequence mitigation	Confirms validity of Murphy's Law; increased distrust of technocrats

Covello constructed a typology of risk communication tasks (Table 2) after performing an interview survey.[43] According to Covello, there are four types of risk communication tasks which are associated with the primary objective of the communication:

1. Information and education;
2. Behavior change and protective action;
3. Disaster warning and emergency information; and
4. Joint problem solving and conflict resolution.

43 *Communicating, supra* note 42, at 224-33; V.T. Covello et. al., *Risk Communication: A Review of the Literature*, 3 RISK ABSTRACTS 171, 173-76 [hereinafter *Review*].

In real risk communication, the above types of risk communication tasks overlap substantially, but they still can be conceptually differentiated.[44]

Table 2[45]
A Typology of Risk Communication Tasks

Type 1: Information and Education

Information and education people about risks and risk assessment in general;

Example: statistical comparisons of the risk of different energy production technologies.

Type 1: Behavior Change and Protective Action

Encouraging personal risk-reduction behavior

Example: advertisements encouraging people to wear seat belts.

Type 3: Disaster Warnings and Emergency Information

Proving direction and behavioral guidance in disasters and emergencies.

Example: sirens indicating the accidental release of toxic gas from a chemical plant.

Type 3: Joint Problem Solving and Conflict Resolution

Involving the public in risk management decision-making and in resolving health, safety, and environmental controversies.

Example: public meetings on a possible hazardous waste site.

44 *Communicating, supra* note 42, at 223 ,
45 *Id.* at 224.

Table 3[46]
Type 1 Risk Communication: Information and Education

Problems	Comparatively Effective Solutions
Because risk information generally involves high level technology and is very complex and ambiguous, it is difficult for the general population to understand.	Identify the nature and extent of public concerns for effective risk communication. Utilize simplified outline methods, defining informational contents, and avoid the use of technological or specialized professional jargon.
It is not certain that even with disclosure of risk information, that the public will accept it. Sometimes this will lead to panic situations.	Point out and explain those unclassified areas of risk estimates. If necessary, comparisons of different risk scenarios may be used to enhance understanding.
Because their understanding is insufficient, the public oftentimes shows little interest in risk associated problems.	
Those with communicative responsibilities lack creditability with the public. For example, if its creditability is less than ideal, Taiwan Power, in relating information regarding its planned Number Four Nuclear Power Plant, will experience many troubles.	To achieve consensus, improve abilities and structures of entities responsible for communication.
Experts and general society each define risk and risk related concepts in different ways. That is, in contrast to the experts, the general public regards the planned Number Four Nuclear Power Plant as an extremely dangerous project.	Identify and understand those broader factors of consideration normally included in health and environmental theoretical topics. These include factors such as political values and forms of social consciousness, with regard to the government's intentions to build a Number Four Nuclear Power Plant. Considerations concerning these intentions must not be made strictly on the basis of science related considerations. Instead, in order to initiate good working communications, political and social problems must also be taken into account.

46 Ming-shen Wang & Chih-kuan Fang, *Tu-hui-chiu kai-fua chien-she chih hwang-jing fong-hsien yu chih-chueh [A Study on Environmental Risk Perception and Management for Metropolitan Development and Construction] in* NATIONAL SCIENCE COUNCIL RESEARCH REPORT 118 [Nat'l Science Council 80-0421-P-110-02-Z] (Taiwan) (in Chinese) [hereinafter *Study*].

Table 4[47]
Type 2 Risk Communication: Behavior Change and Protective Action

Problems	Comparatively Effective Solution
Possible obvious and immediate losses resulting from behavioral changes.	Use multiple channels and the media to enhance impressions of target groups, change behavioral patterns.
Reliance on excuses to assure rational behavior and resist changes.	Establish expert authority and creditability so as to make the public more willing to believe communicated reports and respect communicators, also aids to attaining modifications in behavior.
Due to excessive self confidence, individuals often assume that they will not achieve poor results.	Use new communication methods to attract the attention of target groups. Rely on active influences, cause target groups to become more involved in decision making and other related activities.
Because of political factors as well as demands that it endeavor to make behavioral modifications, there is resistance to the government by the public.	Identify target groups and adopt beneficial communication methods, to modify the risk perceptions of those making up these groups. One possible method is the use of penalties or behavioral advice.

