Disaster Prevention Strategies of an Asia Model in the 21\textsuperscript{st} Century: A Paradigm Shift and the Role of Japan

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## Abbreviations

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<tr>
<td>DiMSIS</td>
<td>Disaster Management Spatial Information System</td>
</tr>
<tr>
<td>IIASA</td>
<td>(Austria) Institute for Applied Systems Analysis</td>
</tr>
<tr>
<td>NIEs</td>
<td>Newly Industrialized Economies</td>
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<td>RSA</td>
<td>(Austria) Risk Management Department</td>
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Disaster Prevention Strategies of an Asia Model in the 21st Century: A Paradigm Shift and the Role of Japan

Executive Summary

1 Necessity of Comprehensive Analysis and Formulation of Policies Based on General Conceptual Scheme

The big question raised by the modernization of the 20th century equates to the objection lodged against an excess tendency towards the so-called division or specialization of task. For our purposes, this question mark raises the fundamental question of how disaster prevention—now subject to division of labor and specialization—ought to work. For example, hardware improvement such as structural reinforcement of buildings is an effective measure for disaster prevention in itself, but implementation of the measure in the society requires multiple verifications and certifications integrated with other policies, as if they were electric circuits connected to a power source. What is important is that these “circuits” must be interlinked with the entire multi-layered system as a foundation of cities or urban lifestyles. Okada et al established a conceptual model of the city or local community as a five-story vital system, based on the understanding that the whole multi-layered urban system as a system with five layers: natural environment, social schemes, infrastructure, land-use and built environment and life in community, in ascending order (see the figure below, in which each layer innately differs in time and space scale).

Future disaster prevention will essentially involve comprehensive analysis and formulation of policies based on a general conceptual schemesuch as this.
2 Lessons Learned from Great Hanshin-Awaji Earthquake

The following is among the lessons learned from the Great Hanshin-Awaji Earthquake.

- Inadequacy in emergency management and risk management and solution to it, as well as cross-sectional cooperation required in the event of an emergency.
- Management that is linked to the scope of everyday life.
- Creation of a social awareness that does not set the possibility of an abnormal situation as a taboo.
- Necessity of management that lights up the darkness of anxiety with intelligence, acknowledging that the darkness is the sea of uncertainty, and that opens up a new phase while each player confronts the situation doing their best in their own field, and combining for aggregate power.
- Need to challenge disasters with low-frequency high-impact risks (catastrophic risks).

3 Suggestions of Other Recent Disasters in Japan

- Lessons from the Tokai Heavy Rain Disaster (2000): A disaster evolves, is a city evolving?
- Lessons from the Western Tottori Earthquake: A disaster accelerating the process of depopulation; is it possible to develop some risk finance scheme as a brake against such tendency?
4 Emergency/Crisis Management and Risk Management

As “kiki kanri” in Japanese is called “emergency management” or “crisis management,” this concept assumes a condition in which a crisis (an abnormal situation), such as a disaster, has already occurred. On the other hand, risk management assumes a condition in which an abnormal situation may occur in the future, based on the acknowledgement that the situation is an uncertain one and other (socially desirable) situations may arise prior to the occurrence of the abnormal situation, and concluding that management is needed to decide what kind of measures should be adopted in advance. Therefore, while it can be said that emergency/crisis management and risk management are quite different in their nature in the narrow sense, in the broader sense, they are sometimes simply combined in the expression “risk management.” What is common to both types of management is the need to confront what people do not want to happen, without turning our eyes away from the condition, and to deal with the uncomfortable darkness with reason and rationality under the light of intelligence. To make Japan a developed country in the true sense of the term, now is the time to break away from the common evil, which tends to change a system only after an incident occurs, letting the fact tell every story, as if depending on the story. To do this, it may well become necessary for politicians on the national stage to seriously discuss a policy in which the management of events that people do not wish to happen is only possible by insisting on examining them as events that may still occur. This is, of course, a matter of them using their imaginations, as leaders or guides of the public and of society. Accordingly, this will necessitate “cross-sectional experts” on the management of safety and security, who support the acts taken by the politicians in a comprehensive way and persuade them.

5 Lessons Learned from Disasters in Developing Countries

The following two remarks can be made based on the two cases mentioned below:

1. India: effective safety standards only if socially implementable -> The need to work to establish affordable (locally tailored) performance criteria
2. China: urbanization causing a disaster
In the future, it will be critical to create a venue for living, the principal object of which is founded on the essential aspects of life (human life) and life (living). Therefore, sustainable maintenance of the quality of life in that sense and persistent improvement in the quality of life should be set as the main theme in creating a country, in creating a region and in creating a city. It is thus of decisive importance to conceive disaster prevention strategies in the 21st century within the framework of the theory of sustainable development. With a position and a mission of taking the initiative internationally to promote this movement, Japan should keep them in mind as it plays its role.
Disaster Prevention Strategies of an Asia Model in the 21st Century: 

A Paradigm Shift and the Role of Japan

1 Introduction

The 21st century is underway. What, we wonder, will it be like? The author believes that the 21st century will be marked by the emergence as a key issue of a reconsideration of the fact that safety and security are the primary grounds for creating a country, a region or a city again from the foundation. The affluence of our society today can be understood in multifarious ways in society’s growth phase, as we move from the 20th century—in which we achieved a certain degree of affluence—to the 21st century, surely life itself should be the greatest concern from both quantitative and qualitative aspects. And amidst this concern, a safe and secure living environment holds the key. Why? Because when it comes to the management of a country, region or city, it is essential to keep in mind as a fundamental concept that economic growth leads to better quality of life only when it is in harmony with improvements in safety and security.

Although the new century is still in its infancy, already Japan and numerous other regions around the world have suffered disasters, with tragic human loss and economic damage. The unprecedented terrorist attacks on New York and Washington D.C. that took place September 11, 2001 were a shocking and vivid demonstration of the truth that while terrorism differs from natural calamities, a major disaster can be created by a surprise attack by human beings against a vulnerable part of a city. Those terrorist attacks showed us that the World Trade Center—the symbol of economic growth in the capitalist world—was a house of cards when it came to the foundations of safety and security. Terrorism, which strikes without a declaration of war, attacking now here and now there with the speed and precision of guerrilla warfare, has finally led to a major disaster that paid no heed to the apparent affluence and prosperity of the target. And the same is true of natural disasters. Typical urban disasters include the Northridge Earthquake in the United States and the Great Hanshin-Awaji Earthquake in Japan, which struck in succession towards the end of the previous century. These examples raise questions about the modernization of the 20th century, which had paid little attention to making safety and security as the foundation of society or the region. Indeed, the urban disasters that occurred at the end of the 20th century should have
served as warnings for the 21\textsuperscript{st} century.

Looking at the situation in this light, it may be said that disasters and disaster prevention as management could, even except for some unusual disasters resulting from terrorism, hold the key to greatly changing relationships between countries, between regions and between cities in the 21\textsuperscript{st} century. At the same time, these 21\textsuperscript{st} century relationships are now requiring a significant change in the way we think about disasters and disaster prevention.

While the author has said that in the 20\textsuperscript{th} century we “achieved a certain degree of affluence,” this does not merely mean that the 20\textsuperscript{th} century succeeded in bringing about “affluence” from material and quantitative aspects. It also means that the 20\textsuperscript{th} century left numerous liabilities, which we have been forced to deal with. This is also true of global environmental concerns. The shadow of the liabilities left by the 20\textsuperscript{th} century, such as the confrontation between affluence and poverty represented by the North-South problem, urban and rural disparities, and the bipolarization caused by depopulation and overpopulation, is extremely dark, and the traces of these liabilities are profound.

Those of us who live in this century should create countries, regions and communities in which even more affluence can be achieved, using new intelligence and courage. This initiative will never succeed as long as we are merely satisfied with our own affluence, so the aspect of “continuity beyond generations” that enables affluence to be passed on to the next generation becomes essential. And we should not be satisfied with affluence only in our own region; rather a perspective of “a network beyond the region” becomes essential. It can be said that this approach is one of the major challenges for human beings since the dawn of history. This challenge will be possible only if people work together, but it also requires an appropriate leader. In the sense of the new century, an advanced country, region or city might be a natural for this leadership role.

A typical and basic issue in the 21\textsuperscript{st} century in this sense is the management of safety and security, and disaster prevention as management of a disaster is a frontier-like field that should be, in the new century, grasped and addressed totally and comprehensively.
2 From Fragmented Disaster Prevention (Disaster Prevention Segmented in Narrow Lanes) to Holistic Disaster Prevention (Disaster Prevention Networked)

The big question raised by the modernization of the 20th century equates to the objection lodged against an excess tendency towards the so-called division or specialization of task. For our purposes, this question mark raises the fundamental question of how disaster prevention—now subject to division of labor and specialization—ought to work. Without having to refer to Maslow’s Hierarchy of Needs, we know that this question means that the social services known as “safety and security,” which at their core should be for the most basic and overall stage of the society, have been transmogrified into fragmented disaster prevention. A fabric as a network with a broad scope that should encompass all aspects of safety and security without omission, today only functions as a fragmented bundle of threads. And this fragmented bundle of threads appears to come to a dead-end when each bundle proceeds down a fragmented series of narrow lanes. In fact, the route that connects each lane horizontally and the thought (orientation) that networks the overall picture are lacking. The new century has begun to demand that such dead-ends be corrected and that the approach be shifted from fragmented disaster prevention (dead-end disaster prevention) to overall disaster prevention (disaster prevention focusing on the network). In other words, these disparate disaster prevention approaches have become something like a series of narrow lanes, each of which aims to make quantitative preparations simply by following a single line. When a dead-end is reached, a new network needs to be built. In this sense, disaster prevention today needs to be reoriented towards comprehensiveness, so it has become essential that we review the shift from quantitative preparation to qualitative preparation, in other words, to reconsider just what is disaster prevention that drives improvement in overall quality of life.

3 Examples: Fragmented Disaster Prevention (Disaster Prevention Segmented in the Narrow Lanes)

Proof is better than an argument. Using an actual example and simplifying what is discussed above, let us look at it in more detail.
3.1 Lessons from the Great Hanshin-Awaji Earthquake (1995)

3.1.1 Disaster Prevention Not Ending Merely with the Reinforcement of Buildings: From Science and Engineering to Social Systems Engineering

Well over 6,000 human lives were lost in the Great Hanshin-Awaji Earthquake, with many dying after being caught in collapsed or partially destroyed residential buildings. And there were reports of more than a few cases in which people lost their lives after being crushed under pieces of furniture that fell down and hit them. Given these facts, the first thought that naturally comes to mind is one that sees hardware as a panacea. This thought says that the aim should be to reinforce the structure of buildings and believes that, if this reinforcement is done, the objective of minimizing the loss of life in an inland earthquake striking an urban region would be nearly attained. Of course, this thinking might be right if “minimizing” literally refers to the social possibilities of implementation. But if the meaning is not so literal, then following this single course of reinforcing building structures would not, unfortunately, bolster the network of safety and security that extends throughout the spectrum of society. In this sense, any principle that deems hardware as a panacea falls into the trap of fragmented disaster prevention.

