



The public perception of climate change in Taiwan and its paradigm shift



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HIGHLIGHTS

- The public had critical view on the policy decision-making of climate change.
- There is low public trust in the government's capacity to resist climate change.
- The public requested more risk communication, transparency and participation.
- The pursuit of an alternative sustainable economic society is highly expected.
- People supported renewable energy by higher prices for carbon reduction.

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ABSTRACT

This study attempts to explore the risk perceptions of climate change in Taiwan. It probes into the public's views toward governments' risk communication regarding climate change, citizens' participation in decision-making, and their trust in the capacity of governments toward risk governance, as well as their attitude towards corporate social responsibility. For analysis, we developed ten types of perceptions under three dimensions: namely the severity of climate change (Type 1), the development of sustainable society (Types 2, 3, 4 and 5), and the risk governance and communication (Types 6, 7, 8, 9 and 10) to discuss whether the Taiwanese public's perception of climate change was prepared for a socially reflective paradigm shift. Regarding the three dimensions in the questionnaire design, although this study individually measured the public's risk perception, there was a high correlation between the variance analysis results among the three dimensions. This could systematically explain the potential change of the governance paradigm in Taiwanese society concerning structural transformation.

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1. Introduction

With the impact of severe global climate change, the development paradigm of modern sustainable society has changed from that of environmental governance to climate change risk governance. Since the 1990s, especially with the Declaration for Sustainable Development made at the Rio Earth Summit in 1992, climate change governance has attracted more attention, as it is seen reflected by the Kyoto Protocol established in 1997. At the beginning of the 21st century, the world encountered severe climate disasters and diverse impacts of technology on ecology. Thus governments, and the public, around the world began paying more attention towards risk governance, and the precautionary principle of climate calamities and combined disasters.

The uncertain impact of climate change on global industry, environment, health, food safety, community and social sustainability has exceeded the scope of scientific evaluation and data analysis. The decision-making related to stakeholders relies on more diverse, long-term and interactive risk governance (with citizen participation). The world has not only established international climate governance research networks, but has also constructed participatory technological assessment of related policies in various countries and regions. Discussion of significant policies of a particular country via risk communication, including social participation, democratic diversity and negotiation, and risk perception mechanisms in precautionary principles, is the key reference for international organizations to measure the systematic and complete risk governance of the country (WHO, 2002).

Regarding the challenge of governance, modern governments cannot deal with climate change through traditional methods of control. In order to obtain the public's trust and enhance the legitimacy of their decision-making, they must include the public's risk perception and communication in control and decision-making.

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However, when dealing with the reform of governance paradigms, a fundamental question revolves around whether the governments of newly industrialized countries, that treat economic development as a top priority, have the capacity to deal with such a reform and simultaneously obtain the public's trust and support.

In the last two decades, CO₂ emissions in Taiwan have increased by 116–137%, indicating an annual average growth of over 4.9%. In 2008, CO₂ emissions in Taiwan totaled 2.52 million tons (1% of the world's emissions). In the same year, per capita emissions reached 11 t (18th in the world). In 2010, per capita emissions of CO₂ rose to 11.53 t (16th in the world). Concerning CO₂ emissions, Taiwan has been ranked the sixth country with the highest CO₂ emissions among countries with a population of at least five million. However, in recent years, the industrial investment plans ratified by the government of Taiwan have continually encouraged energy consumption, particularly in the high-energy intensive steel industry and the petrochemical industry (Chou and Liou, 2012). Since the mid-2000s, disputes on significant industrial development projects in Taiwan have mostly referred to industries with high-energy consumption and high greenhouse gas emissions, such as the petrochemical, oil refining and steel industries. The seventh naphtha cracker, the Hua Lung Steel Corp., the steel plant of Formosa Petrochemical Corp., Dragon Steel Corp., the expansion of the third naphtha cracker, and the expansion of the sixth and eighth naphtha crackers of the Formosa Petrochemical Corp. have been important issues of concern in Taiwanese society. Despite public protests against the continuous growth of high-energy consumption and high-polluting industries, the government has been persistent in subsidizing the energy costs of industries out of concern for the country's economic growth.

The governance of high-energy consumption, high greenhouse gas emitting industries, and climate change, has been a significant challenge for the government of Taiwan. On one hand, the sanction on emerging industries by the international green conventions is increasing, while on the other hand, due to the drastic climate disasters that have occurred in both Taiwan and the rest of the world, as well as the supervision and demands made by the citizen society, the public has become aware of the illegitimacy of industrial development and government control. However, this social awareness is in direct contradiction with the expert political authorities that have been in long existence.

Chou (2007, 2008, 2009) pointed out that the government of Taiwan relies on scientific positivism regarding climate change and environmental governance, and does not value risk communication with society. Expert political authorities, formed by scientific elites and technical experts, tend to hide risk information and delay risk control through knowledgeable authorities and scientific specialties. They are known for doubting the public's perception of risk. Therefore, scientific and technical experts treat the public's risk perception as emotional and irrational. Although this treatment is supported by a number of studies on international society (Wynne, 1980, 2001), long-term structural hiding, and neglect or release of risk control, substantially decrease the public's confidence in government governance, resulting in a system that destroys trust (Chou and Liou, 2009).

