

Biomedtech Island Project and Risk Governance.

Paradigm conflicts within a hidden and delayed high-tech risk society

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Abstract: Among global fierce competitions of biotechnological R&D, as a newly industrialized country and a burgeoning IT power in East Asia, the Taiwan government declared to boost the project – »Island of Bio-medical Technology« in 2005. It attempts to combine niches of local IT industry superiority to construct electronic bio-medical industry thus become the gene research center of global Chinese simultaneously. However, these beaming techno-industrial policy decisions are encountering highly suspicions in terms of human right, ethics, and society development. They not only rouse continuous paradigm war of risk but also bring challenges to the state's capacity on risk governance in its technological policy decision-making.

The primary purpose of this article is to critically discuss decision-making problems in developmental states that deal with disputed and sensitive technological policy. Moreover, by reflecting the example of Taiwan, this article attempts to analyze the emergence of risk governance paradigm conflicts as well as assess the kinds of models and cultures that are created due to this confrontation between disputed technological policy decision-making and society. Secondly, the author tends to further illuminate the pull-push tension behind the special risk governance structures and risk cultures. Phenomena observed from discussions are further examined in depth only if they are problems common to other newly industrialized countries in terms of technological development; or, if they serve as stumbling blocks for a hidden, delayed high-tech risk society that is weaker than those of Western advanced industrial countries and with double risks that may influence global risk governance.

1. Problem identification

In developmental states, technocrats and science elites have generally monopolized the formation and implementation of technological and industrial policy. Since the 1980s, these policies have been quite successful for developmental states as they have helped spur development in the areas of machinery, electronics, information technology, optoelectronics and communication in newly industrialized countries such as Taiwan, South Korea and Singapore. Accordingly, in the late 1990s, these technological latercomers were able to hold on to their successes in technological industries and R&D, and in some cases, in the subsequent years were even able to catch up.

As we observe the development of global techno-industry and technological R&D competition from an industry division and information economy point of view, these electronics and information industry based techno-industries along with R&D competition have enjoyed gains in the global information economy as well as in the emerging »post-industrial society« and »network society« upon which the basic infrastructure for a globalized political system, economy, culture and society is laid. Even some technological laggards have gradually been able to catch up with the global information economy trend. However, along with the rapid development of a knowledge economy and technological R&D competition, for some newly developed technologies (such as genetically modified foods, genetic medicine, nanomedicine, nanofoods, electronic technological systems and genetic nanomedicine which combine information and digital technology) the long term health, ecological, social and ethical impacts remain unclear. Consequently, a »world risk society« and the concept of »globalizational risk« have been formed. In other words, future-oriented technological development has a significant impact on social trust and local interactions within societies. Meanwhile, the risk governance capacities of world governments and transnational governmental organizations are constantly being tested.

From this risk governance viewpoint, the health, ecology, society, and ethics risks of new technology have reached their limitation in terms of global technological policy and the traditional operation of technological R&D, and are being pressed to propose a risk governance model which creates a balance between the advancement of technology and the risks that the newest developments bring to society. Not surprisingly, it is not only advanced industrial countries which confront this challenge, but also the newly industrialized countries. Traditionally, newly industrialized developmental states have tended to apply the logic of »valuing technological R&D, while ignoring risks« in of the development of technological industries and the formation of technological policy. Also, technocrats and science elites tend to duplicate the successful model provided by the information industry – in which the state plays the primary in integrating investment and R&D in order to develop these sensitive technologies and drive high-tech industrial development. This operation model makes it difficult for societies to respond adequately to the balancing act necessitated by a risk governance policy.

From this, two problems can be identified: first, the development of sensitive technologies¹ may help newly industrialized countries hold superior stances. However, since technological policy decision-making monopolized by technocrats lacks bilateral and democratic risk communication, tensions between technological development and the society arise and even foster a serious widespread social distrust. Second, in order to create a competitive advantage in global technological R&D, developmental states tend to apply a comparatively loose risk governance model. Also, technocrats and science elites are accustomed to applying traditional positivist risk assessments in their technological policy decision-making and intentionally and institutionally ignore the existence of social risks, so as to create a disconnect regarding global risk governance trends.

In East Asia, Taiwan remains a stance that is behind other more advanced technological powers. As an emerging power in the fiercely competitive information and biotech industries, the Taiwan government announced the »Taiwan Biomedtech Island Project« which includes three subprojects: Taiwan Biobank, National Health Information Infrastructure (NHII)², and a clinical trials research system. The Taiwan government attempts to explore a superior niche in the local information industry and to construct an electronic biomedtech industry which would pave the way for the creation of a »Global Chinese Genetic Research Center« and developing a related clinical trials research system. However, suspicions on human rights, social trust, and ethics remain. These issues not only create risk paradigm conflicts, but also challenge government risk governance capacity in its impact on technological policy decision-making.

The primary purpose of this article is insofar to critically discuss decision-making problems in developmental states that deal with disputed and sensitive technological policy. Also, by examining the example of Taiwan, this article attempts to analyze the emergence of risk governance paradigm conflicts as well as assess the kinds of models and cultures that are created due to this confrontation between disputed technological policy decision-making and society. Secondly, we further deliberate the pull-push tension behind the special risk governance structures and risk cultures. Phenomena observed from discussions are further examined in depth only if they are problems common to other newly industrialized countries in terms of technological development; or, if they serve as stumbling blocks for a high-tech risk

1) Sensitive technologies refer to emerging technologies that are of highly risks and unpredictable social and ethical impacts such as genetic engineering, GMO, stem cell research, and the Biomedtech Island Project.

2) For this part we focus on discussions of »electronic medical records« in this article.

society that is weaker than those of Western advanced industrial countries and with double risks that may influence global risk governance.

2. Theoretical framework of globalizational risk governance

2.1 Technological policy and risk governance

Science and technological R&D competition has attracted the attention of countries around the world. Nevertheless, as information and communication technology breakthroughs continue to push developments within the global information economy, global competition surrounding science and technology continue to intensify (Stein 2002; Gibbons 1994). In other words, the globalization of science continues to stimulate an even fiercer international technological R&D competition. Even as they try to emulate global techno-industrial trends, the newly industrialized countries are attempting to dig out techno-industrial policies that will prove beneficial for their own individual niches (ibid).