Figure 3.1 demonstrates this fact in diagram form. Even if the building of hardware, which is namely the reinforcement of building structures, is the primary issue to address, it is essential to determine if this approach is feasible from a social aspect. Networked circuits of verification should be pulled out as if they were plugs for a power source, and these “plugs” should be linked. Overall, these plugs are linked to the social environment, the structure and the lifestyle in the region or city, which may be diverse. With the addition of the natural environment to the social environment and the structure and lifestyle of the region or city, Okada et al. introduced a conceptual model of “the system of a city/region as a living creature” that includes the social infrastructure and the building spaces as an ecological system with five layers. (See Figure 8.1. For each layer, the scale of time and space is inherently different. A detailed explanation on this point is given later.)
When an explanation is supplemented using this conceptual diagram, a building space that is independent as a group of individual buildings cannot be, in many cases, self-sufficient, and cannot appropriately ensure the possibility of social implementation. Thus, while the system of a city/region as a living creature is understood as an ecological system with five layers in an integrated manner, as this integration can never be self-evident and, on the contrary, each layer is apt to be fragmented and has an intrinsic inclination towards segmentation, there is always a bottleneck for the management of a city and a region. This bottleneck offers a place
of work for an individual expert involved in management, but it is apt to disrupt mutual communication and joint operations, preventing a cross-sectional expert (who is knowledgeable about the layers in a cross-sectional way) from appearing. In this sense, the management of each layer in a way that consistently contributes to a better quality of life, the top layer, should be one that performs mutual verification by pulling out the power plugs and interlinking them. And this work should be positioned at the core of disaster prevention in the 21st century, as cross-sectional work that mutually guarantees the possibility of implementation in society.

Now, let me describe the real image of the power plugs as a networked circuit for verification in a more specific way. To reinforce building structures from a social aspect, first, a new design standard should be suggested. Then, in that sense, social interpretation and embedding (institutionalization) become essential. The problem that emerges here is the meaning and the scope of “to do one's best as far as possible.” Does this mean to attain a standard that is satisfactory for an expert (not self-satisfaction!) in terms of the strength of the structure? Who will pay for the increase in expenses that is incurred in this case? How do we guarantee that a building is actually constructed to meet that standard? Will the structure be checked in advance at the stage of planning the building? Or will it be checked in the construction stage? Will the check be carried out in the form of an inspection or examination? In that case, who will pay for it? And so on. In this way, the story continues. There should be a circuit for verification, in which this series of questions are well connected and, if necessary, the questions should be fed back in the form of asking again the precondition of “as far as possible.” In fact, although what was mentioned above implicitly sets “a new building” forth as the premise, if a building is an existing building, things become correspondingly more complicated and the problem becomes difficult to handle. To renew an existing building and, moreover, to retrofit that building in connection with disaster prevention is not easy, although it might be easy to say. Even if a building is unqualified under the new standard, it is impossible to force people who already live there to evacuate. In addition, there are more than a few cases in which many of the residents are from low-income or elderly segments of the population, and lack the motivation to renew the building and the economic power to enable that renewal. And it is not rare that these regions are those that typically suffered from the so-called urban inner-city problems, so the root cause of the issue is connected to profound and complex issues of the city or region that can hardly be addressed by “fragmented disaster prevention.” And in the background lie cultural and social factors, as well as multifarious other factors related to historical and chronological development unique to the city or region. While these issues are sometimes internal issues of a country, city or region, in quite a few instances they appear on a global scale in the form of the problems between
developing countries and developed countries, or the so-called North-South problem. That is why disaster prevention requires a comprehensive approach in the context of a city or region or, if necessary, in the context of a country or in a global context.

In fact, the issues surrounding disaster prevention also closely question the very nature of disaster prevention and the experts involved in disaster prevention. In 20th century society, especially in the societies of advanced countries, “an individual expert” is a person of some reputation in his/her “special narrow lane (alley).” So, for the group of administrative/government experts who flattered themselves with the notion that they have been entrusted with a major part of disaster prevention, to do their best was within the scope of discretion that they had in private. It could be said that a principle of efficiency existed, focusing on the introduction of a specialized narrow lane based on good intentions. Needless to say, safety was enhanced to a certain degree for some time from a qualitative aspect. If this fact is not clearly stated, the introduction of specialized narrow lanes based on good intentions, the approach taken to date, would never be rewarded. Rather, as a result of insistently pursuing that principle, the conventional approach reached a decisive deadlock. And this is of course not a problem limited to disaster prevention. The problem is, even at that deadlock, the experts tend to push ahead with the conventional narrow lane in a straightforward way, aiming to break through the deadlock. But what is more important is the point that disaster prevention, which should at its core be a fundamental activity of the broadest range for a city and region, has under these circumstances instead been missing a comprehensive nature and mission, intent on building its own narrow lanes. And this pursuit of the social service of safety and security, which should be the most basic element in city and regional management, has been positioned outside of that interest as “a matter of self-evidence that avoids trouble at any cost.” Safety and security have been treated as extremely incidental and external matters, as special subjects managed by experts in disaster prevention. The author dubs this “independently undersized disaster prevention.” But the future demands that we collaborate in transcending this common evil and addressing the comprehensive issue in which safety and security are positioned at the center, and which lies in the range of disaster prevention as a management problem not only for a city or region but also for the entire global community. As will be discussed below, Japan must now acknowledge its qualifications and its mission of actively taking the initiative in that sense internationally, and must construct a system that translates this qualification and mission into action.

In short, the limits of disaster prevention are clear if it confines itself to the special fields of conventional science and engineering. An approach driven by “social
system engineering,” accompanied by society’s demands and by a number of plugs that enable verification, has now become an urgent issue to address.

3.1.2 The Absence of Emergency/Crisis Management and Risk Management

What suddenly emerged into the spotlight immediately after the Great Hanshin-Awaji Earthquake are the so-called “emergency/crisis management” and “risk management.” These two expressions were the keywords of the day, not only in the mass media but also at academic conferences. The clichés are that “There is no emergency/crisis management” and “Risk management is totally unreliable” in Japan, with the conclusion that these circumstances had made this earthquake more tragic than it needed to be. It appears that the two phrases have become part of society’s conventional wisdom, as the so-called “Basic Knowledge of Modern Terms.” Strictly speaking, however, the two expressions are not necessarily the same. For details, please refer to Appendix A and the References, but as “kiki kanri” in Japanese is called “emergency management” or “crisis management,” this concept assumes a condition in which a crisis (an abnormal situation), such as a disaster, has already occurred. On the other hand, risk management assumes a condition in which an abnormal situation may occur in the future, based on the acknowledgement that the situation is an uncertain one and other (socially desirable) situations may arise prior to the occurrence of the abnormal situation, and concluding that management is needed to decide what kind of measures should be adopted in advance. Therefore, while it can be said that emergency/crisis management and risk management are quite different in their nature in the narrow sense, in the broader sense, they are sometimes simply combined in the expression “risk management.” What is common to both types of management is the need to confront what people do not want to happen, without turning our eyes away from the condition, and to deal with the uncomfortable darkness with reason and rationality under the light of intelligence. This approach also means that conventional fragmented disaster prevention cannot respond to crisis situations. To sum up, both emergency/crisis management and risk management require cross-sectional thought and imagination, which dispense with the segmentation that has become the conventional wisdom in our daily life. To enable this thought and imagination to be implemented from social aspects, the creation of a social system to reflect the implementation and back-up provided by scientific methodology will become indispensable.

Now, let us consider emergency/crisis management and risk management using some specific examples.
(1) Absence of Emergency/Crisis Management and Its Necessity

In terms of emergency/crisis management, the primary constituents are (a) A constitution to work in a cross-sectional way that is required because of an abnormal situation, (b) Management that is linked to the scope of everyday life, and (c) Creation of a social awareness that does not set the possibility of an abnormal situation as a taboo.

a. Organizational Structure Enabling Cross-Sectional Collaborations Required in Abnormal Situations

Let me explain this element in emergency/crisis management using an actual example, at Nagata Ward Office of Kobe City. Nagata Ward is the region that suffered the most severe damage in the Kobe earthquake, and many residences and buildings in the residential zone and commercial zone collapsed totally or were partially destroyed. Further, fires broke out immediately after the earthquake spread, and a number of houses were burned down. While the Nagata Ward Office started restoration work after the earthquake, the ward office decided to launch an administrative service in which, once it was confirmed that it was necessary to dismantle and clear away damaged houses, the ward office would provide public assistance and would place a bulk order for the dismantling work on behalf of residents. As a result, there arose a situation in which the affected residents applied for a grant for that service, forming a line at the counter of the ward office. Then, given the emergency of the situation—since it was required to receive the applications as quickly as possible and to link those applications to systematic order placement for the dismantling of houses—it was decided that Professor Kameda and Mr. Kadomoto (Central Research Laboratory, Hitachi, Ltd.), a part-time lecturer at Disaster Prevention Research Institute, Kyoto University, among others would, as a test case, introduce a new Disaster Management Spatial Information System (DiMSIS) that could also systematically manage chronological change. And by having the residents use that system at the time of registration, they would provide support for the ward office's order placement operations for the dismantling work to make it as quick as possible. As a result, while this test proved to be quite effective, the key actually lies in the fact that the information system demonstrated its real ability as information media that guaranteed a structure that could work in a cross-sectional way, something that is essential in an abnormal situation. This was because the dismantling work, which appears at first glance to be an everyday individual office task in disaster prevention, required operations that were normally related to other divisions, such as reference to the identification of residents, confirmation of the location of addresses, and confirmation of the destruction of buildings (such as the operation of registration of residents and an operation to
confirm buildings), to be handled in a cross-sectional and systematic way.