This structural phenomenon demonstrates the uniqueness of Taiwan as a newly industrialized country regarding risk governance, in that its authoritative regime of regulatory science will encounter significant challenges in climate change governance. In other words, without sufficient risk communication, transparency in risk information, citizens' participation in the decision-making of climate change uncertainty and the public's trust, risk governance will be faced with huge challenges. The partnership and cooperation among governments, firms and society in the face of threat concerning climate change governance, will thus be eroded.

Based on the previous structural analysis, this study further probes into Taiwanese perceptions of climate change risk, in order

to recognize the dialectics between environmental and economic growth, industry and energy development, corporate social responsibility and attitude toward government governance in Taiwanese society under dramatic climactic change. In addition, it demonstrates the dilemma of government authority in newly industrialized countries.

2. This study

This study attempts to explore the perceptions of climate change risk and the public's trust in the Taiwanese government's capacity concerning risk governance in recent years. It firstly recognized the public's change of attitude towards the public view of the dialectics of economic growth and environmental protection, industry and energy cost subsidies (including energy price subsidies, nuclear power as low-carbon energy, and water resources first offered as industrial water) under the impact of severe global climate change in newly industrialized countries upon economic development as long-term priorities. In addition, this research delves into the public's views toward governments' climate change risk communication, citizens' participation in decision-making, and trust in the government's capacity of risk governance and attitude towards corporate social responsibility. In the analysis, this research attempts to establish how governments conduct risk governance, including matters such as transparency in risk information and decision-making, two-way risk communication, and partnerships between governments and NGOs. In other words, as the key agent in risk governance, a government's action will influence the public's risk perception and trust. Regarding the public's risk perception and trust, or its identification with governance capability, countries around the world not only measure the public's attitude regarding controversial risk, but also analyze government reactions, actions, evaluations, and control and trust in governance.

According to numerous past studies on technological risk decision-making in different countries regarding various kinds of new technology such as chemical products, nuclear energy, genetically modified products and food additives traditional technical experts have emphasized the decision-making model of positivism, and suggested that risk control requires specific scientific evidence. In the control model and culture, with a high degree of expert political authorities, uncertainty of toxin is usually neglected, and questions posed by society are treated as irrational, emotional and non-scientifically objective (Wynne, 1980; Rutgers and Mentzel, 1999; Edmond and Mercer, 1998; Chou, 2008). However, sound scientific contemplation upon quantification of elite technical experts have caused more and more improper risk decision-making; thus, its legitimacy has been significantly challenged (Ravetz, 1999, 2002).

Climate change results in a high degree of uncertainty regarding its impact on industry, environment, health, community and social distribution. With regards to decision-making and control thinking, mitigation and adaption are associated with basic scientific evidence, and social value selections and common consensus. Investigation on climate change disasters should be based on the integration of scientific knowledge on areas such as meteorology, hydrology, geology and public health, and it should break through the boundaries of individual disciplines. However, this will also reveal the limitation of individual disciplines' basic scientific investigation and outcomes on decision-making and control. Each decision on climate change risk is not only related to industry and energy development in society, but is also highly associated with the public's health, social fairness, and community justice. Therefore, regarding conflicts within stakeholders' individual selections, knowledge on climatology is insufficient.

The control and decision-making on climate change risk refer to limited basic scientific results, disputes of social value selections and the flexibility of regulations. Expert political authorities, which have been restricted to narrow scientific explanations, cannot respond to the change. Currently, many scholars have proposed sustainable innovative governance and have suggested that complicated technology and social systems, including the technological risk of climate change, require reflexive governance based on risk communication, risk perception and the public's participation in technological decision-making. They have encouraged the involvement of the public's participation in local knowledge and social value selections. This can supplement limited climatological scientific knowledge, and resist the manipulation of complicated scientific knowledge and expert political authorities, as well as prepare for conflicts among stakeholders (Grin, 2005).

Hence, the analysis of this study includes the gravity of climate change (Type 1), the dialectic between environmental and economic growth (Type 2), the action to resist climate change and the generation of justice (Type 3), the priority of the arrangement of nuclear energy or renewable energy, carbon reduction and water resources (Type 4), the willingness of the public to pay (Type 5), risk communication (Type 6), trust in the risk governance capacity of the government (Type 7), citizens' participation in decision-making (Type 8), trust in expert governance (Type 9) and corporate social responsibility (Type 10), with a total of 35 items. Through the above-mentioned types, this study hopes to grasp the Taiwanese public's risk perception on climate change.

3. Procedure and respondents

A nation-wide telephone interview was commissioned to be conducted by Taiwan Real Survey Co., Ltd. The investigation period was from June 19 to June 29, 2012. This study conducted telephone interviews on independent samples. A total of 1,100 valid samples were collected. Based on the estimation of 95% reliability, the maximum sampling error was $\pm 2.95\%$.