Although fierce competition in the global technology industry has helped bring about global economic development, it is also a major factor in driving ecological and environmental destruction. With the emergence of criticism, such as the »small is beautiful« (Schumacher 1989) movement in the 1970s and the paradigm of sustainable development in the 1990s, more and more people are pushing for states to be transformed from a »technological regime« aiming at winning the global technological R&D competition and innovation to a regime that is concerned about sustainable living and development (Smith 2001). In fact, the technological policy decision-making model that values economic and technological R&D competition is being challenged severely. The traditional model in which technocrats and science elites dominate technology development policy has had positive impacts (Gottweis 1998). However, since risks surrounding global ecology, health, society, and ethics are involved, governance dilemmas have been raised. On the one hand, technocrat-dominated regimes have been facing crises in public trust on policy decision-making quality; while on the other hand, they are being challenged by trans-regional risk governance. Hence, nationally, the legitimacy of technological policy, which lacks democratic decision-making, is being critically debated (Irwin 1995; Fischer 1989; Jasanoff 1990). Globally, technocrat-dominated regimes are being examined to assess their capacity for global risk governance.

When doing risk assessment and risk management, technocrat and science elite dominated regimes tend to apply positivist scientific evidences as the fundamental authority for decision-making and likewise they deem that technological assessment should be done in accordance with objective and neutral scientific rationality in order to eliminate political intervention and undermine the social value of non-scientific rationality (Wynne 1980; Rutgers & Mentzel 1999). Such a positivistic based risk assessment paradigm has been the main primary source for world technocrats' technological policy decision-making. This line of reasoning deems national technological policy and social engineering as parts of a broader process of »scientification« and insist that all political and policy affairs must be evaluated and implemented according to the ideals of positivism and scientific rationality. However, such an authoritative and scientific decision-making ideology encountered governance dilemma while facing disasters and threats (Hoppe 1999).

Therefore, as contemporary risks surrounding globalizational and sensitive new technologies involve more and more uncertainties (such as cross-border technological impacts which are uncontrollable, uncountable, irrecoverable and non compensable) (Beck 1993; Ravetz 1999; Chou 2003), unilateral scientific positivistic centered risk assessment begins to lose its effectiveness and is in need of a new risk governance paradigm.

In recent years, technocrats around the world have begun to experience public distrust and bitterness regarding technological and risk policies. In response, public policy makers in recent years have moved in three fundamental directions: the enhancement of the transparency of decision-making processes, the construction of models of public participation and decision-making, and the differentiation of scientific risk assessment and risk governance (Marchi & Ravetz 1999; Löfstedt 2002). From the perspective of post-normal science (Marchi & Ravetz 1999), when considering various kinds of trans-regional risks and threats which are caused by the rapid development of new technologies, many scholars indicated »traditional authoritative and centralized technological policy decision-making becomes unable to react to rapid social changes and dilemmas after risk outbreak« (Healy 1999; Luks 1999; Marchi & Ravetz 1999; Ravetz 2002). Further, the positivist scientific risk assessment model has been unable to respond to various types of uncertain ecological, healthy, social and ethical risks and as a result it is quite essential to develop a decentralized, transparent, diversified and open risk assessment and technological policy decision-making process (Gerold & Liberatore 2001; IRGC 2005).

Facing more and more complicated technological uncertainties, in order to reduce the drawback of a technocrat-dominated regime and to enhance the quality of technological and risk policy decision-making, and as well as to recover public trust on risk policy, the European Union (EU) and the International Risk Governance Council (Renn 2005) have proposed their own new risk governance paradigms. The Science and Society Action Plan (EU 2002) proposed by the EU affirms that risk governance includes risk identification, risk assessment, risk management and risk communication. Since risk issues involve scientific uncertainty, risk assessment and management strategies are differentiated in order to develop independent and transparent risk assessment to serve as the foundation for risk identification. On the other hand, risk communication and public participation are applied to serve as the guidelines for risk governance. Similarly, the IRGC document – IRGC White Paper No.1: Risk Governance – Towards an Integrative Approach (IRGC 2005), stresses that risk governance includes risk contexts and related risk policy in the decision-making process such as reactions to risk outbreak and to related regulations. In addition, the collection, analysis, and communication of risk information are important as well as these diversified political and social contextual factors often influence the overall final risk governance policy decisions. In other words, the political culture and risk perception formed in local societies are the crucial factors in risk assessment and governance.

In short, technological policy decision-making is being forced to face the challenges of the new risk governance paradigm. This is particularly true since the development of globalization, and the emergence of various kinds of technological risks in different fields and their respective impacts on ecology, human health, society and ethics. However, the above risks are often beyond the risk governance capacity of the technocrats and science elites who continue to adhere closely to traditional positivistic risk assessment. Hence, in order to ensure the quality and legitimacy of technological policy decision-making, public participation should be promoted in order to create a more democratic, transparent and diversified risk governance process. This could also serve as the fundamental basis for the public to learn, accept and judge the impact caused by collisions between technological development and as well as its subsequent risks.

2.2 *Glocalizational risk governance*

One crucial problem encountered by risk governance is that as different kinds of newly-developed risks become globalized, uncontrollable and unpredictable, they can have a global impact on ecology, health, society and ethics rather than simply a localized one; this phenomenon has been referred to as the »globalization of risks« (Giddens 2002; Bekkers & Thaens

2005) or also as »world risk society« (Beck 1999). These risks become globalized risks with the intense interactions and exchanges that occur between actors and networking nodes³ in the global society. That is, regarding the development and dialectics of globalization, »risk« attaches itself to the general phenomenon of globalization and in turn develops into the so-called »globalizational risk« (Chou 2003). Although risk formation is influenced by globalization, what is important are its distinct features, definitions and the connotations embedded in the diversified political, social, psychological, cultural and institutional contexts in local societies (Beck 1986; Slovic 2001; IRGC 2005; Kasperson, Jhaveri, & Kasperson 2005). From the perspective of cultural anthropology, such contextualistic local risks bring about echoes, dialectics, influences and stimulation in response to globalization and these responses in turn help create »glocalizational risks«⁴.

Different societies have unique patterns and operational logics in place, which are securely embedded in cultures, events and historical traditions in local societies. These patterns inform a country's political and governance models. As the risks associated with globalizational enter local societies they experience distinct political, institutional and cultural conflicts. Examining the issue from this perspective, there are two interesting points to make an analysis of glocalizational risk governance. First, technological policy decision-making models, stakeholders, politics and cultures in local societies are the primary points for observation. More, globalizational risk governance structures and problems evolve out of specific historical contexts. Second, one issue in need of further examination is how glocalizational risk governance structure and culture stimulates, offers feedback, and poses influence on globalizational risk governance so as to bring about dialectics which respond to general globalization.