b. Management Linked to the Scope of Daily Life

In fact, this example in Nagata taught us a valuable lesson at the same time. Certainly, while the information media that were introduced demonstrated major power, the problem gave us an important lesson: the problem was to input basic information on the dismantling work bit by bit and simultaneously with the abnormal situation. In addition, the problem was made much worse by the fact that most of the information was of the nature that meant, irrespective of the prevailing abnormal time, it was handled as basic data on a day-to-day basis for the administrative service, and the information had been scattered and collected, recorded and managed by each division independently. So the root cause of the problem lies in the fact that, despite the self-evidence, once an incident occurs, information is basic information required beyond the boundaries of divisions (conjugated information). It is basic information that had been collected in an extremely routine and repetitive way in everyday operations. Yet the information is managed independently by each division and is not shared. It could be considered that this situation is caused by the absence of imagination, which could perceive that, “This abnormal situation might arise and, under that situation, the handling of information in a cross-sectional way will be essential.” Or, even if people could imagine that situation, a negative aspect of the structure of administration, which adheres to daily sectionalism and avoids even the slightest divergence from the routine, has become custom. Fortunately, the Nagata Ward Office itself recognized these harmful repercussions, and continues to implement the initiative throughout its organization to overcome such harmful effects after the earthquake. It is worth noting that, of these approaches, DiMSIS was introduced as one of the system technologies for implementation, and further improvements are targeted. Further, with the support of this Nagata Ward Office, the author and others have been conducting a study to provide basic information for the creation of a comprehensive policy in the future, which could lead to the creation of a safer and more secure town, while monitoring and diagnosing the process of restoration of the residential zone after the earthquake using DiMSIS. In this way, small attempts to open up a way to enable management to be linked to the range of everyday life have started.

c. Fostering of Social Awareness to Overcome Our Attitude: Keeping Away from Abnormal Situations as a Taboo

One of the reasons why the Hyogo Prefectural Office took more time than necessary to obtain the support of the Self Defense Force at the time of the Great
Hanshin-Awaji Earthquake may perhaps be attributable to the social nature of Japan, in which it is a taboo to consider the possibility of an abnormal time occurring. In fact, this is not exclusively the fault of the administrative authorities of the Hyogo Prefectural Office, as this nature may be to a greater or lesser extent true throughout our country. In this case, it appears that three taboos were related. The first was the taboo of confronting a disaster, which may not arise for a while in the Hanshin district, squarely as a disaster that potentially could arise, and to give serious consideration to such disaster. The second taboo might be one that forbids seeing the Self Defense Force as an official emergency/crisis management organization. And those two taboos were exaggerated by the taboo which, even at ordinary times, prohibits serious discussions of the management of a city and region under emergency/crisis management, during which times the modes are different from those of everyday life. Thus, the case of the delay in the dispatch of the Self Defense Force might have resulted from the fact that society had left these three taboos untouched.

In fact, it is indisputable that from the very beginning the Japanese government itself accepted such taboos and was idle. And this stance made the disaster of the Great Hanshin-Awaji Earthquake that much more tragic. And it is a fact that these multiple taboos were released because of the earthquake, and we may welcome the fact that the national and local governments have consequently been making serious efforts to incorporate emergency/crisis management in the administrative system. But to make Japan a developed country in the true sense of the term, now is the time to break away from the common evil, which tends to change a system only after an incident occurs, letting the fact tell every story, as if depending on the story. To do this, it may well become necessary for politicians on the national stage to seriously discuss a policy in which the management of events that people do not wish to happen is only possible by insisting on examining them as events that may still occur. This is, of course, a matter of them using their imaginations, as leaders or guides of the public and of society. Accordingly, this will necessitate “cross-sectional experts” on the management of safety and security, who support the acts taken by the politicians in a comprehensive way and persuade them.

(2) Absence of Risk Management and Its Necessity

It is said that, immediately before the Great Hanshin-Awaji Earthquake, not only emergency/crisis management, but also risk management (in the narrow sense) was extremely defective in Japan’s social system. What is the reason for this? As one possible factor, the author would like to offer here a personal view in terms of
the basic requirements for the introduction of risk management. There are five basic requirements, namely: (1) Confront uncertainties proactively and manage them in advance; (2) Failure can not end up at zero, so even if you do fail, do not make it a fatal failure; (3) Do not treat matters as other people’s business and do not leave things to others; (4) Prepare for failure, and if you fail, learn from it; and (5) Share and disclose information as much as possible (the quality of information is a decisive factor in the quality of risk management). The answer to the introduction of risk management is, to use a metaphor, “Management that lights up the darkness of anxiety with intelligence, acknowledging that the darkness is the sea of uncertainty, and that opens up a new phase while each player confronts the situation doing their best in their own field, and combining for aggregate power.”

What I would like to add here is that it is said that the Great Hanshin-Awaji Earthquake was considered the kind of disaster that does not arise frequently, but that has the potential to cause massive damage once it arises. In technical terms, it is a disaster with low-frequency-high-impact risk. Sometimes, this particular risk is called a “catastrophic risk.” (This is an area of research regarding extremely frontier-like risk management, and a number of new, cutting-edge, cross-disciplinary and international research activities around the world have been started to build up this field. The author is also active in these research activities. While cooperating with Risk Management Department (RSA), of the International Institute for Applied Systems Analysis (IIASA), an institute located in the suburbs of Vienna, Austria, the author has been holding symposia and has been engaged in research activities for integrated risk management of disasters. Therefore, with the Great Hanshin-Awaji Earthquake in particular, it could be said that it was an earthquake considerably beyond the total ensemble of scientific knowledge regarding risk management that had existed before. And in that sense, if anything, the earthquake provided a number of issues from which human beings should learn. Under this definition, the heavy loss of life in the earthquake could at least begin to have produced some good. Frankly, the main point of the lessons from that earthquake is to express that we, as a society, will never take the stance described, and we will build a structure and a system to avoid taking such a stance. It means breaking away from the stance of deeming that an event that rarely occurs will not occur for a while, so let us concentrate on measures for other events.

For details of risk management, please refer to the disquisition in the appendix. Here, we look simply at the gist of risk management.

Risk management (in the narrow sense) is to review and to take ex ante measures prior to the occurrence of uncertainties. Moreover, the target is
uncertainties, including a mix of both desirable and undesirable uncertainties. If only undesirable incidents arise, it may not be a rational choice to choose to be in or to live with such uncertainty. We should certainly assume that in the minds of those people who have houses in regions exposed to the risk of volcanic eruption, and who are determined to continue living in such places knowing full well the risk, that there uncertainty mixes both the desirable and the undesirable. In regions where volcanic activities themselves are the source of tourism, those who use the tourism for their livelihoods carry out this risk management without even knowing they are doing so. But risk management in this paper does not mean acts taken by individuals unconsciously or without any self-awareness. Risk management requires people, more than anything, to turn unconscious acts into conscious acts, to be aware of a lack of self-awareness, to consider risk management as a social issue that transcends an individual issue, to review reason and rationality with responsibility, and to take measures. In that sense, risk management should have a sound and responsible social nature.

3.2 Lessons from the Tokai Heavy Rain Disaster (2000): A Disaster Evolves, Is a City Evolving?

It could be said that the Tokai Rainstorm that attacked Tokai City and Nagoya City in Aichi Prefecture on September 11, 2000 was flood damage, in which the vulnerability of a city to a disaster caused by urbanization was clearly revealed. Certainly, it was the fact the rainfall exceeding conventional wisdom was concentrated on a specific region, and that was the immediate catalyst (peril). On September 11, in Tokai City, Aichi Prefecture, rainfall of 114 mm per hour was observed. On the same day, in Nagoya City, rainfall of 428 mm per day was observed. It was a rare rainstorm, about double the former record high.

As a result, then, significant damage was sustained, including 10 deaths, 115 injuries, 31 totally destroyed buildings, 172 partially destroyed buildings, 22,894 houses flooded above their floors, and 46,943 houses flooded under their floors. At the peak of the flooding, about 220,000 households and 580,000 people were advised or instructed to evacuate, and the number of evacuees at the shelters reached about 65,000 at one point. According to a trial calculation issued by the Ministry of Construction (the current Ministry of Land, Infrastructure and Transport), the amount of damages was about 850 billion yen. It is said that the characteristic of this disaster was that the amount of damages to assets in general was high. In response to the disaster, the government undertook rescue activities for those who were isolated, etc. using the Self Defense Force (about 9,700 people were called up), the Maritime Safety Agency, fire stations, police stations and other sources. The
government also revised the standards for small and midsize companies, designated the rainstorm a major disaster, and implemented a special emergency project for major disasters that involve rivers; including drainage activities such as collecting 20 drainage-pump vehicles from all over Japan.

The author would like to make the following observations about the characteristics of the damages caused by the flood in Nagoya City because of this local severe rain. While in Nagoya City a numbers of districts sustained damage because of the flooding, what was especially characteristic was that even though the dike of Honkawa did not collapse and the river did not overflow, a massive volume of rainwater attacked the residential/commercial regions, causing major flooding damage, and valleys that were exposed to the risks of muddy streams. Omitting the details of this disaster, let us consider the structure of the issue by looking at it schematically (See Figure 3.2 and Figure 3.3)

**Figure 3.2. A Diagrammatic Representation of the Damaged River Basin (Before Disaster)**

**Figure 3.3. A Diagrammatic Representation of the Damaged River Basin (Immediately after the Occurrence of Disaster)**
Among Districts A, B and C, the valley that was damaged was particularly concentrated in District C. In fact, urbanization had generally developed in the order of District A, B and C. And District C was an area with low ground, which about 30 years ago had been open space with paddy fields. In other words, it could be said that this vacant land in the city functioned as an underground pool where the drained off water could accumulate. However, along with the rapid development of urbanization, the vacant land was developed as a district designated for urbanization, and ended up being covered.

Disaster prevention of rivers under modernization in the 20th century, the mission of which was to support such urbanization, aimed at:

1. All districts are basically protected by equal (same) safety standards (the principle of equality).
2. All drainage is processed exclusively in each district, so no consideration is given to cooperation or mutual effect with other districts (assumption of establishment of independence by each district).

So for a district developed later than its neighbors, it was deemed natural to invest more money accordingly, as that district is at a disadvantage when it came to disaster prevention. Efforts need to be made so that the district does not lag other districts in terms of safety by setting up large-scale facilities (for example, massive drainage pump facilities). And as long as this principle and assumption are realized, the urban valley should have been basically safe from flood damage.

However, the rainstorm caused by the “rare rainfall” in this case reversed that precondition from the ground up. For example, look at District B, which is relatively elevated, and District C, which is located in a lower position: rainwater that could not be drained off independently within District B district started to invade territory outside its district, in District C. Following her wise and matter-of-fact dispensation, in which water flows from higher ground to lower ground, Mother Nature attempted to return the town to what it had been in ancient times. The principle and the assumption were reversed completely. And what made the situation worse was the fact that, in District C, an unexpected event occurred, in which the massive drainage pumping station for processing drainage within the assumed range was itself flooded. This added to the damage and exacerbated the situation.