The subjects were residents living in Taiwan and Minnan areas (including Taipei City, New Taipei City, Taichung City, Tainan City and Kaohsiung City of Taiwan, and Kinmen County and Lienchiang County of Fukien) and were above 18 years of age. This study employed the telephone book from Chunghwa Telecom as the computer database and treated it as the list of sampling, in order to conduct computerized systematic sampling. Furthermore, in order to avoid errors caused by the lack of interviewing subjects living in accommodations without a registered telephone number, this study established a complete and random telephone number list utilizing the last two numbers among the telephone numbers selected, to supplement the samples.

4. Measures

4.1. Attitude towards climate change risks

According to the trend of international carbon reduction, high-energy consuming and high-polluting industries of Taiwan have encountered social awareness, protests, and authoritative decision-making models from expert political authorities. For analysis, this study developed ten types of perceptions under three dimensions, namely the severity of climate change (Type 1), the development of sustainable society (Types 2, 3, 4 and 5), and the risk governance and communication (Types 6, 7, 8, 9 and 10) to discuss whether the Taiwanese public's perception of climate change was prepared for a socially reflective paradigm shift.

4.2. Effect

The first dimension, the severity of climate change, was based on Type 1, the perception on the severity of climate change, and included items 2–5. The second dimension, the development of sustainable society, was based on Type 2, the dialectic between environmental and economic growth (items 6, 9, 10 and 35), Type 3, the action to resist climate change and the generation of justice (items 8 and 12), Type 4, the priority of the arrangement of nuclear energy or renewable energy, carbon reduction and water resources (items 7, 13, 14 and 28) and Type 5, the willingness of the public to pay (items 5, 15 and 36). The third dimension, risk and governance communication analysis, was distributed in Type 6, risk communication (items 16–20), Type 7, trust in the government's capability of risk governance (items 21, 22, 24 and 25), Type 8, citizens' participation in decision-making (items 27, 29 and 30), Type 9, trust in expert governance (items 31–33) and Type 10, corporate social responsibility (items 23 and 26).

4.3. Attitudinal position

In recent years, Taiwan has encountered several serious climatic disasters, and in 2005, the UN Development Programme included Taiwan as one of the global disaster areas. In Type 1, this study explored the public's attitude towards the severity of climate change (items 2–5). Newly industrialized countries tend to make efforts in economic development, all the while neglecting environmental protection, and Taiwan is no exception. However, under the pressure of global carbon reduction, the local high carbon emission industry structure and serious environmental pollution this study examines the change of the Taiwanese public's attitude towards the sustainability paradigm using Type 2, the dialectic of environmental and economic growth (items 6, 9, 10 and 35). Moreover, taking personal action as independent variable, this study explores the public's resistance to climate change and their attitude towards the generation of justice in Type 3 (Items 8 and 12).

In 2010, Taiwan's Executive Yuan proposed the Energy-Saving and Carbon Reduction Action Plan, which identified nuclear energy as an option of low-carbon energy, and arranged the development of an alternative energy to lower greenhouse gas emissions. In Type 4, this study explored the public's attitude towards nuclear energy and renewable energy as carbon reduction tools (Items 7, 13, 14 and 28). In addition, this study investigated the public's attitude towards the priority of water resource arrangements. Upon the same context, in Type 5, this study looked at the public's willingness to pay energy and environmental taxes that would be collected by the government for oil and power subsidies (Items 5, 15 and 36).

Risk governance was the second most important dimension of this study. With the severity of threats from climate change, transparency in risk information and public communication have become essential. Since Taiwan has encountered several severe calamities in the past few years, allowing the public to access the information of various significant policies and disasters, particularly information pertaining to outcome, resistance and mitigation of climate change and specific transparent decision-making, is an important base for the public to understand the government. Therefore, in Type 6, this study explored the public's attitude towards government risk communication (Items 16–20). Furthermore, in Type 7, concerning risk governance capacity (Items 21, 22, 24 and 25), this study probed the public's views toward central and local governments, as well as individual and group actions aimed at resisting climate change and trust.

Likewise, besides transparency in information and communication, since mitigation and adaption of climate change are related to industry, energy and local stakeholders, the liberation and

transparency of decision-making and the expansion of private groups' participation in decision-making are the social asset directions that should be constructed in Taiwan in order to resist climate change. In Type 8, this study investigated the public's attitude concerning social participation in decision-making towards the government's climate change governance (Items 27, 29 and 30). In Type 9, this study probed into the public's attitude towards trust in expert governance, in order to find whether the long-term expert political authorities' control model was challenged (Items 31–33). Finally, in Type 10, this study examined the public's view towards Taiwanese firms' undertaking of social responsibility regarding energy consumption, and its effects on climate change (Items 23 and 26).

