Chapter 3
Contemporary Societies and Risk

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Abstract We plan our safety measures under economic, personnel and time constraints. The extent of how far we take these measures depends on our acknowledgement of risk of whether we "stop because it is risky" or we "cannot stop because of its benefits despite its risks". This chapter discusses our risk recognition and concerns about mass media that strongly affect our risk recognition. It also overviews differences in risk evaluation about natural disasters and social disasters.

Keywords Disaster frequency · Mass media · Risk assessment · Risk recognition · Vulnerability approach

3.1 How People Cope with Risks in Contemporary Societies

3.1.1 Risk Perception by Human

Advancement of scientific technologies has given a great number of convenience and benefits to human. The power, however, that scientific technologies produce is far greater than what we, a mere biological being, are born with. We thus started to have anxiety against risks associated with scientific technologies going out of our control. In fact, the 2010 Gulf of Mexico oil spill and the 2011 Tokyo Electric Power Company's Fukushima Daiichi NPP accident, although such events are rare, had us experience the great dangers and damages that accompany the introduction of scientific technologies. ISO defined risk as "effect of uncertainty" (ISO 2009). Risk perception is about acknowledging future dangers with uncertainty in whether they will actually take place or not and, at the same time, acknowledging future benefits with uncertainty in whether they can be gained or not.

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Humans are not good at making probability-based judgements of uncertain events. And we tend not to carry conflicting emotions about an event at the same time; thus, if we try to perceive the negative side of an event (danger) and its positive side (benefit), we get exhausted. We, therefore, tend to fall into the pitfall of perceiving risk based on partial information about an event, unless we have high motivations to evaluate the event. We also lean towards single-sided judgements that there are no benefits with dangerous matters or no dangers with profitable ones by ignoring one or the other, i.e. danger or benefit. This tendency is called affect heuristic because it is an emotional judgement of "bad things (matters disliked) are dangerous" or "good things (favored matters) are profitable" (Finucane et al. 2000; Tsuchida 2011). Also, not limited to risk perception, we have the habit of only looking at information that support our judgements (self-justification). We carry our own ideas (schema) about the reality, and we tend to perform risk perception based on our own ideas.

Another bias in making a judgement is that it is affected more by information that is easier to remember. Tversky and Kahneman reported results of an experiment where Americans were asked if more English words starts with "r" or have "r" as the third character, and although there are more of the latter, most Americans answered that there are more that start with "r". The reason was because the former is easier to recall compared to the latter (Tversky and Kahneman 1974). Similarly, those with strong memories of airplane accidents, tend to think there are more airplane accidents than automobile accidents.

When we make judgements about risk, "dread risk" and "unknown risk" are clearly the especially dominant factors. We tend to judge matters that are more frightening and matters that we lack knowledge about as more dangerous (Dimension of risk perception: Slovic 1987). People basically have a logical and conscientious judging system (fast thinking) and an intuitive and emotional judging system (slow thinking) (Kahneman 2011). Risk perception relates to emotions of fear, anxiety and desire; thus, it receives strong effects from the intuitive and emotional judging system. This tendency is one of the reasons for our risk perception to differ from objective facts. There are about 126 psychological models and theories, in addition to the one discussed above, that cause distortion in our risk perception.

3.1.2 Significance of Risk Perception for Resolving Social Problems

We want to live in societies that offer more safety; however, when we implement safety measures to resolve social problems, we have restrictions in budget (economic restrictions) and human resources (personnel restrictions) and when to complete the work (time restrictions). The more budget, personnel and time we spend, the level of

safety goes higher; however, we end up spending the best within reasonable and rational ranges. This is called the "as low as reasonably achievable (ALARA)" standards. Our risk perception, at the end, determines the levels of "reasonable and rational ranges that are possible". In other words, the extent to implement safety so it is "safe enough" depends on our risk perception of whether we "stop because it is risky" or we "cannot stop because of its benefits despite its risks".

A measure to reduce the danger of an event often increases the odds for another risk in realistic safety measures, like not using preservatives which are food additives will increase the danger of food poisoning. Also, a strategy to lower risks often results in reducing the benefit, e.g. driving slower delays the time of arrival at the destination. The final decision to prioritize which risk to lower among all dangerous events or how far to reduce the risk when the cost has to be balanced with profit depends on our risk perception.