The case of the Tokai Rainstorm suggests that future disaster prevention should respond more flexibly and with anticipation to the potential risk of catastrophic “phase transition” (the evolution of a certain type of disaster), which
makes more complex and more gigantic the circumstances of a disaster that can be triggered by urbanization. In other words, it is very likely that the mere handling of the expected risks of a disaster will not be able to respond to the increase in catastrophic risk potential brought by urbanization, which moves further during that process (such as population, economic activities and growth and the centralization of assets). In that sense, a city is inherently inclined to promote an increase in catastrophic risk potential. When it comes to risk management of the safety and security of cities in the 21st century, it will be necessary to constantly grasp this fact as a fundamental recognition. And as long as the approach is a fragmented one, no effect can be expected, so a comprehensive and general approach is required.

### 3.3 Lessons from the Western Tottori Earthquake: A Disaster Accelerating the Process of Depopulation; Is It Possible to Develop Some Risk Finance Scheme as a Brake against Such Tendency?

The Western Tottori Earthquake that occurred in November 2000 forces us to feel that it is no wonder that, as an earthquake disaster with an epicenter in intermediate and mountainous regions, the circumstances of the damage and ideas on how to proceed with restoration/rehabilitation differ considerably in their qualitative aspects from those seen in the many cases of urban earthquake disasters. We consider here only the key points as follows:

**Figure 3.4 The Epicenter of the Western Tottori Earthquake and Areas of Damage**

As Figure 3.4 shows, the Tottori Prefectural Office dealt with this earthquake in quite a unique way, which drew nationwide attention. What was so unique was that the
prefectural office voluntarily designed a scheme for a certain amount of risk financing to provide in the form of financial aid of approximately three million yen or one million yen funds for respectively rebuilding or repairing houses that were totally destroyed or partially destroyed in the intermediate and mountainous region, and actually introduced the scheme. Since then, using the scheme, the Tottori Prefectural Office has also proposed a disaster fund program, which also included cities, towns and villages in the prefecture as well as the national government. (Table 3.1)

Table 3.1 Disaster Fund Program Proposed by the Tottori Prefectural Government

<table>
<thead>
<tr>
<th>Profile of the Fund</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) Fund contribution goal: 5 billion yen (42 million US dollars)</td>
</tr>
<tr>
<td>b) Contribution period: 25 years</td>
</tr>
<tr>
<td>However, if an eligible disaster does occur, the period will last only until the total amount of the fund reaches the limit of 5 billion yen.</td>
</tr>
<tr>
<td>* It is hoped that the national government will also contribute an additional 5 billion yen to the fund.</td>
</tr>
<tr>
<td>c) Ratio of prefecture and municipality contributions: 1/2 each</td>
</tr>
<tr>
<td>Municipality participation is voluntary. The prefecture will match the amount of funds raised by participating municipalities. If all municipalities participated and raised 100 million yen, the prefecture would also contribute 100 million yen for a total contribution of 200 million yen to the fund in any given year.</td>
</tr>
<tr>
<td>d) Target aid provision: housing reconstruction and repairs</td>
</tr>
<tr>
<td>e) Subsidy funds: 80% of the general subsidy aid provided will come from the fund.</td>
</tr>
<tr>
<td>The remaining 20% will be borne by the prefecture and local municipalities at times of disaster.</td>
</tr>
<tr>
<td>General subsidy aid:</td>
</tr>
<tr>
<td>3 million yen (25,000 US dollars) for housing construction</td>
</tr>
<tr>
<td>1.17 million yen (10,000 US dollars) for housing repairs</td>
</tr>
</tbody>
</table>

Directly investing public funds in each household in this case has been “prohibited” in conventional disaster prevention administration. Given the trend of promoting a decentralization of authority, for a local government directly hit by an earthquake to independently propose this model deserves considerable respect. Further, as “an easy-to-understand theory of persuasion” for this type of investment of public funds, there is a theory that, “Once one person is removed from the population or one household is removed from the total number of households, the overall community becomes that much more difficult to live in from a social aspect.” In short, it might be the theory that such measures are not merely financial aid for rebuilding and restoring individual houses, but rather they are measures fully in the public interest, because they maintain the vitality of the community. But this is a theory that only applies to depopulated regions, where the population is low.

Although the theory mentioned above has some persuasiveness, it might also
be necessary to add the fact that concerns have been raised, namely that the implementation of financial aid could on the contrary provide a negative incentive to “making efforts to keep buildings safe on a day-to-day basis.” Naturally, with various ideas such as the combination of this mechanism and an inspection program regarding the observance of the safety standards of buildings, it is desirable that more realistic and effective mechanisms be developed.

Figure 3.5 The Diagram of the Relationship between the Advantages and Disadvantages of this Disaster Fund Program, and Points for Improvement

Tottori Pref’s Challenge:

Proposed Public Financial Assistance Scheme

- Revitalization of Local community
- Inspection and enforcement for public interest
- Less motivation to improve safety of one’s house (moral hazard?)
- Less enforcement to sustain built environment (not applicable to big cities?)

4 Lessons Learned from Disasters in Developing Countries

4.1 India: Effective Safety Standards Only If Socially Implementable and Efforts Made towards the Development of Affordable (Locally Tailored) Performance Criteria

The Gujarat Earthquake that struck on January 26, 2001 caused massive damage centering on the rural farming regions, including about 400,000 houses totally destroyed, and 50,000 houses partially destroyed, and 120,000 houses partially damaged in the urban region. In fact, it was shown that this damage to buildings accounted for the highest proportion of the financial damage. For details, please refer to other documents. In this paper, the author would like to point out
one thing considered to be the important point, which was confirmed with an expert who visited the actual site of the disaster.

That one point is that it might be a fact that the building safety standards had not been observed, for whatever reason.

As the reason, the facts that
(1) the volume of cement used might have been changed depending on the budget; and
(2) the actual performance of buildings might have differed significantly also depending on the wealth of the person who built the building could be cited. But the problem is that these facts—namely that those damaged most severely are those in the poorest groups—are not simply resolved by a simple diagram.

For example, apartment houses of between four and five stories and apartment houses with around ten floors, which had been built recently were the buildings that were damaged most severely in this earthquake, but the groups of people able to purchase such buildings were groups in the upper-middle class or higher, so in fact it could be said that those groups were the most severely damaged in practical terms. It sounds ironic, but it is also a crucial point. In short, groups that are actually poor cannot purchase the houses from the very beginning, and live in tents, etc. in their daily life, so it appears that they were hardly ever impacted by the damage from the earthquake. In their daily life, however, this poorest group of people faces a number of difficulties, and it is not difficult to imagine that it would face serious problems during the rainy season.

The point is that, in a developing country like India, which is a complex economy and a multi-layer society with economic disparities, the real poverty group is the one that does not have as much to lose in its everyday life, and this group only sustains damages accordingly even in the wake of an earthquake. So it could be considered that damages in an earthquake are sustained by the affluent groups in their own way, because of the economic gap.

In comparison with the fact that within Japan, considered a developed country, many of the weakest groups in a disaster caused by an earthquake are also the economic weak in everyday life, this case in India suggests an extremely important hint in reviewing an assistance provided to a country that has suffered a disaster as part of the assistance to developing countries.

Now, let us consider the points that appear to be important and are related to
this case.

- The actual conditions were that, even though building safety standards for earthquake-resistance had existed, the standards were not being observed and, in fact, observance only became an obligation after the earthquake. In that sense, economic efficiency had received priority.
- There is a possibility that contractors might not have had sufficient knowledge about the structure and the construction method of steel reinforced concrete construction (it could be deemed a social issue, namely the absence of a certain education and experience, and a shortage of human resources.)

According to a remark made by an expert, the detailed parts of constructions and finishings were extremely bad, so if more attention had been paid to the fixation of reinforcing bars, damage could have been more minor in scale. Further, it is also said that there is an impression that, depending on the quality of the non-foundation walls (the infill wall for concrete blocks), the level of damage has been significantly different.

What can be assumed from the above is that, as a result of major damage to houses, as the large ineffective application of design standards had been a mere shelf warmer since priority had been put on economic efficiency, groups in the upper-middle class or higher might have been the largest victim groups. But in the background lie a number of issues, so it is impossible to simply say that the major cause for the damage is the issue of economic strength. Rather, it might be necessary to understand that general factors such as the socioeconomic structure, the historical process to reach the current stage and educational and cultural issues are related to the cause for the devastating damage caused by this earthquake.

- It is reported that bridges and railways were not damaged as severely, and nor were roads, perhaps partially because the roads passed through flat areas. In short, the degree of damage to the infrastructure was minor in comparison with the damage to buildings.
- It is highly likely that the introduction of high-rise buildings along with urbanization might have made the damage more severe (but depending on the city, it is impossible to make that kind of sweeping generalization.).
- In connection to this, traditional two-story brick-built buildings (apartment houses, hotels and residences with shops) were not damaged as severely; but medium-rise RC buildings that had been built recently were damaged badly. In a nutshell, we could conjecture that damage was more severe with the thoughtless adoption of steel-reinforced concrete buildings, done to deal with urbanization.

In conclusion, I would like to point out the following facts:
No matter how magnificent the safety standards set out by law and put into effect, unless the standards are those that can be observed by a large number of people in society, they are useless. Or, in the sense that such standards are likely to end up as a mere salve for the conscience of experts, a polite excuse of managers or a shifting of responsibility, they could even make matters worse. However splendid the logic is from the aspect of technology and engineering, that logic is rather a sinful system design from the aspect of social system engineering (it might have something in common with what I discussed in 3.1 Lessons of the Great Hanshin-Awaji Earthquake.). In short, the society or region has its own level of socioeconomic maturity and adaptation to the environment (its own stature), and also has its unique process of historical accumulation to reach that level. Unless the system design matches the stature and is adaptable, the design cannot be affordable. We need now system technology, which takes the aspect of actual creators and users and which is flexible and reasonable.

4.2 China: Urbanization Causing a Disaster

In reality, the fact that urbanization has made the scale of disaster more severe and has made its nature more complex and diverse is not only true of urban zones in Japan (for example, the Great Hanshin-Awaji Earthquake and the Tokai Rainstorm); it is also true of developing countries in general and the newly industrialized economies (NIEs), including China. But it is necessary to note that the circumstances in developed countries, including Japan, are different from those in NIEs. In the former, the issue is vulnerability to disasters that urban regions, which appear at first glance to be mature, have after attaining certain expansion and growth as a city. On the other hand, many NIEs are regions in which quantitative expansion is prominent in every aspect, including population, industrial activity and their region, but in which the building of the infrastructure and housing policy, the adoption of measures to fight poverty, the availability of education for creating human resources, including experienced engineers and skilled workers, etc. and the expertise for that education have not kept pace with the growth. In those regions, therefore, a number of different socioeconomic strains have increased, as has the vulnerability of their cities.