5. Analysis of results

5.1. Severity of climate change

The first dimension (severity of climate change) was designed in the questionnaire survey. Using four items in Type 1, this study initially explored the Taiwanese public's attitude towards the severity of climate change. Of the respondents, 76.4% suggested that climate change was the most serious problem in the world, while 54% submitted that global financial crises were the severest of all problems. A total of 46.6% of the subjects indicated that poverty, and lack of food and water, were the most serious problems (Fig. 1). Thus, climate change and poverty, food and water resources were considered as exceptionally serious issues by the public. Using 10 points as the full score to represent the degree of severity, most of the subjects suggested a score of 7–10 points (80.6%), hence demonstrating the degree of importance of climate change to the public. The average score for all subjects was 8.42 (Fig. 2).

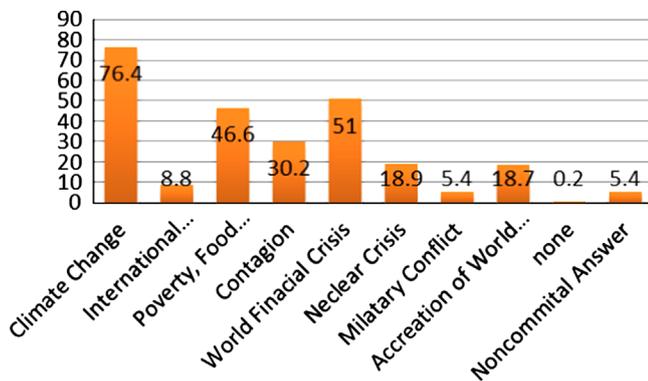


Fig. 1. The most serious problems currently encountered by the world, as suggested by the public.

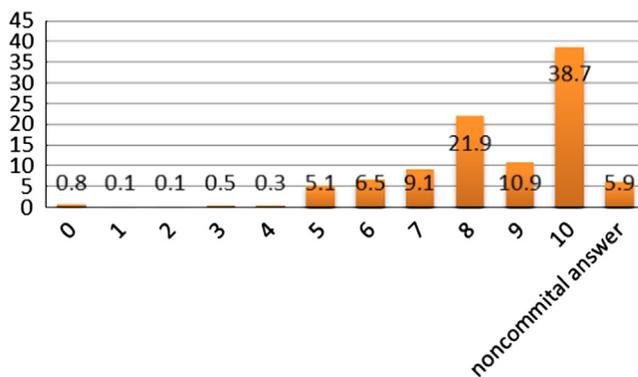


Fig. 2. How important is climate change?

A total of 63.5% of the subjects did not think that climate change was a process that could not be stopped, mitigated or resisted; however, 31.9% of the subjects were more pessimistic. In addition, 65.1% of the subjects did not think that the severity of climate change was exaggerated, while 33.2% of the subjects shared the opposite opinion (Table 1).

As to the second dimension (sustainable societal development), in the questionnaire design, this study focused on Type 2 (paradigm shift of environmental and economic development), Type 3 (personal action and the generation of justice), Type 4 (items of low-carbon energy and priority of water resources) and Type 5 (willingness of the public to pay and environmental subsidies).

5.2. Environment and gradual transfer of economic development paradigm

According to the questionnaire outcome for Type 2 (as shown in Fig. 2), 72.2% of the subjects suggested that the implementation of environmental protection could enhance economic development, while 69.1% of the subjects did not think that the implementation of environmental protection would hinder economic development. In other words, the Taiwanese public insinuated that environmental protection and the economy could be balanced. Although 44.2% of the subjects did not think that resistance to climate change particularly enhanced Taiwan's economy, 37.4% of the subjects were positive that it would. According to the preliminary outcome, a certain percentage of the people in Taiwan had abandoned the myth of the clash between environmental protection and economic development, and were gradually identifying with the international trend of sustainable economical society that would change the economic growth model.

The paradigm shift of environmental and economic development matched Item 4 in the dimension. Regarding the structure of energy intensive industries in Taiwan, 57.9% of the subjects voiced their opinion that although the government has adjusted the structure of high-energy consuming and high-polluting industries that would influence economic growth, they still had full intention of supporting the adjustment to the industrial structure.

5.3. Personal action and the generation of justice

According to the questionnaire result of Type 3, 40.4% of the subjects stated that they had adopted the actions of resistance or mitigation to climate change (including 14.4% that stated "mostly" and 26.0% that stated "partially"). However, nearly 55.8% of the subjects advocated that a few of them (39.3%), or none of them (16.5%), had adopted the actions of resisting or mitigating climate change (Fig. 3).

Regarding the generation of justice, 86.2% of the subjects revealed that for the following generations, despite delay in economic growth, environmental protection should be implemented (including 45.7% who completely agreed and 40.5% who vaguely agreed). Only 10.6% of the subjects disagreed (including 2.2% who entirely disagreed and 8.4% who partially disagreed) (Fig. 4). Therefore, the Taiwanese public had appreciably noticed the severity of environmental damage caused by rapid economic growth in the last 30 years. This would negatively influence the sustainable development of later generations.

5.4. Items of low-carbon energy and the priority of water resources

According to the questionnaire outcome of Type 4 (as shown in Table 3), 80.6% of the subjects hinted that alternative energy could lower greenhouse gas emissions. As to the substitution of nuclear energy, 81.6% of the subjects had the intention of rejecting nuclear energy, in spite of its lower prices, and supporting higher priced

Table 1
Importance of climate change.