In such a context, it is clear that risk governance in newly industrialized countries is a subject worthy of further observation. From the perspective of »systemic risk« proposed by the OECD (2003), structural problems derived from political, social, cultural and scientific systems in newly industrialized countries have their own unique traits. On the one hand, internal political, economic, cultural, scientific and technological developments in these countries have been chronically dominated and influenced by advanced industrial countries. However, due to the compression of industrialization and globalizational technological R&D and economic competition, various aspects in local societies, including institutional, scientific, cultural and social factors, are being compressed and unbalanced by the frantic urgency of global economic competition. On the other hand, in these newly industrialized societies, decision-making, formulation and implementation of technological policy are usually dominated by technocrats and science elites. Although the state's role as a »leader« in society in the past has been transformed into the role of »custodian«⁵, there is still a pronounced cultu-

3) Here, Castells' (1996) sagacious idea of »network nodes« represent the relationships between the author's ideas of globalizational and glocalizational risks. Basically, they are mutually mobilized and stimulated. And, the dialectics raised would pose influences on both of them. No matter a risk stem from which node (regional or country), it will be spread to local societies worldwide according to its cause capacity, thus develop into mutually affected dialectical relationships among local societies. For instance, after the outbreak of 911 Attack, political, economic, social and cultural dimensions have been under immeasurable threats. Thus, globalizational terrorism, cultural confrontation, economic depression, and new political cod war were caused.

4) In terms of the idea of Robertson (1992) and Appadurai (1998), the author further develop the thesis of glocalizational risk, which basically includes the followings: 1) features of globalizational risk formation and their relationship with globalization; 2) the impact that political, institutional and cultural context have on local societies reaction to glocalizational risks? 3) how should we analyze the dialectical and mutual influence processes which result from globalization and glocalization.

5) The role of »custodian« highlights one aspect of the conventional role of regulator. All states formulate and enforce rules, but the thrust of rule-making varies (Evans 1995; Hsu 2002).

re of centralized policy decision-making and authoritative domination. By the same token, even though the »instructor« has successfully performed the role of promoting the development of the information and communication industries within the structure of the global original equipment manufacture (OEM), many problems still have yet to be resolved, including ecological destruction and social inequity. Still, with the development of highly sensitive and disputable technologies, more transparent, open and diversified risk communication and policy assessment are needed as traditional technological policy decision-making models in developmental states continue to encounter legitimacy challenges.

For newly industrialized countries, no matter whether for making decisions of scientific or technological policy, they still tend to follow the operational model of traditional developmental states in dealing with risks. However, on the other hand, they are under great pressure from globalized technological R&D as well as from economic competition. Thus, society itself begins to lack the capacity to criticize and examine itself introspectively. As a result, systemic gaps form (Chou 2002, 2004). This phenomenon accordingly evolves into the »systemic risk« proposed by the OECD, or, in other words, the »double risk society«⁶ – a hidden and delayed high-tech risk society. With this in mind, in the context of this paper, the policy decision-making process surrounding the Taiwan Biomedtech Island Project will be examined to see if such an authoritative and centralized policy decision-making model is able to respond to sensitive and highly-disputable technological risks and is capable of reacting to social challenges. In addition, it will examine how the paradigm conflicts of risk assessment and risk discourse emerged in the wake of these debates. From a discussion of the above arguments, the following paragraphs intend to explore the special structural problems associated with risk governance culture in local societies and impact on global society.

3. Technological policy decision-making and risk governance in the Taiwan Biomedtech Island Project

3.1 Technological policy decision-making contexts

As a newly industrialized country with an eagerness to learn and catch up with the advanced technology of the developed world, the Taiwan government has devoted itself to promoting techno-industrial policies in the information, electronics, chemistry, and biotechnology industries. It has attempted to create local niche in the environment of fierce global competition and industrial division (Chou 2000). With the cold war and the prevalence of national authoritarianism as a backdrop, technocrat and science elite dominated technological policy decision-making model became the pronounced feature of developmental states since the end of 1970s (Evans 1995). In the 1980s, as the technocrat-dominated policy making mechanism was being challenged by a creeping democratization in Western industrial countries (Jasanoff 1990; Dryzek 1997), technocrats continued to enjoy their authoritative and instructive role, even until the 1990s when authoritarianism in the developmental state had already faded away (Hsu 2002). At that time, in directing technological and industrial policies, technocrats and science elites were still in possession of their top down directive mechanism. Such an authoritative and centralized technological policy decision-making model continued until now, and has become a longstanding tradition of scientific policy operation in government sectors. It was not until the year 2000 that this system began to face oncoming social challenges.

6) In Chou (2000, 2002, 2004) successive examinations of Taiwan's technological policies, such the risk »time bomb« (Beck 1993) formed by the »systemic gap« will seriously accumulate society's risk governance, especially the public's distrust of disputable technologies. Similarly, the public also failed to trust the government's capacity for risk governance.

Within such an international environment, technocrats and science elites began to propose the construction of a Taiwan Biobank in 2000. In 2003, an initial deposit of 3,312 samples was made to the Biobank. In 2004, a large-scale genetic database of 500,000 samples was proposed to open the Taiwan Biobank – a figure which mirrored that of the UK biobank (Liu 2004; Chou 2005a). In this context, the Taiwan government first announced the proposal of a Taiwan Biomedtech Island Project in December 2004 and formally began the project with an initial investment of 15 billion NTD (est. 375 million euros) (Hsie 2004).

This significant national technological policy includes three subprojects: the National Health Information Infrastructure (NHII), the Taiwan Biobank itself as well as a clinical trials research system. All of these are instructed by the Science and Technology Advisory Group of the Executive Yuan, an organization made up of science elites who supervise policy formulation and information communication. The main focus of the project is to make a connection between the genetic-pharmaceutical and information industry by combining Taiwan's existing niches in information engineering with of the NHII subprojects, creating an EMR system (electronicalized medical record), and the establishment of the Taiwan Biobank. At the same time, the government planned to develop biomedical technology research that matches »Bio-IT« development in order to expand the potential but crucial markets of genetic-pharmaceutics and genetic therapy. The government aims to establish Taiwan as the premier »Research Centre for Genetic Medicine and Clinical Studies« in Asia (Science and Technology Advisory Group of Executive Yuan 2005).