This fact is clearly evident in the case of India mentioned above, but taking China as an example below, we consider the relationship between urbanization and the expansion of disasters. Figure 4.1 is based on research in 2000. This figure suggests that the number of disasters in China has grown by slightly less than three times in the half century from 1950 to 2000, and the amount of damage caused by the disasters has expanded an astonishing 13 times. In particular, the characteristic is that the increase in the amount of damage over the past ten years
has been rapid, and has overwhelmingly exceeded the amount of the preceding 40 years. The infrastructure should have been built and investment should have been made in disaster prevention during this period. But the background to this growth in disasters and change in circumstances, which have been rather prominent in the recent years, is clearly the remarkable economic growth of this country, the concentration of the population in urban regions and the growth and concentration of assets, which have accompanied the development.

Figure 4.1. Losses Caused by Urban Disasters in China

And in terms of this increase in disasters in China, it may be necessary to note that, so-called “damages covered by insurance” have increased only at a pace that matches the number of disasters. But the amount of covered damages has fallen significantly short of the increase in the amount of actual economic damages.

5 The Framework of Sustainable Development and the Disaster Prevention Strategies in the 21st Century

In fact, what the author has argued from the viewpoint of disaster prevention to date is closely linked to the theory of sustainable development as a new paradigm for the creation of a country or region that is suitable for the 21st century. When it comes to the most modern Western scientific paradigm, this concept is certainly “new,” but in a sense it is linked to the general circular argument as the Asian view of nature. In short, the concept matches the wisdom of Oriental thinking—an
attempt to discover new things by studying the past through scrutiny of the old—to no small extent. It also shares certain ideas with the Buddhist concept of transmigration of the soul in. So this concept of sustainable development is never something that should be the people's business for Asian countries, including Japan. And we should not hold on to a passive, wait-and-see principle in the far-sighted enlightenment movement taking place on a global scale, which is attempting to call together the wisdom and energy needed for people to act by naming the concept “sustainable development.”

At any rate, in this new approach, the system of science and technology in the 20th century, which strayed into the narrow lane and lost its way out, is to attempt to review how mighty Mother Nature and human beings should be related modestly and to shift the thinking towards that of a society driven by improvements in quality of life, breaking away from the mega city and material civilization, which have grown too gigantic to deal with, and a principle focused on quantitative expansion, which has supported this growth of cities. In a word, what is now required is to create a venue for living, the principal object of which is founded on the essential aspects of life (human life) and life (living). Therefore, sustainable maintenance of the quality of life in that sense and persistent improvement in the quality of life should be set as the main theme in creating a country, in creating a region and in creating a city.

When things are considered in this way, it becomes critically important for disaster prevention strategy in the 21st century to be seen within the framework of the theory of sustainable development. In fact, this approach has sufficient grounds.

In reality, in building a paradigm of sustainable development, we are apt to focus on the environmental aspect of nature, while the aspect of disaster prevention tends to conceal itself behind this environmental aspect. But in creating a venue for living, the principal object of which is founded on the essential aspects of life (human life) and life (living), disaster prevention should in fact be a concern that is as essential as concern for the environment. In some cases, a disaster may deprive a number of people of their lives or may damage the health of many people for a long period of time, so disaster prevention as appropriate management of disasters should be seen as a very fundamental theme in reviewing the sustainable development of a country, region or city. Surprisingly, this basic recognition was, as discussed above, lost in the promotion of undersized modern disaster prevention and was put completely outside the scope of consideration in the 20th century. In short, in separated and polarized expert groups, namely experts engaged in disaster prevention and experts engaged in planning a country/region/city, this recognition
was lacking and was not even deemed necessary. Moreover, this absence of recognition became a matter of course without people realizing it, under the precondition of, “Leave it to us. We are the experts in this field.” For the so-called “amateur residents,” who were left out in the cold under this noble cause known as the “mission and duty of the experts,” this absence of recognition has been unconsciously accepted without complaint as a price for expecting that an idle safety net has been publicly secured. This manifests itself in the attitude, “Leave problems to the government,” or “If things don’t work out, the authorities will take responsibility.” Under these circumstances, the basic conditions that support sound and responsible risk management in the sense described above are decisively lacking. Now, it has become clear that this attitude is not paying its way, so warnings and signals against the attitude have begun to be issued by our living environment and the global environment. Further, the rapidly globalizing economic system, and the information technology that supports it, has attempted to fundamentally break free of the structure of the 20th century social system. It appears that the theory of sustainable development is a far-sighted mutual enlightenment movement designed to find a new way to overcome the dead-end of the last century. And Japan, which has suffered numerous disasters, must now take an active attitude that contributes to the development of a sustainable global society, using its “specialty,” namely the management of a base system of safety and security in a country, region, city and community. If Japan does not take show this leadership, which developed country can take the role of Japan?

When the disaster prevention strategy is reviewed in an Asian context, the point at issue mentioned above will have a more active and specific meaning. Many Asian countries located in the Asian monsoon climate and on the circum-Pacific earthquake belt have been exposed to hazards of diverse and major disasters (the possibility of the disasters occurring) from both topological and geographical aspects. In addition, this region is home to a number of mega cities with extremely high population densities, and especially in many developing countries, the growth rate in the population density is very high. Further, accompanying the increase in densely built-up streets, in which blocks and basic roads are not arranged well and the safety level is extremely low when it comes to disaster prevention, as well as the advance of urban sprawl, these regions have been exposed to an extremely high level of risk of disaster (because of high exposure). As a result, centering on urban districts, the regions have become increasingly vulnerable to disasters. Therefore, in creating a venue for living, the principal object of which is founded on the essential aspects of life (human life) and life (living), in Asian countries in particular, irrespective of whether they are developed or developing countries, in the sustainable development of a region or a city it is desirable that disaster prevention
as the management of disasters should be positioned and carried out as a fundamental theme, no matter what the cost.

6 Environmental Issues Appearing in the Form of a Disaster/Accident and the Necessity of Integrated Sustainable Management

In fact, an environmental problem sometimes closely overlaps with the problem of disaster prevention in the form of an accident or a disaster. For example, the unlawful dumping of garbage upstream in a valley is an environmental problem, but this act sometimes becomes a sudden problem as an accident involving the contamination of the headspring by a toxic substance. Oil contamination of the ocean after tankers collide or are stranded is an environmental accident. In all cases, the accident is caused artificially, or by man, but when an incorrect measure is initially taken, the accident can turn into a disaster that brings major social damage. One effective way to minimize this damage is to take measures to attenuate it in advance. In addition, it is important to interpret the problem of the increase in densely built-up streets and the progress of urban sprawl as one that concerns the aspect of the quality of space and the quality of the environment, which is a shortage of open spaces (a certain redundancy) as a buffer zone and the lack of block formations. When things are considered in this way, it becomes clear that the urban problem is also an issue regarding the management of the quality of environment and, at the same time, it is essential to deal with this urban problem in a multilateral way as a comprehensive issue concerning sustainable city management, which also has the aspect of disaster management, to improve the quality of safety.

7 Synergetic Urban Management Considering Diversity of the Scale in Space and Time

In fact, the integrated sustainable management of a city mentioned above requires the introduction of an approach that gives appropriate consideration to the dimension of not only space but also time (See Figure 8.1). Further, what is important in this consideration is to acknowledge that the quality of life represented by the quality of the environment and the quality of safety is considerably regulated by the speed of spatial and temporal changes and their forms. For example, urban sprawl is attributable not only to the inconsistency of changes in spatial form but also to the inconsistency of the speed of time changes. If it is possible to arrange...
timing with which the progress on the fundamental building of the framework roads that form the blocks is carried out prior to (temporal change) the process of formation of residential regions (spatial change), or if both tasks could proceed simultaneously in an interactive way, urban sprawl could be minimized. Sadly, in the creation of cities in Japan in the second half of the 20th century, the drive of expansion of residential regions, the background to which was rapid economic growth, was unable to make the social allowance to adjust to the speed of building of infrastructure that guarantees the quality of the living environment. This resulted in a further increase in exposure to risks caused by inconsistencies in spatial and temporal changes as the potential of social strain. Unfortunately, the Great Hanshin-Awaji Earthquake of 1995 was a surprise attack on this weak bottleneck of the city, making the disaster all the larger in scale. In this way, integrated urban management that views both the pillars of space and time is a lesson that Japan’s urban creation in the 20th century learned in compensating for the loss of lives that cannot be replaced.

8 Issues for Japan as a Developed Country

I would like now to enumerate the items in terms of how Japan’s characteristics and uniqueness may be considered in the argument concerning disaster prevention strategy in the 21st century.

8.1 Quick-Fix Matured Society (A Society Hitting Its Quantitative Peak)

From the aspects of infrastructure development and diffusion of the material urban civilization, it could be said that Japan has already become a quick-fix, mature society. It means that this type of society will, sooner or later, shift its helm from a society that hit its peak in terms of quantitative expansion under a structure emphasizing sheer scale to an economic structure aiming at qualitative growth in an environment of sustainable growth. When this shift is viewed in relationship with the infrastructure development,
in the means of planning and process, a change in thinking is required. In other words, it is essential to introduce an accountable evaluation standard that considers efficiency and social priority, and to carry out an optional development based on that standard. Further, as will be described in II. Theory of the Paradigm Shift, it has become essential to introduce risk management that implicitly deals with the risk that accompanies a plan (for example, a business risk) and a risk contained in the subject itself (for example, a disaster, an accident and environmental pollution).

### 8.2 Awakening of the Civic Society

In comparison with Western society, in Japan, one cannot help but feel that the existence of citizens and the substantive roles played by them in the social decision-making process are not satisfactory. On the other hand, however, it is considered that the sense of existence of civil society has been certainly enforced in our country. As a result, different regions have carried out actual test cases in the form of planning with the participation of citizens in the creation of a town, and the introduction of a planning process for transparent infrastructure development through the introduction of an accountable evaluation standard as mentioned above. The existence of the civil society has become essential in the argument that connects the proposal of a practically effective disaster prevention plan and the creation of a town. Further, it has been demonstrated that the methods by which the entire issue regarding safety and security is entrusted to the administrative authorities no longer works. So it has been gradually known and accepted even at the civilian level that it is essential to ultimately select a certain risk at the individual level and to
deal with that risk independently and at the responsibility of the individual.