	Strongly agree	Agree	Disagree	Strongly disagree	Noncommittal answer
Climate change could not be stopped	8.3	23.6	45.5	18	4.5
The importance of climate change is exaggerated	3.8	24.4	45.6	19.5	6.6

Table 2
Dialectic of environmental and economic growth.

	Strongly agreed	Agreed	Disagreed	Strongly disagreed	Noncommittal answer
Fighting climate change will help Taiwan's economy	8.5	28.9	40	14.2	8.5
Implementing environmental protection will facilitate economic development	20.7	51.4	18.1	3.7	6.1
Implementing environmental protection will hinder economic development	4.6	19.6	48.4	20.7	6.7
Supporting Government to adjust high-energy-consumed and high-pollution industrial structure	17.7	40.2	21.5	8.1	12.5

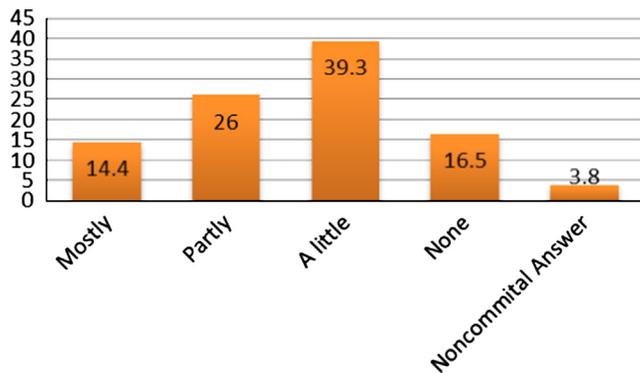


Fig. 3. Individuals' actions toward climate change.

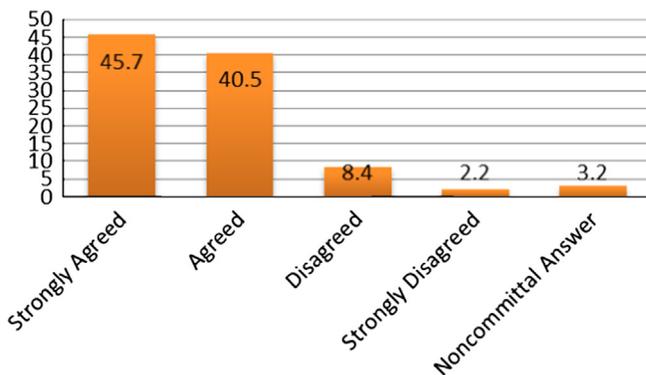


Fig. 4. For the following generations, environmental protection should be implemented despite delay in economic growth.

renewable energy (including 30.5% who had higher intentions and 51.1% with lower intentions). Only 12.2% of the subjects implied a lack of intention (included 3.3% who were completely unwilling and 8.9% who were somewhat unwilling). Regarding nuclear energy as a mitigation of CO₂ emissions, 58.5% of the subjects intimated their disagreement to mitigate CO₂ emissions by replacing thermal power by nuclear energy. Only 34.1% of the subjects agreed with it (including 6.4% who completely agreed and 27.7% who partially agreed).

A total of 72.8% of the subjects identified their disagreement with treating industrial parks as the priority for water resource offerings instead of farmers, and only 18.7% of the subjects agreed that the government should treat industrial parks as the priority for water resources (including 3.4% who absolutely agreed and 15.3% who partially agreed). According to the outcome, at least 80% of the subjects supported the development of renewable energy, and the majority did not support the substitution of nuclear energy for low-carbon energy. Regarding industrial and social fairness, 73% of the subjects did not agree with treating industrial parks as the priority for water resources instead of farmers.

5.5. Willingness of the public to pay and environmental subsidies

In Type 5, the public's willingness to pay for maintaining the environment, and their disagreement with the government's economical subsidies that would serve as compensation for sacrificing the environment (Table 4); 64.4% of the subjects had the intention to protect the environment by paying higher taxes (including 16.4% with a strong intention and 48.0% with a weaker intention). Only 28.3% of the subjects did not have any intentions of paying higher taxes. A total of 61.1% of the subjects supported the government's collection of energy and environmental taxes (including 19.9% with a strong support and 41.2% with a weaker support), while 29.3% of the subjects did not support it (including 9.7% who were strongly against it and 19.6% who showed a relatively weaker lack of support).

In comparison to the industrial priority of water offered by the government, regarding the legitimacy of the industries' oil and power price subsidies for the concern on economic development, 59.3% of the subjects disagreed and 32.6% agreed. Thus, most of the subjects did not agree with the government's long-term subsidy of energy costs for enterprises.

As to the third dimension, risk and governance communication, this study conducted the analysis using Type 6 (risk communication), Type 7 (trust in the capacity of risk governance), Type 8 (citizens' participation in decision-making), Type 9 (trust in expert governance) and Type 10 (corporate social responsibility).

5.6. Risk communication

Regarding Type 6, risk communication of climate change, including related information, outcomes and mitigation (as shown

Table 3
Perception of sustainable society.