47 *Communicating, supra* note 42, at 227-29; *Study, supra* note 46, at 119.

Table 5[48]
Type 3 Risk Communication: Disaster Warning & Emergency Information

Problems	Comparative Effective Resolution
In most of disasters and emergencies, macro-objectives (to minimize the loss of life and to minimize property damage) often conflict with the micro-objectives of local residents. The objectives are frequently assigned the highest priority to the protection of family members, friends, personal possessions, and property.	Promote the notion that just because different parties have different interests does not mean that those interests are incompatible.
Communication channels are frequently broken down during disasters and may result in the confusion and diffusion of rumors.	Encourage local citizens to have a share in activities related to the crisis management systems.
Warning systems frequently produce false alarms, which confuse people, generate mistrust warning system, and may desensitized people of future warnings.	Reinforce the education of crisis management, thus, decreasing the loss of urgent disaster.
People frequently delay the timely actions against urgent disaster owing to confirmation of the original communication through several communication channels.	Design the credible warning systems to strengthen the confidence of the local public in these systems.
Time pressure frequently result in the enlargement of the social wasted loss of emergency.	Devise multiple warning systems and multiple communication channels to prevent the possibility of failure.

48 *Communicating, supra* note 42, at 229-31; *Study, supra* note 46, at 120.

Table 6[49]
Type 4 Risk Communication: Joint Problem Solving and Conflict Resolution

Problems	Comparative Effective Resolution
The public participation programs initiated by the government agency, such activities are sometimes viewed as an attempt by the agency to escape its legal duty and responsibilities.	Emphasize the strategy and the techniques of joint problem solving and conflict resolution, such as small group discussions, workshops, advisory committees, and conflict mediation.
Even a small event may escalate into a big one due to the full hostility and distrust among groups during the initial risk communication task.	Create opportunities for ventilation of hostility. This may require a series of conferences prior to conflict resolution.
Officials and local residents often do not understand the nature of the conflict or sources of disagreement. Such disagreement can range from factual conflict among experts to value conflict[50] among individuals or groups.	Develop a public involvement plan, which is responsive to the level of interest and concern expressed by the lay public, to ensure the implementation of public involvement is carefully and systematically designed as part of the decision-making process.
Different publics will be involved at different stages of the conflict management process.	A risk manager should assist in construction of framework which gives negotiator a guidance about how they might want to proceed in resolving their conflicts and what the costs and consequences of their choice might be.
Individuals and groups are often invited to have a share in decision making only after many of the most important decisions have been made. Thus, resulting in an irony that public participation are frequently unable to react fully to public opinion.	A risk manager should assist the parties in drafting an agreement that will represent maximum net joint gains for the parties and all the potential affect produce by the implementation of the agreement. Obtain a complete understanding of how the problem(s) is viewed by all significant interest groups, which facilitates the implementation of conflict resolution associated with joint problem solving orientation.

49 *Communicating*, *supra* note 42, at 224-27; *see also Study*, *supra* note 46, at 118-21.

50 According to investigations into the sources of enironmental disputes by AMY, *supra* note 25, Creighton, *supra* note 29, as well as the analytical hierarchy for multiple public decision-making (Figure 1), the definition of factual and value conflict is as follows:

a. Factual Conflict

The concept and definition of factual conflict are that, different decision-makers make different judgments about the decision criteria, even though they face the same goal or problem and with reference to the same information. In the analytical hierarchy for multiple criteria decision-making, factual conflict mainly concerns conflict arising from different judgments between decision attributes and decision objectives. Thus, it is similar to the data disputes suggested by Amy and Creighton.

b. Value Conflict

Value conflict is the conflict over multiple objectives. In the analytical hierarchy for multiple-criteria decision-making, this is the conflict produced by different judgments of objectives by decision-makers. That is, different decision-makers judge differently on the importance of decision objectives, and thus cause conflict. *See generally* AMY, *supra* note 25, at 41-66; Creighton, *supra* note 29, at 119.