8.3 Risk Management of Cities and Disasters Requiring Metabolism

It could be conjectured that the quick-fix, mature society is in a sense one of the consequences when a social infrastructure of a country or a region has attained a fixed standard, but when things are seen from a much longer-term perspective, it is considered that the society has a risk of the existing social infrastructure becoming gradually obsolete, and this infrastructure would lose its original performance. In short, it could be said that, in the infrastructure development that forms the land and cities of our country, we need to introduce metabolism-driven management from a longer-term point of view, and this approach is a very typical issue in the sustainable development of a mature city. Let us interpret this issue as risk management of disasters. For example, assume a measure to reduce disasters (attenuation measure) regarding lifelines such as waterworks, gas and electricity. As a sustainable attenuation measure, it might be necessary to carry out a measure to upgrade the quality of safety by systematically taking a lifecycle perspective. In short, as long as we attempt to maintain the function of a lifeline that we plan to build at present in a sustainable manner, it is necessary to renew the function again after several decades, so it could be interpreted in a sense that the involvement in the preparation of a lifeline at this stage means a commitment to maintaining the option of this renewal project and to project management. When things are considered in this light, a new type of risk management for projects, one that differs from the conventional building method that has become common sense, may be planned. Further, with the acceptance of the differentiation of such performance standards on the quality of safety by region or by sector, it might also be possible to devise an idea to build a mechanism in which a stakeholder requiring a different service will take risks. In short, by breaking away from the safety level as a consistent civil minimum, it may be possible to review disasters from the standpoint of the management of disaster risk in a way that provides a safety service system, which allows diversity in performance in exchange for bearing a different risk (to additional safety performance exceeding the minimum standards).

8.4 The Role and the Mission of Japan with Abundant Experience of Disasters: an Initiative for the Global Society

In Japan, as an advanced country in terms of its experience with disasters, the accumulation of its long-standing wisdom has resulted in a combination of a strategy to focus on coordination between attenuation as an ex ante/preventive strategy and restoration/rehabilitation strategy as ex post facto measures. For
example, a disaster restoration project is basically work to restore public as well as private facilities that were damaged in a disaster. But repeating the project every time a disaster occurs will never lead to an improvement in the safety of a region or city. Despite this fact, government spending invested in the name of a disaster restoration project is growing to massive proportions. Moreover, we can theoretically deduce that, as an appropriate attenuation project is not implemented, every time a disaster occurs, Japan will fall short of the economic growth for its land and its regions, which it should have been able to attain if the disaster were not repeated. It is understood that, as a matter of course, the allocation of fiscal spending to an investment in a preventive attenuation project means that economic growth is sacrificed to a certain extent, but it is deduced that, given the effect of disaster prevention that can sufficiently cover this sacrifice, a growth pattern applicable to a more economically affluent society could be expected to be realized. The experience that Japan has as an advanced country when it comes to experience with disasters, in diligently focusing on a number of projects whose objective was attenuation, rather than devoting itself to the mere ex post facto handling of projects whose objective was recovery from disasters (tacit knowledge), should be stereotyped as explicit knowledge from a more scientific aspect and its general effect should be verified. At any rate, in the coming years, as an effective strategy for financial aid to developing countries described below, it is desirable that Japan’s past experience be used more actively. At the same time, as an extremely effective economic financing measure from a strategic aspect, and one that has been demonstrated by past achievements in Japan as an advanced country when it comes to experience in disasters, it might be necessary to review the possibility that Japan, as a donor country, take attenuation-oriented disaster prevention strategies.

8.5 Appropriate Combination of Risk Control and Risk Finance

In risk management of disasters, it is more realistic and effective that, with the transfer of financial risk through monetary or fiscal measures, a combination of the measures for the attenuation and measures for the reduction of disasters focusing on hardware and a measure to reduce the burden of damages after a disaster be instituted. The combined measures described above are known as risk control because the main point is the reduction of the overall scale of damages that could result from a disaster. As a measure that is more generally applied, an ex ante measure to strengthen the capacity and readiness of society for a disaster is also one attenuation measure, and it is distinguished from the hardware-focused attenuation measure. This measure is sometimes called “preparedness.” The most widely known means of risk finance include fire insurance as property insurance, and flood insurance and earthquake insurance, which are used in combination with fire
insurance. As disasters that could arise in reoccurring intervals from 10 to 50 years, such as floods, it could be said that flood insurance has spread to a certain extent, and it has achieved certain results as a method of transferring financial risk, but it still has room for improvement in the coming years. And in terms of earthquake insurance, except for a region where the subjective awareness of the risk associated with earthquakes is high, such as the Kanto region, the policyholding ratio is generally low, and in fact existing earthquake insurance cannot be an effective measure for a strong local earthquake, such as in the case of the Great Hanshin-Awaji Earthquake. In short, to deal with a disaster in the nature of low-frequency/high-impact risk (a catastrophic risk), a disaster insurance scheme that presumes the holding of the law of large numbers does not work, so it is necessary to devise a scheme of disaster risk finance from a totally different perspective. This is one of the themes on which cutting-edge study has proceeded at present in the field of disaster risk, and an approach using the securitization of disaster risks (cat bond) is one such example.

Figure 8.2 Comparison between Risk Control and Risk Finance

8.6 Public-Private Partnership

Although in terms of the disaster insurance described above, a private non-life insurer generally provides the service, Japan has a scheme to prevent individual non-life insurers that undertake the transfer of individual risk in the case of earthquake insurance, etc. from bearing excessive collective risks. This is a system
in which the national government is allowed to secure the fixed risks in the form of reinsurance. This may be a good example of the so-called public-private partnership (in which the public sector and the private sector cooperate and divide up roles) in risk finance for disasters. Moreover, the public-private partnership in a form in which the public sector is mainly responsible for attenuation measures focusing on hardware and the private sector is responsible for the majority of the preparedness and risk finance will draw more attention as a mainstay approach in developed countries such as Japan.

9 Issues for Developing Countries and Newly Industrialized Economies (NIEs)

9.1 Management of a Growing Mega City

In developing countries and NIEs, which have been catching up with developed countries, the theory of sustainable development requires issues that are different from those in developed countries, and an approach from a suitable aspect. One of the prominent characteristics in those countries is that, while the population and economic activities have continued to grow, cities have also been expanding in terms of their space, resulting in the creation of a number of mega cities, and this creation of mega cities has been encouraged. Along with this expansion of cities, the urban environmental risk and the disaster risk have been growing further and, taking the form of a deterioration in the quality of space, they have been increasing risks synergistically, and have even been combined with mismatching in time changes. In short, in those cities, integrated management on the spatial and time axis is extremely inappropriate, and this fact has exacerbated the vulnerability of cities.

9.2 Introduction of Affordable (Locally Tailored) Technology

In introducing technology regarding disaster management from Japan and other developed countries, developing countries are apt to introduce technology that is thoughtlessly large in scale under the name of boosting the national prestige or pride of the developing country, and technology transfer that assumes cutting-edge high-technology tends to be carried out. And this way of directly introducing the system technology adopted by a developed country can never take root in that country. To sum, as the counterparty country lacks the soil to support the technology in a sustainable manner and to have the technology acclimated to the social culture of that country or region, and as a social system for watering does not exist in that country, the technology will not ultimately take root, and will end up remaining decayed. This case is also closely related to the issue concerning the
maintenance costs incurred by ordinary activities to maintain facilities and equipment in a sustainable manner, including human resources who use such technology efficiently. As a result, what is left afterwards is the wreckage of gigantic facilities and equipment that symbolizes failure. Therefore, a technology that can truly take root in that country should be affordable technology that matches the stature of that country. In addition, it is also essential to provide the support to enable the development of human resources that can learn about the technology and apply it repeatedly. These human resources should also be capable of being involved in the simultaneous development of that technology in a form more suitable for the regions and in the development of a social system that supports the development of human resources. In short, it is important that the modest technology and the management technology for the creation of a social system to introduce that technology be provided together as a package.

9.3 Promotion of Mitigation-Oriented Disaster Prevention

As mentioned in the case of developed countries, it is necessary to actively include attenuation-oriented disaster preventions that aim at ex ante and preventive measures, and not to spend all the time on ex post facto and passive disaster restoration measures. This is also true of disaster prevention in developing countries. With this approach, there is conjecture that it will become more likely that a more affluent and safer region or city will emerge, but the issue is that an obstacle has arisen in that the way to verify the effect of attenuation-type disaster prevention, to set that approach as a guideline and to regulate an effective scene and scope for application have yet to be clarified from a scientific perspective. Thus, in a number of developing countries that do not have any discretion to make judgments on the allocation of their own financial funds to attenuation, it is difficult to justify loans for disaster prevention through the attenuation method from overseas. In those countries, the priority of economic investments tends to neglect the aspect of safety. In fact, this situation is a domestic condition in developed countries, which provide assistance. The fact that even developed countries do not have a logical framework or empirical evidence sufficient for judging whether the investment is valid from an economic perspective has become a bottleneck. So a challenge by interdisciplinary systems science to eliminate such bottleneck has, at any rate, been required.
10 Conclusion

As already discussed, and to sum up, disaster prevention in the 21st century needs to become integrated under a new paradigm of the sustainable development of a region or a city. This approach has begun to be called “integrated disaster prevention” in general. It is thus required that this approach should be reconstructed as risk management under the perspective of disaster prevention, and that several stakeholders should manage disasters in multiple ways under the principle of self-discipline. In that sense, also, the handling of disasters should evolve into even more integrated management of risks.

Japan, as a developed country, must continue to challenge the integrated risk management of disasters as its own ongoing issue. At the same time, it is necessary for Japan to stereotype its own experience as explicit knowledge and to accumulate the expertise that transforms that knowledge into affordable technology. For Japan to play a suitable role as an international leader in the 21st century, an effective way would be to position the theory of sustainable development from the aspect of disaster prevention and, especially, to support the development of Asian countries. And in the intellectual activities that support this approach from a scientific perspective, it is important that Japanese researchers take the lead in carrying out such activities. Based on this belief and sense of mission, the author has been playing a role in international research cooperation projects between the United States and Japan, and with ASEAN countries, and has been actively engaged in rallying like-minded people in terms of a research network regarding integrated risk management of disasters and forming forums for discussions on research with the IIASA in Austria. It is expected that in the coming years a financial institute with a public utility, which is involved in this intellectual enlightenment movements, will emerge to encourage financial assistance and provide support for the realistic application (integration) of the results to society from the perspective of international cooperation.
Appendix 1 (Supplementary Discussion) Why is Risk Management Required Today?

1. What are the Basics of Risk Management?

   - Three misunderstandings about risk management

   Christopher (2000) argues about risk management from the perspective of corporate management. Through the introduction of the “three misunderstandings regarding risk management” that he suggests, I would like to trace back the essence of risk management.