	Strongly agreed	Agreed	Disagreed	Strongly disagreed	Noncommittal answer
Renewable energy should reduce the emission of GHG	29.6	51	9.3	2.1	8
Continue to use nuclear energy to reduce GHG increase	6.4	27.7	30.5	28	7.4
High energy price to support renewable energy	30.5	51.1	8.9	3.3	6.2
Government should first deploy water to industrial parks	3.4	15.3	40.9	31.9	8.6

Table 4
Willingness of the public to pay: oil and power subsidies and green tax systems.

	Strongly agreed	Agreed	Disagreed	Strongly disagreed	Noncommittal answer
Industrial oil and energy subsidies should remain the same	6.9	25.7	35.7	23.6	8.2
Willing to be charged more tax for environmental protection	16.4	48	18.6	9.7	7.2
Should charge energy and environmental tax	17.7	40.2	21.5	8.1	12.5

in Table 5), 42.8% of the subjects implied that information sources related to climate change were sufficient, 45.8% of the subjects suggested that the outcomes were sufficient, and 39.0% of the subjects suggested that the levels of resistance and mitigation were sufficient. In conclusion, the public's acquisition of information on climate change in Taiwan should be reinforced.

As to policy communication (as shown in Table 5), only 38.2% of the subjects stated that the government had proposed specific climate change policies to prevent dramatic climate change. A total of 63.1% of the subjects indicated that the government's related climate change policies (including oil, power and water prices) were not transparent. Thus, there was a serious lack of policy transparency, promotion and interactive explanation. The indicators of the government's risk communication were low.

5.7. Risk governance and trust

Resistance to severe climate change relies on the efforts of the government and the public. However, according to investigation result of Type 7, over 70% of the subjects suggested that resistance and mitigation to climate change from the central government (71.3%), local governments (71.1%) and the public (75.7%) were insufficient (Table 6).

In addition, the lack of risk communication indirectly influenced the public's trust in the government's capacity to resist climate change governance. According to the investigation (Fig. 5), only 24.6% of the subjects trusted the government's capability in resisting climatic abnormalities (including 2.4% with a strong trust and 22.2% with a weaker trust); on the contrary, 68.1% of the subjects did not trust it (including 22.4% who strongly did not trust it and 45.7% who trusted it relatively less).

5.8. Citizens' participation in decision-making

As to Type 8, citizens' participation in decision-making (Table 7), only 22.1% of the subjects agreed that the government's policies related to climate change were open and transparent (including 2.6% who completely agreed and 19.5% who somewhat agreed). On the contrary, 67.4% of the subjects disagreed (including 19.2% who completely disagreed and 48.2% who somewhat disagreed).

As to the government's active resistance to climate change by cooperating with private organizations, 49.5% of the subjects disagreed with it (including 15.3% who entirely disagreed and

34.2% who somewhat disagreed). However, 41.2% of the subjects supported it (including 7.3% who strongly agreed and 33.9% who somewhat agreed).

However, 88.9% of the subjects suggested that the government's climate change decision-making should include private participation (including 50.0% who unequivocally agreed and 38.9% who somewhat agreed). Only 6.6% of the subjects disagreed with it (including 2.1% who totally disagreed and 4.5% who somewhat disagreed).

5.9. Trust in expert governance

As to Type 9, trust in experts, (Table 8), many policies (such as those dealing with climate change) were related to complicated scientific problems. Although it was associated with many people's benefits, the decision-making should only rely on the experts. The result showed that 43.5% of the subjects agreed to authorize climate change policy to the experts (including 8.1% who totally agreed and 35.4% who somewhat agreed). However, more than half of the subjects (50.8%) disagreed with it (including 9.0% who completely disagreed and 41.8% who somewhat disagreed).

Regarding the full trust in experts, 50.6% of the subjects trusted in the experts (including 14.3% with complete trust and 36.3% who somewhat trusted in the experts). However, 44.7% of the subjects distrusted them (including 10.7% who completely distrusted them and 34.0% who somewhat distrusted them). However, as to the disputes of policies, the experts authorized by the government and private experts usually have different opinions. A total of 70.8% of the subjects did not trust the experts authorized by the government, and only 21.7% of the subjects trusted them. Thus, due to the controversial incidents of technology and risk, the Taiwanese public has gradually become conservative regarding the objectivity and authority of experts.

5.10. Lack of corporate social responsibility

As to Type 10 (corporate social responsibility), regarding the firms' actions and responsibility in resisting climate change, according to the investigation (Table 9), only 8.1% of the subjects suggested that firms in Taiwan had undertaken corporate social responsibility when dealing with climate change and energy consumption; while 81.4% of the subjects suggested that they had not undertaken corporate social responsibility (including

Table 5
Risk communication.