By coordinating the activities of different governmental, academic and industrial sectors, the Taiwan Biomedtech Island Project actually involves two great risks. The first relates to the establishment of a large-scale genetic database; the second relates to the circulation, calculation, delivery and duplication of electronic information. Both of these risks involve other concerns including information divulgence, social discrimination and breaches in ethics and human rights. However, policy decision-making powers lay with the science elites ensconced in the Academia Sinica's Institute of Biomedical Sciences (IBMS) who dominate the overall process of scientific counseling and policy decision-making in Taiwan. With the intense top down network which combines technocrats in the Science and Technology Advisory Group of the Executive Yuan, the National Science Council (NSC) and the Department of Health (DOH), national science resources have been mobilized to fully support this official techno-industrial R&D project (Lie 2005).

Shortly after the policy-making process of this technological project, local scholars criticized it saying that there is no complete privacy protection mechanism in place designed to ensure and protect the rights of genetic sample donors; they claim in fact that the whole policy decision-making process appears to be some kind of black box operation (Chen 2003). The Taiwan Biobank establishment fails to fulfill the four governance principles proposed by Science and Society Action Plan (EU 2002): accountability, accessibility, transparency and participation. Usually, risks stemmed from Biomedtech Island Project involving ethics, human rights and society, but they are not supervised under public scrutiny (Liu 2004; Chou 2005a). Further, compared with the risk governance mechanism of the UK Biobank (Petersen 2005), the Taiwan Biobank lacks critical introspection and professional and public consultation.

Although technocrat-dominated risk assessments of the Taiwan Biobank have acknowledged the emerging ethical and social disputes; in fact, it still closely follows the positivistic scientific risk assessments. As Wynne (1996) indicates, the government has tried to develop mainstream institutional scientific discourses such as »World Chinese Genetic Research Center« in order to facilitate the construction of a racial genetic database and to strengthen the importance of national technological R&D. Also the government appears to believe that

risk disputes involving ethics, human rights and social questions can be resolved by regulations alone. They have even devalued social scrutiny of the program, labeling critics as ›reckless‹ (Chen & Shen 2006). In other words, technocrats and science elites hold a simplistic view of risk assessment and tend to overlook the great social risks involved in the establishment of a genetic database. They have not really examined the possible risks of breaches of privacy, information divulgence, social discrimination and ethical problems in the process of saving, preserving and managing data. Instead, they believed that strengthening policy regulation and risk governance could reduce these risks, which seems to indicate that they do not truly understand the importance of discretion in the creation of a gene collection system and a genetic database proposed by UNESCO's Universal Declaration on the Human Genome and Human Rights (UNESCO 1997).

Similarly, a subproject of the Taiwan Biomedtech Island project – NHII encountered social disputes as well. For the establishment of the Taiwan Biobank, there are potential risks in the divulgence of personal and group genetic information. For NHII, there are the potential risks of EMR circulation and divulgence. In facing the challenges of new technological risks, if technocrats and science elites keep applying given risk assessment and risk communication models and continue ignoring the existence of risks, they will become trapped in paradigmatic conflicts of risk governance.

3.2 Information risk dispute and social movements

Taiwan Biobank, NHII and Bio-IT in the Taiwan Biomedtech Island Project all involve computer calculations and information circulation systems. Therefore, it is possible that there are risks in the process of managing, exchanging, duplicating and using related information. More, for the promotion and development of the medical industry and in order to reduce costs, governmental sectors have begun to encourage the exchange and delivery of EMR and electronic medical images. Thus, in 2005, the National Health Information Infrastructure was launched (Science and Technology Advisory Group, 2005; Department of Investment Services, 2005). The policy calling for the creation of an EMR system and an intra-hospital medical information exchange and circulation included in NHII are similar to the Taiwan Biobank project and they all face serious risk challenges to information security.

In the past decade, new academic connections among scholars involved with information technology, human rights, society and gender coupled with the frequent outbreaks of information divulgence cases, helped usher in a new information risk discourse that was different from that of the government. In 1994, the Taiwan government planned to combine the functions of the National ID card, the NHI Card and personal fingerprints onto one electronic National IC Card. In 1998, a comprehensive new social movement seeking to offset the information risks began to emerge and in the same year, the Personal Information Protection Alliance of Taiwan successfully mobilized an Anti-National Card movement, which served to dilute the program. In light of the failure of the National IC Card policy, the DOH decided to separately formulate an electronic NHI IC Card. Together with the adoption of the Electronic Signatures Act, the new EMR system enabled policy makers to save medical records in one NHI IC Card. However, this idea was savaged by human rights and patient groups. In August 2002, the Personal Information Protection Alliance of Taiwan, which connects tens of social movement groups, was founded and was formed in opposition to the idea of combining EMR in NHI IC Card. Regardless of the objections, the NHI IC Card policy started on July 1st 2003. However, only limited information was recorded, such as doctor diagnosis, description of illnesses and examination items. In 2003, the ›Fingerprint Collection with New ID Card Issuance‹ policy was implemented and in response social movement groups gathered again and two years of social protests followed. In September 2005, through the

strategy of »constitutional release by grand justices« in the Constitutional Court, the policy intending to collect the biological features of nationals in the name of ensuring social security was stopped. These issues raised international concerns and criticisms as a similar law, the Identity Cards Bill was passed by the United Kingdom Parliament in 2004 (Chou & Chang 2006).

To summarize, opposition to the »Anti-National IC Card«, »Anti NHI IC Card«, »Anti-Fingerprint Collection with New ID Card Issuance«, and Taiwan Biobank in the past decade, focused specifically on security, management, circulation and the utilization of personal information. Information risk movements developed in local societies and were directly related to the main idea of the Taiwan Biomedtech Island Project – to exchange and deliver genetic and medical information. From the perspective of risk assessment of technological policy, it is clear that technocrats put the heaviest stress on effectiveness and development. They insist that as long as there is good risk governance, the problems of privacy divulgence can be resolved. In other words, technocrat-dominated decision-making was limited in the model of traditional positivist scientific risk assessment. They believe that the risk of possible privacy divulgence is controllable. However, such a simplistic view of risk assessment will not clear public doubts, especially criticisms from health reform, human rights, patient, and sex-worker groups.