   (1) A risk is always something that is wrong. \(\rightarrow\) Mistake

   This misunderstanding leads to the general misunderstanding of dealing with risk management as “disgusting,” as mentioned above. According to Christopher, for example, an insurer properly accepts “a bad event” (an event that people do not desire) as an event that can arise and that plays the role of notifying citizens that they are exposed to the risk. At the same time, when a disaster actually occurs, the insurer makes a contribution to reducing the level of damages that should ultimately be borne. Accepting properly that “a bad event” can arise and letting beneficiaries know that fact, an insurer collects premiums from its policyholders, creating its own management opportunities. In this case, the insurer is the stakeholder in risk management. On the other hand, the citizens who hold the policies are the beneficiaries of a service with public utility and they are also consumers. (In this case, the citizens who hold the freedom of choice of whether to hold the policies or to spend the premium on items with more priority also implement their own risk management as one of the stakeholders. However, when a citizen is forced to buy compulsory insurance in accordance with a national government program, etc., a citizen is not directly involved in that risk management as one of the stakeholders.)

   There are two important points here. The first point is, as “a bad event” could arise, use that possibility as a resource for wisdom to identify a possibility that “a good event” could arise. This means in other words finding a ladder to extract an opportunity that “a good event” could arise. The second point is that this choice is made at the judgment of a stakeholder, and there is freedom of choice. As a result, if things go well, the stakeholder will get results. In contrast, if things do not go well, the stakeholder will accept the damage (negative results). Even though a stakeholder makes a choice, that choice is a right as well as an obligation. This is
what is called the principle of self-responsibility.

(2) Among risks, there are those that are very evil, and they should be removed by any means (whatever costs are required).  \( \rightarrow \text{Mistake} \)

Since disaster prevention has become the topic, I would like to take the opportunity to advance my discussion using disaster prevention as an example because many experts involved in disaster prevention are, in a sense, considered to have this second misunderstanding. They think, “As an expert in disaster prevention, we are a group that gives serious consideration to disasters that are evil events, and to ways to avoid such disasters at any cost day and night.” (In that sense, there may appear a simple counterargument that, when it comes to disaster prevention, without particularly stating it, we have implemented risk management. But that is precisely the second misunderstanding.) And the experts tend to conclude that they should realize safety that should be attained from their own expert judgment at any cost. In fact, it is considered that such upright, albeit exclusive inclination that allows for no judgment made by amateurs, used to be a typical real image of a good old civil engineer. In that sense, it could be accepted that the following argument is also be true of most civil engineers other than engineers in disaster prevention.

Then, a shift of ideas is required here. Now, let me clarify the point at issue using the debate style as given:

(i) It is good to attempt to reduce bad things. But there is a risk.

In reality, sometimes things go well, but sometimes things do not go well.

Counterargument:
A1. There should not be any things that do not go well. So there is no risk.
Or,
A2. There should not be any things that do not go well. If there is any, that means an unexpected event happens, so we cannot take responsibility to that extent (thus, there is no risk.).

Re-counterargument:
CA1: There is no guarantee that something that should not arise will never arise. Therefore, there is such a risk.
CA2: Through what kind of process and how should an assumption be decided? How could we confirm a case that is not assumed? Unless such matters are not clearly suggested in a form that beneficiaries can confirm, it is difficult to declare that we do not have any responsibility. In the coming age, this
accountability will certainly become indispensable. Where accountability is taken, if a case is shown to be unexpected, a risk is the one that beneficiaries should ultimately accept on their own responsibility, but if a case is shown to be expected, there is a risk that the administrative authorities that are in charge of disaster prevention bears their own responsibilities as the stakeholders.

(ii) Spending money on good things could cause a loss of opportunity to spend money on much better things.

Counterargument:

We use money on good things based on the trust of the public under their authority and at their discretion. In that sense, there is no opportunity to spend money on better things. (Or there is no scope or no necessity to think about it.)

(3) The safest way is to only be involved in something that is demonstrably safe. → Requiring attention (Although this concept cannot be said definitely to be a mistake, the usual reserve is required.).

Christopher explains using the following example. “Politically delicate (sensitive) issues,” such as environmental protection, health and safety, are apt to bring in “conservatism” to risk management, and that tendency has been enhanced further. For example, it is said that the Food and Drug Administration (FDA) of the U.S. government has the tendency to take a policy, “Unless safety is confirmed, (an applied food or drug is) not approved.” Although it is understandable that the administrative authorities cannot help but rely on this “conservatism” given its position of protecting human life, Christopher offers a counterargument. How could we consider a possibility that society loses an opportunity to enhance “the other safety,” sticking to “involvement only in things that are proven safe?” In short, an opportunity in which that drug is approved and there could be patients who would be saved with the use of that drug might have been missed before our very eyes. This fact can be interpreted as a problem of two kinds of errors in the statistics.

In other words, this is a problem attributable to the first error caused by the fact that the correct hypothesis is not adopted and the second error caused by the fact that the incorrect hypothesis is adopted. In this case, the first error is that, although the hypothesis, “A new drug is safe,” had been adopted, in reality, it proved wrong. On the other hand, the second error is that, although the hypothesis, “A new drug is safe,” had not been adopted, in reality, that hypothesis proved correct. It is said that in this case, people in general tend to deny the hypothesis, the truth or falsity of which cannot be decided, rather than agreeing on it actively. In that sense,
the problem arises from the real nature of people, so it might be difficult to correct the tendency. In fact, after acknowledging the difficulty of correcting that tendency, Christopher goes so far as to call for a challenge to that tendency. Moreover, it is relatively easy to find examples that demonstrate the second error after the event (for example, data regarding the number of fatalities), and the impact when such fact is clarified is enormous. On the other hand, information to back up the first error after the event (how many people died because they did not use the new drug) is extremely limited in number, and is difficult to obtain. In particular, scientists commonly try to avoid involvement in an application of the reality unless they can verify the case with facts. It is not difficult to imagine that this common behavior has been serving as a factor to make the issue more complex.

In fact, there has already started an attempt to solve this issue proactively. For example, according to Amendolla (2001), in the European Union a decision was made that sustainable development would form the framework of development of countries/regions and environmental measures throughout Europe in the coming years. Consequently, directives have been suggested, and initiatives to materialize those directives in policy form have developed in each member country.

From the very beginning, the concept of sustainable development is not necessarily a defined one, and in fact this concept is based on a number of hypotheses regarding man-made climate changes, such as global warming, and the influence of such changes on the ecology of life. But there is a basic hypothesis: “If the 20th century consumption-driven civilization continues, the earth and survival of the human race will be endangered.” In this case, not waiting for the time when such hypothesis is proved, but assuming that it is correct, the European Union adopted a tentative hypothesis and revises/develops the hypothesis while studying and verifying it step by step, with the implementation of monitoring to confirm the truth or otherwise of that hypothesis and setting a checking point (the place and the point in time). This approach is called an “anticipatory approach.” It is believed that the introduction of a phased process driven by adaptation and revision through this anticipatory approach will be indispensable for risk management in the years to come.

Upon consideration, we cannot help but notice that, around us, the conservatism reflected in this third misunderstanding has prevailed. This conservatism takes no action if unknown possibilities exist, until the action is proved certain, and thereby ensures safety. But unless we take the first step in a new action, we cannot obtain any fact that verifies that action, so inaction means turning our back on improving safety in society from a long-term perspective. It
would be better for us to consider that, preferably, the active introduction of the anticipatory approach is rational, and from a long-term perspective this approach is beneficial for society.

2 Other Basic Features of Risk Management

In a sense to supplement the requirements for risk management described above, I would like to mention several characteristics briefly.

(1) Sound and Responsible Risk Management

This expression also owes to Christopher (2000). There is an argument that we implement risk management in our daily life nonchalantly. For example, it could be said that a person who crosses the road in a hurry, neglecting the red signal so as to be on time for a meeting for which he/she is running late, takes an act in which not being late for the meeting has priority over the possibility of being killed. This is perhaps a certain type of risk management, but it could not be called sound and responsible risk management. In the first place, the basis of sound and responsible risk management is to leave home with sufficient time to spare, anticipating that you could be late. (This matter is related to characteristic (2) mentioned later.). Then, the preposition is to act with rational judgment. Further, in terms of an act of running the risk of crossing the road with the red signal, it might also be possible to explain this act as a certain kind of emergency/crisis management. The following point is important:

(2) Emergency/Crisis Management and Risk Management are Relatives, But They Need to Be Distinguished.

Many people consider that emergency/crisis management and risk management are the same thing, but strictly speaking they need to be distinguished. Certainly, both types of management have some overlapping features, so in that sense it could be said that they are the relatives. But in the wider sense, there is an idea of including emergency/crisis management in risk management. But in the narrow sense, they are separated. (See Figure 1.) Emergency/crisis management, on an ex post facto basis (phenomena), basically assumes that a bad event (crisis) has occurred, provides management to review a measure to end the change in the situation afterwards in a form that minimizes expansion of damages and executes the measure. In this case, management is also a battle against irreversible and limited time, so it could be said that time itself is a decisive resource constraint in this type of management.
On the other hand, risk management (in the narrow sense) basically assumes that a bad event could arise, what management to review what kind of decision should be made and what type of measure should be taken in response to the possibility on a ex ante basis. As a matter of course, deciding in advance what type of measure should be taken after the event bridges emergency/crisis management and risk management and improves the quality of both, so in that sense, needless to say, both types of management enjoy a close relationship. Disaster prevention might be a typical field.

(3) The Future Is Not Certain, But Does Not Mean Un-imaginable: Imagination is a Basic Capacity for Risk Management

According to Borge (2001), the objective of risk management lies in improving the future, but does not lie in an explanation of the past at all. Based on this concept, Borge emphasizes the positive aspect that a future figure could be drawn to a certain extent with preparation by the anticipatory system and imagination, even though the future is not definite. This is linked to the argument regarding the validity of the anticipatory approach mentioned above.

(4) Measure and Quantify as Much as Possible

This feature requires no explanation. To enable scientific judgment, it is essential to introduce a scientific method that measures and quantifies a risk as much as possible for risk management. In this paper, I would like to omit the explanation on this point.

(5) Belief and Preference as Subjectivity Involved in Evaluating Risk

While it is extremely important to measure and quantify a risk, it is a feature that, in such case, a risk is not always explained by the objective numbers, but rather than that, a risk largely depends on the subjectivity of a stakeholder of risk management, who is exposed to that risk. This feature can be recognized as an issue regarding “belief,” or how a stakeholder grasps the probability that an uncertain phenomenon arises, and an issue regarding “preference,” or how a stakeholder grasps the preference of a phenomenon. For example, people in a region that experiences disasters tend to avoid risk when it comes to risks caused by disasters, but it is highly likely that people in other regions will show the opposite tendency. This feature becomes an important point in the implementation of risk management of disasters because social awareness and risks have a close relationship, and risk management targeting a region or a society cannot implement any appropriate
management by neglecting that relationship.