Our risk perception is affected by the situation that surrounds us. For example, developing countries with large crop damage by locusts could face starvation to deaths in the following year. Under such circumstances, if it can effectively control the outbreak of insect pest, the carcinogenicity of pesticide is often unrecognized. In general, under poverty conditions, people develop strong feelings to make profit and tend to recognize present dangers as within safety limits. In contrary, when surrounded by wealth, people do not have an urge to make profit and recognize even the smallest danger as unacceptable.

There are two styles of risk governance in securing safety for the society; one is top-down and the other is bottom-up style. The top-down style typically has skilled administrators, researchers and engineers to plan and implement safety measures by giving instructions or orders to the general public. On the other hand, in a matured democratic society where democracy has penetrated the society with a large number of citizens armed with advanced education, the people want to build their own safety measures. This style is bottom-up. If the general public in the bottom-up style forms risk perception that match those of experts, i.e. researchers, engineers and administrators, the results are the same safety measured with top-down style.

Slovic, however, pointed out that risk perception between experts and the general public is largely different (Slovic 1987). For example, experts recognize that automobiles carry higher danger than NPPs based on death toll data; however, the general public tends to recognize that NPPs are more dangerous. These differences in risk recognition often lead to the general public refusing the safety measures suggested by experts in bottom-up type policies. For bottom-up-type policies to function reasonably, therefore, risk governance or risk communication plays important roles in balancing risk perception for the whole society.

3.1.3 Contemporary Societies and Mass Media

In the contemporary world, the mass media largely affects risk recognition by the people.

One of the phrases that describes today's societies is "advanced information society". The advancement of information communication technologies allows us to transfer various information over the world in split seconds. We can now easily place our hand on the information we want anytime and from anywhere using these technologies.

The information generator takes a variety of forms including the central or local government, a corporation, a non-profit organization (NPO), a school, a hospital or local residents, but among them all, those that carry information broadcasting as their occupation and send out information towards the mass are the mass media. Many of them take an enormous amount of information, edit and process them into their own shapes (Tuchman 1978) and constantly and continually send them to the audience and readers via the television, radio, newspaper and magazines. These conventional style media are called legacy media which are losing chances of reaching the youth after the internet made its way to the world. Nevertheless, they, in fact, still have large influences.

The mass media carry with them the "agenda setting function" to select what to discuss at the time and present them, the "gatekeeping function" to guide the mass to look at specific topics and the "watchdog function" to keep eyes on actions by power organizations like policy decisions by the government, executions by the administration or judgements by the judicial system. The mass media, however, tends to shape public opinions along the lines of the mass interest, thus, often end up causing social confusion themselves. Especially when a large number of reporters gather at the scene of disasters or accidents, they tend to corner and torture the victims. These problems of mobs of overheated reporters are sometimes called "media scrum" in Japan extending the meaning of the original English phrase to such happenings. It has also been pointed out some years ago that the media after "sensationalism" often focus on the pain and grief of victims and produce exaggerated information at the price of exposing privacies (Virilio 2005).

Information transfer by the mass media, if conducted effectively, can lead to swift actions against approaching dangers, or it can also cause amplification of initially minor troubles leading to serious situations. In *Risikogesellschaft* (Risk Society), Beck pointed out that where risk has spread to individuals and societies, the role of the mass media cannot be ignored (Beck 1986).

Events with social impact like disasters or incidents turn into "social events" only after they are publicized by the media. For example, when victims of a major earthquake living in temporary housing die one after another with earthquake-related deaths, if the media does not cover the happenings to transfer and share the information with those that did not suffer from the disaster, the serious events are the

"same as never happened", and there will not even be the desire to learn lessons from them. In contrast, composing a "media event (Dayan and Katz 1992)" in a way so we can learn lessons can expect more supporters and thorough preparations throughout the nation even in case of local disasters. The risk society and the information society develop in an interrelated manner. Risk is heard of as information, and the relay of information always has some risk. We need to acknowledge these facts to survive through the contemporary society.