In analyzing the government's policy promotion of the above projects, it is clear that there are structural problems in the corresponsive risk assessment and risk communication procedures. Basically, technocrats and science elites held fairly positive attitudes towards the following issues: »National IC Card«, »NHI IC Card«, »the creation of an EMR system«, »Fingerprint Collection with New ID Card Issuance«, and »National Health Information Infrastructure«. Table 1 compares the following development aspects: »decision-making agency«, »main discourse«, »official risk assessment«, »social movement«, and »risk communication and results«. Regarding risk assessment, the technological policy-makers have strongly embraced the positivistic viewpoint in their belief that risk control and damage prevention are possible. As long as information management and circulation security measures are implemented, damages will be only minimal. Regarding risk communication, they deem that continuous communication with social movement groups and public education are needed for smooth policy promotion. Hence, they advocate an overall governance strategy that tends to be a formalistic social assessment with instrumental regulation amendments for policy promotion. Such operations represent a top down and authoritative decision-making process. Under the traditional risk assessment model, the government does ignore some problems (such as information and social uncertainties) that are caused by sensitive technologies. Thus, risk assessment and risk communication are operated in the most cost effective way possible. For example, technological projects and policies with personal information on individuals, clans, and ethnic groups were not perfectly evaluated before implementation and thus resulted in fierce criticism from social movement groups. The government did not perfect its precautionary strategies until after it suffered serious losses in public trust.

In fact, in developmental states, technocrats and science elites continuously apply the logic of technological R&D, industrial development, information security and management application in policy promotion. Aside from serious criticisms from social, gender, human right and patient groups, they also have to deal with numerous crimes and related disputes occurring in Taiwanese society. All of these results are products of information and medical record divulgence. Since 2000, information divulgence cases have emerged in an endless stream. For instance: information on Taiwanese citizens was sold to detective agencies and tabloid magazines by policemen in Miao-li County (Taiwan Association for Human Rights 2002), customer information was sold to fraud groups by Chunghwa Telecom (Huang 2004),

student information was divulged to insurance companies by National Ping-tung University of Science and Technology (Taiwan Association for Human Rights 2002; Zeng 2004), and the mishandling of medical information has also occurred (out-of-date paper medical records were discarded by Chang Gung Memorial Hospital – Lin-co Branch and Mackey Memorial Hospital – Hsin-chu Branch) (Zeng 2006; Chen 2006). Outbreaks of these risk issues resulted in a great deal of information crimes and had a significant social cost. Ironically, this is the result of valuing techno-industrial superiority rather than information security. Paradoxically, these serious risk issues were not cautiously deliberated in national technological policy assessments, and were seriously ignored by the technological policy-makers. Apparently, technocrats and science elites were too over confident and believed that regulation modification would be sufficient to resolve any problems that emerged. The consequence is that serious information divulgence and related crimes have become fuel for social movement groups critiquing national technological policies (Chou & Chang 2006).

Structurally speaking, with the fierce global technological R&D and economic competitions, the technological policy-makers in developmental states tend to promote national medical industry in terms of ignoring social and ethical risk concerns. In facing newly-developed sensitive risk disputes resulting from genetic engineering and the information technology industry they like to apply limited positivistic scientific risk assessments similar to those put in place by industrialized Western countries. The network composed of technocrats and science elites still dominate technological policy and they have grown accustomed to applying authoritative and top down guidelines for policy decision-making. Hence, in analyzing this dual policy decision-making structure, we can see there are risk governance problems in this type of de-contextual developmental state that ignores technological risks.

Table 1: Comparison of Risk Issue Development

Technological Policy	Decision-making Agency	Main Discourse	Official Risk Assessment	Social Movement	Risk Communication and Results
National IC Card (1998)	Ministry of the Interior	To include information of household register, banking, health insurance and fingerprints.	Involving risks of privacy and information divulgence, social discrimination and crime. Formally, legal institutions should be amended.	Popular Alliance against the National IC Card System – academic-based social movement with an »anti-expert« argument.	The government was forced to stop the project and to start risk communication.
NHI IC Card and EMR (1999 to present)	DOH	To include medical records in NHI IC Card	Involving risks of privacy and information divulgence, social discrimination and crime. Formally, legal institutions should be amended.	Personal Information Protection Alliance of Taiwan – academic-based social movement of »anti-experts«.	The government was forced to communicate with patients and human right groups. However, NHI IC Card policy and EMR are still being promoted.
Fingerprint Collection with New ID Card Issuance (2002-2005)	Ministry of the Interior	To record and store biological features of nationals by computer systems.	Involving risks of privacy and information divulgence, social discrimination and crime commitment. Formally, legal institutions should be amended.	Taiwan Association for Human Rights –Anti-Fingerprint Collection – academic-based social movement of »anti-experts«.	Paradigm conflicts among the government and human right groups. Policy was stopped because of constitutional violations. However, afterwards, up to 68.5% of the participants still supported the states drive to collect fingerprints of citizens ¹ .
Taiwan Biobank (2003 to present)	Science and Technology Advisory Group of Executive Yuan, DOH and NSC.	To establish a genetic database including 200,000 samples recorded by computer system.	Involving risks of privacy and information divulgence, social discrimination and crime commitment. Formally, ELSI research should be done. »Protocol of Personal Data Protection Law« should be amended for the policy.	Supervision and criticisms of Taiwan Association for Human Rights and aboriginal groups – academic-based social movement of »anti-experts«.	Science elites were forced to converse with the public. Original blood collection plan in 2006 stopped.
NHII (2005 to present)	Science and Technology Advisory Group of Executive Yuan and DOH.	To promote intra-hospital exchange and circulation of medical information with the NHI IC Card project.	Involving risks of privacy and information divulgence, social discrimination and crime commitment. Formally, ELSI research should be done. »Protocol of Personal Data Protection Law« should be amended for policy.	Supervision and criticisms of Taiwan Association for Human Rights.	The government tries to develop the reflections of ethical and legal dimensions with scholars.
1 The author had done a national telephone survey after the Council of Grand Justice announced that »fingerprint collection policy« is a breach of the Constitution on September 28th 2005. The survey was done during November 2nd 2005 to November 17th 2005. As many as 68.5% of the respondents agreed that »the state can collect citizens' fingerprints and to establish Citizen Fingerprint Database«, while only 28% disagreed. The question being asked was »Do you agree with the MOI policy of collecting citizen fingerprints and to establish a Citizen Fingerprint Database?« 30.2% of the respondents strongly agreed; 38.3% of them agreed; 15.2% disagreed; and 11.8% strongly disagreed. The fields of sample collection included the island of Taiwan, Kinmen, Matsu, and the Pescadores. Subjects over the age of 18 were selected by the Computer-Assisted Telephone Interviewing system. 924 valid samples were collected with the standard error of ±3.29%, confidence level of 95%, 14-80% completion rate, and 35.59% rejection rate.					