3 Key Points of Risk Management for Infrastructure Development Specialists

So how could an expert on the infrastructure development introduce risk management? Based on the discussions so far, I would like to list the key points briefly.

a. The ultimate beneficiaries of risk management in the infrastructure development are the citizens who have been exposed to the risk concerned.

b. As a stakeholder directly involved in risk management in infrastructure development, in addition to an expert on infrastructure development, an expert on risk management should be included. Both types of expert could be the same person or the same organization, but it might be realistic to consider that, in many cases, they are different. Further, in some cases, the expert belongs to an administrative authority, but in more than a few cases, the expert is a consultant or belongs to a think-tank. Or the expert could belong to a general contractor. In addition, in terms of risks that cannot be covered, it is to be requested that each private citizen should accept such risks in the end. In that sense, it is also necessary to clearly assume that there could be risk management born by each citizen or a local community where he/she belongs as a stakeholder.

c. It is necessary to give consideration to what people do not desire to arise as an event that could arise. Further, it is essential to clearly suggest and publicly announce such events.

d. As it is likely that when a bad thing and a good thing are mixed and an uncertainty is added to the mixture, acceptance of a risk has a meaning.

e. Risk management means to review acts and measures that should be taken in advance and to execute them under such circumstances. In that sense, the characteristic is that freedom of choice and the scope of discretion of a stakeholder are allowed. However, it is necessary to clearly suggest the scope that an expert can take responsibility for and the scope not covered by the responsibility to external parties in advance.

f. It is necessary for an expert to acknowledge that he/she would do his/her best as a stakeholder under clearly suggested conditions, but there will not be perfect safety.

g. It is necessary to clarify to the ultimate beneficiaries that the clearly suggested conditions may be changed and, with such changes, as an ultimate possibility, greater safety can be realized, but with the realization of such safety, expenses are to be paid and troubles will grow accordingly without limit.

h. Decisions on changes in the clearly suggested conditions are an issue of social
decisions, involving the ultimate beneficiaries. It means that, not only a result, but also the process itself ultimately decides good or bad risk management.

i. To enable the matters mentioned above, indispensable requirements are to disclose and share basic information and to make communication.

4 Illustrations: Scopes of Applications Which Require Risk Management in Infrastructure Development

(1) Disaster Risk Management

As repeated several times already, disaster prevention might be a typical field that requires risk management. The peculiarity of disaster prevention is that there is a possibility that one aspect of an uncertain natural phenomenon takes place as a trigger, having an impact, and that phenomenon could bring about a social phenomenon, and as a result, a major damage could be brought about. In that sense, research to identify an uncertain natural phenomenon (natural hazard) and to grasp the hazard as a risk is important, so it is not necessarily meaningless if the research accounts for a traditional research field in the disaster prevention study. But in addition to this research, the elucidation and understanding of a social phenomenon caused by the natural hazard is in no way inferior in importance to such traditional research. Further, this example is, strictly speaking, a case of disaster prevention related to natural disasters. So besides such case, a case in which a social phenomenon serves as a trigger, causing the other social phenomenon, and as a result a major damage is sustained, can also be considered. An incident at a nuclear power plant, an accident of oil pollution following the stranding or collision of tankers in the ocean and, in addition, terrorism and war, are typical cases.

(2) Environmental Risk Management

Environmental issues have an aspect that is similar to disasters as well as an aspect that is different from disasters. As the most prominent characteristic of environmental issues, it could be explained that an event that has taken place being triggered by an uncertain social phenomenon has an impact on the society again through the dispensation of nature, which brings about a new social phenomenon, resulting in damage on the society. In this way, there is a time lag when impact that has returned to the dispensation of nature returns again to the social phenomenon, and when such return is slow and is not visible, considerable time passes until society recognizes the damage and is able to confirm it. That is why, when it comes to environmental issues, it is frequently fuzzy as to whether an issue takes place as a phenomenon after it has made an environmental issue. In short, it is inevitable
that a certain gray zone will cover the question of event arises before or after in the judgment. Therefore, risk management for the environment also needs to be appropriately based on this feature of environmental issues. Further, as a particular case, where a social phenomenon that serves as the initial trigger arises, it is forecast that the phenomenon will bring about a social damage in the form of a disaster at a certain point of time, then in that case it is better to recognize the phenomenon as an environmental issue as well as one of a disaster. And, where a certain measure can be taken using the lead-time before the phenomenon enters the filter of the dispensation of nature (the transition time), this ex post facto measure could be deemed a type of emergency/crisis management.

(3) Project Risk Management

While Japan has recently faced an urgent need to review its public works, on the basis of that argument, it has become necessary to decide if a project should be carried out or not based on the assumption that a bad event, namely the failure of a project, is highly likely to arise due to a miscalculation in the plan, even in the case of a highly public project for infrastructure development, and to prepare a mechanism or a measure in advance to avoid the worst scenario, even if that bad situation occurs. As a factor that drives failure, not only changes in the economic condition and changes in the social structure, but also project conflicts (conflict of interest) caused by insufficiencies in the ex ante agreement about the promotion of the project or in agreements supporting such ex ante agreement, etc. can no longer be ignored. Although all of the occurrences of those factors are uncertain phenomena, occurrences that cannot be predicted at all in advance are rather small in number, contrary to expectations. When things are considered in this way, it is clear that risk management has become indispensable even for public projects. Further, in terms of the way to promote a project, it has become necessary to introduce the viewpoint of project management more actively as well as to introduce a method based on the discretion of responsible partnerships between the private sector and the public sector. For example, PFI has drawn major attention recently and is a typical case, but unless PFI is connected in an approach of risk management for the project, it will be no magic wand capable of instantly solving the demands imposed on public works.

As those examples show clearly, when it comes to the infrastructure development in the coming years, risk management has become an indispensable way to view matters and a methodology of management.
5 Necessity and Issues of Integrated Risk Management

It is considered that, when risk management is introduced to the infrastructure development, a comprehensive approach (integrated risk management) would become more important in the coming years. The reason for this significance is as follows:

(1) Even when it comes to the infrastructure development, the helm needs to shift from the age of mere “new creation” to the age of “creation and renewal of created matters simultaneously.” This means that it is essential to aim at sustainable development of the infrastructure comprehensively over a time base. For example, huge facilities that cannot be maintained could be effective when they are built, but from a long-term point of view, they will turn into a burden. In that sense, it is necessary to introduce a building method, in which sustainability is guaranteed.

(2) So far, the infrastructure development has been promoted in a form that is excessively “individualized/segmented,” just as a road is a road, a river is a river and a park is a park. It is true that this approach was effective in a sense to build the infrastructure to the minimum level individually, in the shortest time, and certainly up to a certain point in time. But clearly the approach has become not to match the needs of the age. For example, from the viewpoint of citizens, a public space that should be “the same open space” is separated as a road, a river and a park, and buildings for the building of each space are apt to multiply in a form that does not coordinate with each other. The coming age will be one in which the building of the infrastructure, which matches the environment of a city or a region, which matches the creation of spaces and the construction environment and which is high in quality is required. On the other hand, funds and resources that can be invested in this building of the infrastructure will be accompanied social constraints and much stricter monitoring than before. And for an expert on the infrastructure development, the mission should be to break away from the individualistic approach driven by how to handle facilities, and to realize the integrated management cooperation of each stakeholder.

(3) Today, we need to graduate from an approach in which a hardware focus driven by the idea of how to handle facilities is set at the core and software plays a supporting role. Instead, we need to build social standards, in which both approaches are positioned equally. In particular, in disaster prevention and environmental issues, the idea that a combination of risk control, which is
risk management using hardware as the main constituent, and the approach of
risk financing, which attempts to reduce damages through insurance and
bonds, will drive the comprehensive improvement in safety and the quality of
the environment that society requires has become a general idea worldwide
(for example, see Okada (2000) and Okada (2001)).

The introduction of risk management to the building of the prescriptive social
norm will in any event be an unavoidable trend in the years to come. Thus, the role
played by think tanks and consultants, which have become part of the experts, will
be more important in this field. Therefore, the author believes that, including the
development of new human resources and the reeducation of internal human
resources, the parties that set about such measures as quickly as possible and that
“make hay” will survive in the end. It would be a great pleasure for me if my paper
encourages an opportunity for this engagement.
Appendix 2 (Supplementary Discussion) What are the Key Points in Emergency /Crisis Management?

When it comes to emergency/crisis management, actual activities start with the fact that things cannot wait for an ex ante, and in a sense an easygoing discussion or review, such as “It could arise, or could not arise.” Emergency/crisis management is the management of crisis, setting an abnormal condition (peril) as a trigger that has already come forth as a premise, to minimize damages as a result of doing its best with measures taken after the event. In this case, what is important is that it is a battle against time, and time is an irreversible restraint. At the same time, as the standpoint is that the fact that human lives and the foundation of safety and security in the society are endangered is a self-evident situation, priorities that differ from everyday priorities need to be set. In addition, those matters that should be prioritized are changing over time. Further, it is no wonder that the priority differs by place. For example, immediately after an earthquake, rescuing people is the first priority. Emergency recovery of services of public utility, such as roads and lifelines, are also in demand. At the same time, opening a shelter and quick arrangements to maintain daily life under an abnormal situation are required. After those matters are stabilized to some extent, a full-scale return of services of the lifeline and a return of the service standards regarding other social infrastructure, and restoration aimed at a full-scale comeback of the social economy to the level of daily life should be implemented. It is emergency/crisis management that manages this series of crisis, and management with an understanding of each phase of the time and place (space) appropriately will be the key for that action. It could be said that the key lies in the “mode change” of management. The preliminary change is a shift from the mode in daily life to the mode in the abnormal situation. Then, based on this mode change, the issues that should be prioritized, and resources and human resources that are to be allocated to such issues are changed by each phase.

When it comes to the key point in emergency/crisis management, while the top-down style should be positioned first to create a management structure, the key point is a management system that can implement scattered and adaptive bottom-up handling based on the transfer of authority to the disaster scene in terms of specific management, that understands changes in the situation across a broad region acknowledging the overall picture, and that can make a top-down arrangement focusing on the broad region if required. At a glance, it tends to appear to be limited to ex post facto management after occurrence of crisis. But unless a system that can be changed to such ex post facto structure instantly is arranged appropriately in advance, it would end up being a pie in the sky. In that sense, then,
it is considered that thorough planning in advance and the building of a system for execution of the plan are indispensable management. So even though risk management of disasters in the narrow sense is involved in the preparations for an abnormal situation in the ex-ante stage, distinctions from emergency/crisis management are highly relative, so it should be said that both types of management are closely related in ex-ante planning.
References