	Strongly sufficient	Sufficient	Insufficient	Strongly insufficient	Noncommittal answer
Information for climate change origins	7.4	35.4	40.2	10.3	6.6
Consequence about climate change	8	37.8	38.6	9.1	6.4
Information for dealing with or mitigating climate change	6	33	44.4	9.2	7.4
	Strongly agreed	Agreed	Disagreed	Strongly disagreed	Noncommittal answer
Governmental policies on climate change is very significant	8.2	30	34.5	16.8	10.4
Governmental climate change policies are in-transparent	31.9	31.2	19.8	10.8	6.2

Table 6
Trust in capacity of risk governance.

	Too much	Adequate	Insufficient	Noncommittal answer
Central Government	2.1	16.2	71.3	10.4
Local Government	0.7	16.4	71.1	11.7
Individual, citizen and the public	1.7	14.2	75.7	8.4

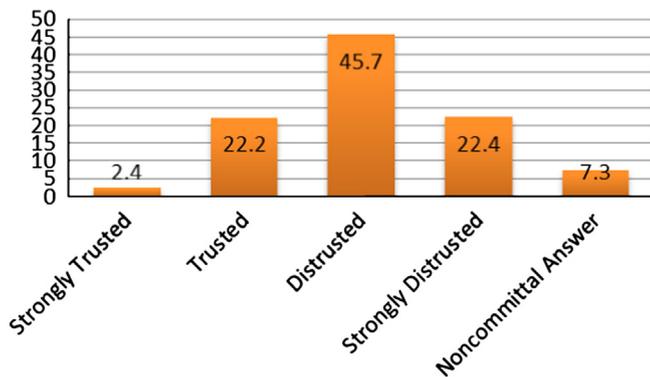


Fig. 5. Public distrust of the government's capability in resisting climate change.

20.2% stating “no responsibility whatsoever” and 61.2% stating “partial responsibility”).

Furthermore, 71.4% of the subjects insinuated that the firms' resistance to climate change and mitigation were insufficient. Only 13.2% of the subjects believed that they were appropriate. Hence, since industrial development was associated with environmental pollution, energy consumption and CO₂ emissions, the Taiwanese public mostly recommended that the firms should undertake more social responsibilities.

6. Discussion

According to the outcome of the survey, Taiwanese society is at the cutting edge of structural transformation, and the majority of the public has realized the gravity of climate change. As to the selection of sustainable society and economic development, as well as national and private risk governance and communication, there are critical and reflective views on the review of industrial decision-making and decision-making mechanisms of high-energy consumption, high CO₂ emissions and high risk. More precisely speaking, external international pressure on carbon reduction,

severe global climate disasters, and internal local calamities caused by torrential rain and long-term improper energy subsidies for high carbon emitting industries have directed the Taiwanese public's high-risk consciousness towards climate change. This in turn directly challenges the industrial policy, energy policy and decision-making model related to mitigation and adaption. As a result, a conflict and tension for the risk governance paradigm of climate change has arisen. Thus, because of the structural social transformation drive, this study recognized the governance paradigm shift inherent in the outcome of the questionnaire.

Regarding the three dimensions in the questionnaire design (severity of climate change, sustainable societal development, and risk governance and communication), although this study individually measured the public's risk perception, there was a high correlation between the variance analysis results among the three dimensions. This could systematically explain the change of the governance paradigm in Taiwanese society in structural transformation.

According to variance analysis in the first dimension (as shown in Figs. 1 and 2, and in Table 1), the public had a highly positive attitude toward the selection and importance of the most serious problems, (exaggeration and oppression of efforts in climate change). In other words, the Taiwanese public has affirmed their belief in the threat of climate change and the attitude of resistance. This attitude was specifically responded to in the second dimension, namely the sustainable societal development.

Regarding the second dimension (perception of sustainable societal risk), the public had developed an attitude of moderating the relationship between environmental and economic growth, and they rejected the old confronting paradigm. The public recommended a pursuit of an alternative development model of sustainable economic society (Table 2). Therefore, the majority of the people supported the government's adjustment towards the original high-energy consuming, high polluting and high carbon emitting industrial structure (Table 2) and was willing to pay for it (Table 4). Concerning the latter, the public, to some degree, rejected the government's long-term industrial subsidies of oil and power costs, and supported environmental protection, as well as the collection of higher energy taxes.

Regarding low-carbon energy and economic development (Table 3), most of the subjects agreed to support renewable energy, via higher power prices, as the substitute of carbon reduction. They rejected the government's policy of treating nuclear energy as low-carbon energy, and did not support the government's preferential water offering to industrial parks in sacrifice of agricultural food safety. Regarding the generation of justice, most of the subjects suggested that despite the probability of an ensuing delay in economic growth, environmental protection should be the highest priority (Fig. 4). However, there was still a significant gap between the Taiwanese public's practices and

Table 7
Citizens' participation in decision-making.

	Strongly agreed	Agreed	Disagreed	Strongly disagreed	Noncommittal answer
Governmental decision-making is open and transparent	2.6	19.5	48.2	19.2	10.5
Government have communicate and co-operate with nongovernmental and environmental organizations	7.3	33.9	34.2	15.3	9.3
Decision-making should be more transparent and more public participation	50	38.9	4.5	2.1	4.5

Table 8
Trust in expert governance.