3.3 Paradigm conflicts in risk discourses

Two risk paradigms can be gleaned from the above technological policy discourses. Not only do the risk discourses address different technological policies; the systemic debates within these two paradigms are also crucial. It is also important to know what kinds of influences risk governance will cause in their impact on local technological policy.

Discourse Group (I) emphasizes the technological security of biofeature and electronic medical information systems and the issues to be examined to reveal this paradigm include the following: the Ministry of the Interior promoted the policy of »Fingerprint Collection with New ID Card Issuance« through a computer recording systems (1995); the inclusion of household registry, banking, health insurance and fingerprint information on the »National IC Card« (1998); NHI IC Card and the creation of an EMR system (2000 to present), the »Citizen Fingerprint Database« (2001); Taiwan Biobank (2003); and the Taiwan Biomedtech Island Project (including Bio-IT and NHII) (2005). This discourse group emphasizes public security effectiveness, the reduction of health insurance costs, the valuing of technological R&D and economic development. The fundamental base of Discourse Group (I) is the certainty of technological risks; in other words, the paradigm is quite instrumentalistic.

Discourse Group (II) emphasizes the high technological uncertainties in terms of information storage, management, exchange and circulation of biofeature data and the electronic medical information system. These technological risks include the social and ethical impacts which result from information divulgence. From past issues, it can be seen that many different discourses from sociologists, human right scholars, and social movement groups have emerged in recent years. From the National IC Card debate in 1998, they raised some critical issues, such as privacy protection, information divulgence, commercial crime, and social discrimination (please refer to Table 2). Then, from the NHI IC Card policies and the EMR system drive (2000), social movements began to emerge which coalesced around »Anti-Fingerprint Collection« (2005), criticism regarding the Taiwan Biobank (2005), and supervision of NHII (2006). Discourse Group (II) has chronically fought against the discourses of Discourse Group (I) and what has emerged is a paradigmatic war over the efficacy of positivistic scientific certainty.

The special policy decision-making model and culture in local society has formed the paradigm conflicts between the two discourse groups. We can call this debate the confrontation between »security/effectiveness« and »human right/uncertainty of technological risks«. Using the Taiwan Biomedtech Island Project as an example, there has been a serious confrontation between »technological R&D/economic development« and »information divulgence/social and ethical impacts.« In terms of risk society theory, discourses surrounding these two paradigms have stemmed from the production logic of »simple modernity« and »reflexive modernity« (Beck 1986; Chou & Chang 2006). The ideology of »simple modernity« lies in the logic of positivism, scientific certainty, countability and controllability. The »reflexive modernity« paradigm was deduced from the contradictions and uncertainties which have emerged alongside technological civilization. Thus, the logic of scientific development should be cautiously and preventively reconsidered in terms of spreading networks of transboundary risks (Ravetz 2002).

Basically, the discourses advocated by these two groups have created a phenomenon in which the positivist technological policy decision-making model of technocrats and science elites has been challenged by social movement elites' arguments regarding technological uncertainty. This shift reflects the impact of the paradigmatic shift and the tension it has created in a local society which clings to the ideology of »valuing technological R&D, ignoring risks«. Also, the paradigmatic conflicts between the two discourse groups and in fact the legitimacy of such a centralized and top down technological policy decision-making model is

Table 2: Paradigm Conflicts of Risk Discourses

	Discourse Group (I) »simple modernity«	Discourse Group (II) »reflexive modernity«
Main Discourse	Public security, effectiveness, technological R&D and economic development.	Human right breaches, technological risks, information divulgence, social and ethical impacts.
Logic	Simple modernity	Reflexive modernity
Epistemology	Scientific certainty	Scientific uncertainty
Foundation	Based on the certainty and security of biofeature and an EMR system. Emphasize on information security control.	Arguing there is high uncertainty for preservation, management, exchange and the circulation of biofeature and electronic medical information.
Actors	Technocrats and science elites who possess counseling resources.	»Anti-expert« groups including sociologists, human right and information scholars, and related social movement groups.
Main Issues	<ul style="list-style-type: none"> • 1995 – »Fingerprint Collection with New ID Card Issuance« policy by the Ministry of the Interior – preserved by computer systems. • 1998 – »National IC Card« – combining information from the household registry, banking, health insurance and fingerprints. • 2000 to present – »NHI IC Card« and the creation of an »EMR« system. • 2002 – »Citizen Fingerprint Database« • 2004 – »Taiwan Biobank« • 2006 – »National Health Information Infrastructure« 	<ul style="list-style-type: none"> • 1998 – »Anti-National IC Card Movement« – risk discourses on privacy breach, information divulgence, commercial crimes, and social discrimination resulted from scientific uncertainty. • 2002 – Social movements against »NHI IC Card« and »EMR« policies. • 2005 – Social movements against »Fingerprint Collection«. Suggestions on violations of the Constitution. • 2005 – »Taiwan Biobank« project was criticized as a possible human rights breach and a social/ethical risk.
Features	Utilizing the strategy of risk governance and technological R&D competition to promote functional national tasks, including information management systems of genetic database, biofeature, electronic medical information, and biometric verification .	Any large-scale genetic, medical and bio-IT system cannot be perfect in its preservation, storage, management and utilization of information. Besides the social risks caused by information divulgence, state monitoring would also cause violations of human rights.
Impacts on technological System	Trust in controllability (able to preserve confidentiality and information security), amendability (the worth of sacrificing human rights for public security/effectiveness/technological R&D/economic development), and recoverability (the ability to rebuild personal reputations after an information divulgence) of biofeature and electronic medical information systems.	Insisting on uncontrollability (it is possible to duplicate, falsify and steal computerized data), unamendability (sacrificed human rights cannot be made up); and irrecoverability (there is no way of rebuilding personal reputation if suffering from information divulgence) in using computer system for preserving biofeature, genetic information, and EMR.

	Discourse Group (I) »simple modernity«	Discourse Group (II) »reflexive modernity«
Social Impacts	Technological instruments should be utilized to improve social security and administrative effectiveness, and to strengthen the abilities of technological R&D and economic development in order to respond to globalizational competitions.	Once information is divulged, uncoun- tability, unamendability and irreco- verability results including privacy divulgence, social discrimination of in- dividuals, clans, or ethnical groups, and related crimes. The society is thus threatened by globalizational risks.

Concerning the NHI IC Card and EMR policies, the main idea of the DOH is that the utilization of NHI IC Card will enhance administrative effectiveness by recording the time of visiting a hospital, the division visited, prescription details, and medical expenses. Also, the system would avoid repetitive prescriptions and guide patients to not see a doctor for trivial illnesses thereby reducing medical resource waste (Liberty Times 1999). Regarding the security protection mechanism, the Bureau of National Health Insurance (BNHI) stressed that the NHI IC Card ensures confidentiality. Each card holder has a PIN number to lock information in his/her NHI IC Card, except with an individual's approval, and thus there is a low possibility of information divulgence (Christian Health Care Alliance 2002). At this point, Discourse Group (II) proposed its own criticisms of the system from the perspective of scientific uncertainty. Therefore, it should be clear there is no perfect information security system. Based on the assertion of privacy violation, the HIV/AIDS Rights Advocacy Association of Taiwan (PRAA) and the Taiwan Association for Human Rights were also against the NHI IC Card and EMR policies.

Regarding the establishment of a »Citizen Fingerprint Database«, the main discourses of MOI officials focused on enhancing the speed of dead body identification, the improvement of social security, and facilitating the search for missing elderly people (Wang 2002). Although MOI officials' statements indicate that there is a possibility for privacy breaches, as long as there is good data management/control, the »Citizen Fingerprint Database« is practicable. While the »simple modernity« paradigm emphasizes social security and effectiveness, the »reflexive modernity« paradigm stresses scientific uncertainty regarding technological risks. Information experts have mentioned: »A computer system which is able to record millions of fingerprint data of all nationals and facilitates making comparisons with »unknown« fingerprints collected at the scene of crime must be designed with high specifications. However, the result may turn out to be – a computer system with a high cost but with a low rate of verification.« In recent years, »there are frequent cases of computer crimes and information divulgence, and as a result the public has come to distrust the government's crisis management and handling abilities. Thus, if the Citizen Fingerprint Database policy is to be managed by the government, we cannot say for sure that the fingerprint database will not be stolen and divulged. If so, disputes will be raised and there will be social costs even higher than those expected for promoting effectiveness« (Jang 2005). The establishment of a fingerprint database cannot be evaluated from only the dimension of data management/control and possible problems in fingerprint verification must be addressed as well. More, since there is a possibility that computer systems can be hacked into, discourses on controllability, countability and amendability of the »simple modernity« paradigm have failed. Advocates of the »reflexive modernity« paradigm have begun to worry about the oncoming »slippery slope effect« which causes a great deal of social uncertainty regarding these newly developed technological risks.

The »simple modernity« paradigm held by technocrats and science elites is also shown in the risk assessment and policy formulation of the Taiwan Biomedtech Island Project. As

mentioned above, the project will combine complete household registry with health insurance records, the distinct genome of Taiwanese citizens, intra-hospital information circulation and exchange, and Bio-IT industry mechanisms for upgrading genetic medicine and bio-IT industries in Taiwan. However, complicated problems are involved, such as personal autonomy, privacy rights, information confidentiality, social ethics, benefit sharing of research results, and the appointment of directive agents. Compounding these risks, there is insufficient legal regulation currently in place in Taiwan. At this point, the government is being seriously criticized by the Taiwan Association for Human Rights.

Liu, Ching-yi (2005, 2006), vice president of the Taiwan Association for Human Rights, criticizes that »this project involves great national resource input and it relates to the rights and welfare of all citizens« (ibid.), so not only simply a »scientific theses«. Hence, »it is essential to build an operational model in accordance with life ethics and the principle of justice« (ibid). Also, she strongly criticizes technocrats and science elites for »ignoring human right and research ethics« (ibid.), because with the support from DOH, NSC, MOI, and other related organization, the establishment of the Taiwan Biobank has been marked by its secrecy. »While the Taiwan Biomedtech Island Project has been undertaken, NHI IC Card projects, EMRs, and Taiwan Biobank are all major national projects which are lacking scrutiny« (ibid). The paradigm of Discourse Group (II) attempts to outline the social, ethical and human right risks that stem from the Taiwan Biomedtech Island Project. It also requires a more transparent policy decision-making model, diversified communication strategies, and democratic participation. Arguments of Discourse Group (II) also challenge the legitimacy of Discourse Group (I) arguments by pointing out that the technological policy decision-making model used in the traditional positivist risk assessment is unable to respond to newly-developed technological risks.

In brief, paradigm conflicts on risk assessment and discourses over the past decade reveal that the two groups hold different opinions about definition, range, decision-making and the resolution of technological risks. Discourse Group (I) argues that as long as we follow the positivist scientific view – to control, calculate and manage risks, combine technological R&D for biofeature and genetic medicine, it is possible to successfully utilize modern information and digital technological systems. Thus, within the limited boundary and definition of risk, the following traditional decision-making model can undertake a risk governance program. Discourse Group (II) argues that technological systems of biofeature and electronic medical information system involve high levels of uncertainty in the processes of managing, controlling and using these data. Also, these technological risks may be leaked out of the scientific community into local society thereby creating unpredictable harm to individuals, clans and ethnic groups.

It is because the field and definition of risk are highly socialized, risk governance must not be undertaken in an aboveground fashion. It must be an open model with responsibility, transparency, participation and accessibility in order to review social impacts caused by these newly-developed sensitive technologies. These are also the basic principles promoted by the EU (2002). However, the new risk governance paradigm proposed by social movement elites and by the government has often been under fierce assault. In developmental states, under programs to promote technological R&D and economic development, the paradigm shift has encountered some significant dilemmas.

4. Discussion and comparison: Glocalizational risk governance in a delayed and hidden high-tech society

As the major instructor and actor in national technology policies, technocrats and science elites continue to duplicate and generate institutional and positivistic mainstream discourses

(Wynne 1996). Also, within the environment of fierce global technology R&D and economic development, technocrats and science elites have also attempted to strengthen the legitimacy of the national interest competition by improving biofeature and medical information systems. Under this situation, the Taiwan Biomedtech Island Project has become a crucial target for catching up with developments in the genetic engineering and IT industries.

The dual decision-making structures in developmental states discussed in this article include the: 1) authoritative, top-to-down technocracy; and 2) its governance model and culture in terms of positivistic risk paradigm. Those are highly facing the problem of legitimacy challenged by the domestic society, which raises distrust in technocracy, and by the development of globalizational risk governance. Influences caused by globalization can be traced back to the worldwide anti-GMO movements of the mid-1990s. Beginning around the year 2000, there were paradigm shifts regarding risk control and risk governance of genetic engineering, IT industry, nanotechnology, and other related fields. For example, at this time, import bans on GMO, labeling regulations of GMO, and the announcement of the Convention on Biological Diversity, International Declaration on Human Genetic Data (UNESCO 2003); and regulations on research, collection, storage and management of genetic data were proposed by both the WHO (WHO 2004) and the EU (EUROPA 2002).