	Strongly agreed	Agreed	Disagreed	Strongly disagreed	Noncommittal answer
Climate change policies should be mandated by experts	14.3	36.3	34	10.7	4.6
Experts are absolutely objective, should trust in them	8.1	35.4	41.8	9	5.7
When governmental experts and public experts conflicted, will lean to government	2.6	19.1	52.9	17.9	7.6

Table 9
Corporate social responsibility.

	Too much	Adequate	Insufficient	Noncommittal answer
Corporation's actions on dealing with climate change	1.5	13.2	71.4	13.8
	All of them	Most of all	A few	None of them
Taking corporation social responsibility	1	7.1	61.2	20.2
				Noncommittal answer
				10.6

ideals in the battle of resisting climate change (Fig. 3). Thus, the subjects had Giddens's paradox (Giddens, 2009).

The attitude towards sustainable development in the two dimensions was directly reflected in the third dimension (the public's demand for government governance and corporate social responsibility). The public suggested there was a lack of information transparency and communication of climate change, and they stated that the government's policies of climate change were not transparent (Table 5). Moreover, according to the public, the resistances to climate change from the central and local governments should be reinforced (Table 6) and they demanded further citizen participation and cooperation (Table 7). Since there was a lack of risk communication and partnership with civil society, the public did not trust the government's governance capacity in resisting climate change (Fig. 4). This was reflected in the public's mistrust in expert governance (Table 8). Therefore, the government's risk communication and expert governance model significantly encountered the necessity for reform. Likewise, in the triangular relationship between government, society and firms, the construction of systematic partnerships was lacking. Consequently, as a result, firms' corporate social responsibility seemed to be weak (Table 9), and a strong social capacity cannot be established to resist the challenge of climate change.

This study demonstrated the public's perception of climate change risk and the paradigm change of governance. People perceived a serious threat from climate change and recognized the need for a sustainable development of society and the generation of justice. They correspondingly demanded more sufficient decision-making communication, information transparency and social participation. Furthermore, the questionnaire analysis result of the three dimensions revealed the gap between governance and trust among

government, firms and society. The systematic delay and hidden risk control model of the past should be overcome by reform in governance and innovation by the government.

This study recognized the public's perception of sustainable society and their subsequent pursuit of alternative economic development; however, on the other hand, since it lacks decision-making and the communication mechanisms of liberation, participation, interaction and cooperation, the public also recognized the insufficiency of government's, or firms', capacity in governance and taking responsibility, and this has significantly lowered the public's level of trust. Therefore, the capacity of risk governance within the whole society is fragile and cannot fulfill the suggestions of many studies (Jasanoff, 2003; Nowotny et al., 2001) that with complicated scientific uncertainty and severe threat of climate change, the three major agents should enhance cooperation and construct social robustness to deal with challenges.

Upon the previous study on structural governance in the technological risk society of Taiwan, the finding of this study does not come as a surprise. In the last decade, research on new technology, food, environmental pollution and industrial development has demonstrated that the positivism control model of authoritative technical experts tends to seriously neglect open and transparent risk communication and social participation. This results in a delayed high-tech risk society (Chou, 2000, 2002, 2008) and structural expert political authorities. Since the governance model lacks reform and innovation, there has been hung risk governance in confronting the relationship between government and society in recent years.

The most direct effect is on the public's trust towards expert governance. In the combined tragedy of the nuclear disaster from the tsunami caused by the earthquake in Fukushima on March 11,

2010, it seems that the public's view towards expert governance has slightly changed. In the investigation on social change conducted by Academia Sinica in 2010, the outcome showed that the subjects did not trust the government's capacity in environmental governance and decision-making. The result should match the long-term observations in a delayed high-tech risk society. However, an analysis of the same questionnaire showed that 87% of the subjects still relied on the importance and specialty of experts. According to the latest investigation in June 2012, Taiwanese society's trust in expert governance has lowered, and people are questioning the professional statements of the experts authorized by the government. In recent years, in a series of disputes over the environment and food safety, the professionalism and representation of the expert committees formed by the government have been criticized. After the nuclear disaster of Fukushima, due to the discussion on the security of nuclear energy in Taiwan, the public has gradually lost trust in the guarantee provided by technical experts.

Therefore, the Taiwanese public's paradigm shift of climate change risk governance has occurred with a systematic gap among government, firms and society. The long term control model and culture, formed by expert political authorities, have been cumulatively demonstrated in this study. In other words, the public has perceived the reality of the serious threat from climate change, and they have the active intention and demand for sustainable development and participation in decision-making. Nevertheless, they disagree with delayed innovative governance, which only focuses on science and firms that lack social responsibility. If the structural problems are not actively improved, society will encounter the systemic risks emphasized by the OECD (2003), and the legitimacy of national governance will decrease. As this fragility of governance continues, under the threat of climate change, energy, environment, industry, health and social distribution policies of the government, firms and society will lack the base for cooperation and trust. In conclusion, the risk governance of the country should respond to the public's demand and expectation through significant reform. The findings of this study specifically recommend a baseline for innovative governance and reform.

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