So far, the traditional technological policy decision-making model and risk governance paradigm are being challenged by the political and social environment. As a result, glocalizational special risk culture and structural problems have emerged. With respect to the research on GMO risk perception and public trust, Chou (2000, 2002 2004) indicates in his work that decision-making and risk governance models in newly industrialized countries are the main factors that cause »systemic gaps« among risk perception, information communication and social learning. Based on positivistic risk assessment viewpoints, technological policy decision makers and risk governors tend to ignore the existence of risks. Survey results from 2003, 2004 and 2005, regarding the great amount of imported GMO, show that over half of Taiwanese did not know why using GMO products is risky. They also did not know that the government ever propagated and communicated the health and risks associated with GMO to the public and did not know there is a labeling policy in place in Taiwan. Most of the people are unaware due to a sizable knowledge gap and information gap. These systemic gaps resulted in the reality that local society is unable to deal with risks and in fact, often hides the existence of risks. Thus, this special risk culture and structure have formed dialectically and meanwhile, systemic gaps in risk decision-making, governance models, and culture have resulted in a high degree of public distrust of technocrats and science elites. With national policy decision makers fully advocating the benefits of the new technologies, a delayed perception gap and judgment gap regarding technological risks has formed (Chou 2005a). This is the »systemic risks« that accumulate within these special social, political and cultural contexts (OECD 2003). It is also the »double risk society« emphasized by the author.

Such »systemic gaps« are likely to appear in paradigm conflicts in the biofeature and electronic medical information system as well. Such as arguments put forward by the movements against the National IC Card policies, NHI IC Card, EMR, and Taiwan Biobank. Basically, these risk movement groups are composed of experts and also patient, woman and environmental groups. In all, risk movement participation is restricted to experts and a few minority groups. Thus, less public mobilizations have been launched. Even though social movements were launched to boycott the implementation of technological policies with high-tech risks, the phenomenon in which the public has tended to blindly accept technocrats' arguments (valuing the benefits of technological development) cannot be changed. This means, to some degree, even elite-dominated »anti-expert« social movements cannot shake the impact caused by existing decision-making models and ideologies dominated by technocrats and science elites, and therefore, new risk governance paradigms remain trapped.

In analyzing risk issues in Taiwan, whether for disputes on GMO or the Biomedtech Island Project, the special technological policy decision-making models within a hidden and delayed high-tech risk society have been formed. Chou's research indicates that such a culture/structure with hidden risk and delayed risk governance has caused dilemmas for the risk governance paradigm shift in local society (Chou 2005a, b; Chou & Chang 2006). Thus, as a newly industrialized country eager to learn and catch up with advanced industrial countries, do other countries face a similar problem? Are there different glocalizational risk decision-making cultures that have formed? With loose policies and legal regulations in place, many newly-developed sensitive technological risks must be dealt with which would in turn have impacts on global risk governance paradigm.

What is certain is that this type of hidden and delayed risk governance culture and decision-making model have both globalizational and glocalizational meanings. On the one hand, these distinct risk governance dilemmas formed in local society face the challenge of fierce global technological R&D and economic competition. On the other, since there is weak risk governance over technological policy, systemic gaps and risks are generated cyclically. Thus, newly industrialized societies become rather weak in their response to technological risks. That is, newly industrialized countries (characterized by a double risk society) face more serious systemic gaps than advanced industrial countries do. The fragility of society in reaction to risks in newly industrialized countries lags far behind that in Western countries (Bijker 2006)⁷. Second, issues surrounding decision-making and risk governance in developmental states are not merely regional problems; instead, these issues could become international through the impact of globalization. Thus, such phenomena reflect a relaxation in risk governance around the world and form serious dilemmas for those confronting the next wave of risk governance.

5. Conclusion

New technologies such as genetic engineering, IT industry, and nanotechnology are continuously combining biofeature and electronic medical information systems in order to respond to the global trend of fierce technological R&D, economic development, and anti-terrorism. While on the one hand, high-tech industrial competition is ongoing, on the other, systemic tools for global anti-terrorism and national security are still being developed. In confronting these growing dialectical challenges, countries around the world are gradually beginning to address world crises that stem from globalization and technological competition. Also, they are integrating diversified and democratic new risk governance paradigms in response to the disputable, sensitive, and innovative systemic risks. From the analyses in this article, we see the conflicts and dilemmas of risk governance paradigms shift; all of which are embedded in the distinct political, cultural, social and historical contexts in societies worldwide.

In analyzing risk discourses and decision-making national technological policy disputes, we know that paradigmatic structural dilemmas have stemmed from a serious collision between top down/authoritative decision-making models and positivistic risk assessment culture. On the one hand, in the process of rapid techno-industrial development, the ability to cri-

7) By comparing »Eurobarometer – Risk Issues 2006« done by European Commission (2006) and Chou's successive survey results of the past three years (2003, 2004, & 2005) (Chou 2005a), it is observed that the trust rates in the risk governance capacity of the government in major industrial countries (ex: UK, Germany, France, and Finland) were about 60%, which is higher than that of Taiwan. On the contrary, the rate of distrust regarding risk governance capacity of the government in Taiwan was around 70% in the past three years (refer to footnote 71). The reason why may be there are stricter regulations in place for governing technological risk (ex: GMO).

ticize current situations in political, social, cultural and technological developments have been compressed, while on the other hand, the driving push of global technological R&D and economic competitions, means that the discourses of system security and scientific certainty continue to be at the disposal of technocrats and scientific experts who held negative attitudes towards risk control. This situation has resulted in the problem of a delayed and hidden risk culture and structure (double risk society). Concerned about the technological risk disputes discussed in this article, social movement groups have been launched protests for competing the risk discourses. However, as the government continues to push the old model of technological decision-making, the possibility of a successful risk governance paradigm shift does not seem probably in the short term.

The special risk governance structure in newly industrialized countries, which tend to heavily value technological R&D and industrial competition, has been systemically ignoring threats of technological risk. This is a major problem worldwide. Accordingly, many newly industrialized countries, especially those which rely heavily on technocrat and scientific elite dominated decision-making models, all face similar problems. The technological systems developed by modern human beings such as genetic engineering, IT industry and biofeature, are usually highly sensitive and disputable. In addition, they may result in the generation of unpredictable globalization risks and unintended consequences. In sum, risk governance dilemmas and the structures in place will have a major impact worldwide.

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