3.2 Evaluation and Measures Against Risks in Contemporary Societies

3.2.1 Purpose of Risk Evaluation

Whether the disaster is natural or social, the concept of risk covers a wide range and there are a number of evaluation methods about it. For example, the effect of chemical substances to the human body or cancer risk on health with food items are evaluated with dose-response relationships that relate the biological reaction to dosage of chemical substances to set the guidelines for standards of making judgement. New disaster preparations are often discussed with the damage volume (cost of damage) and probability of damage causing disaster (exceedance probability). Other practices include setting standards for part strength from the relation of damage (destruction) to strength and frequency of force applied on the part or developing insurance plans based on the relation of magnitude of damage from an accident and the frequency of the accident.

All these evaluation methods share the same purpose of setting quantitative guidelines (1) against an event that is likely to happen, (2) to implement some countermeasure, (3) so proper comparison and judgement are made. Risk evaluation is nothing but a probabilistic (quantitative) description of a damaging event that is likely to happen in the future for the purpose of making a judgement. At each point in history, human society has recognized actual risk through risk evaluation and executed measures to reduce the risks. The safety of our society now is the accumulated result of such efforts.

3.2.2 Understanding Disasters

A natural disaster is "a damaging event caused by natural phenomena", meaning just a natural phenomenon alone does not mean a disaster. Today's social sciences have a mainstream concept about the relation between natural disasters and human society

that "natural disasters are caused by the combination of external force from the nature and vulnerability of the society" (Wisener 2003). Thus, in expressing natural disasters as risks, the expression is

$$[\text{risk}] = [\text{hazard}] \times [\text{vulnerability}]$$

where [hazard] means a natural phenomenon and [vulnerability] the social environment. If we apply this formula to general risk evaluation, it means

$$[\text{probability of a natural phenomenon over a set strength}] \times [\text{amount of damage due to social vulnerability}]$$

and it is unique in combining natural and social phenomena. This expression shows us that a same size hazard would result in different magnitudes of damage depending on where it happened, and a hazard with physical size of twice as big does not necessarily mean the amount of damage is also twice. Damage from a natural disaster is not only dependent on the magnitude of the natural phenomenon, but it also depends on strengths in prevention and response to it at each region that is hit and also on the interrelated effect of the natural and social phenomena.

A social disaster is "a man caused disaster that causes damage to people and the society", and we may want to formulate it similarly to a natural disaster with the cause being the [hazard] and people and the society that suffers damage the [vulnerability]. Today, however, such a formulation is not common in evaluating risks of social disasters.

In the contemporary society, natural phenomena change slowly; however, human life and social environment change so rapidly. For both natural and social disasters, human- and society-side factors have stronger effects on risk evaluation.

3.2.3 Difference in Evaluations of Natural and Social Disaster Risks

The most common risk evaluation takes the form

$$[\text{amount of damage caused by the event}] \times [\text{probability of event}]$$

As we discussed earlier, clear distinction of natural disasters and social disasters is difficult; however, this section will discuss the differences between the two.

In general, in the contemporary society, natural disasters are less frequent than social disasters. Their low frequencies make it difficult to predict occurrences of natural disasters in a timeframe. Damages that local areas suffer from natural

disasters are diverse; thus, estimating the amount of damage to local communities is extremely difficult as well. Evaluating risk from natural disasters, therefore, takes the form of assuming several scenarios that can take place and estimating the amount of damage for each scenario instead of carrying out strict calculations. Summing up [magnitude of damage × probability of occurrence] for all expectable cases gives the expectation of damage that serves as the basic evaluation metrics for discussing measures and their extent.

Natural disasters also have different effects depending on the regions. Sociology of disaster offers ways to clarify which societies are vulnerable to what disasters and how such vulnerability is born. This method allows relative comparison of how susceptible each region is against a disaster, and it gives the guideline for regional risk evaluation against natural disasters. Kenneth Hewitt, on the other hand, warns against determining risks of natural disasters only by reviewing social vulnerabilities and ignoring external forces of the nature. He claims natural phenomena are hazards that cause damages; thus, their attributes should affect risk evaluation (Hewitt 1997). Estimating levels of damage is not easy; however, natural phenomena and geological features are analysable with physics, and the results can be probabilistically expressed. The National Seismic Hazard Maps for Japan (HERP 2005) is one such example that gives the guideline for risk evaluation of natural disasters with relative assessment for each region based on probabilities of occurrences of natural phenomena, the risk factors. Both reports are useful in promoting preparations against them at local regions.

Most risk evaluations of social disasters are limited to events with relatively simple relations between cause and effect (damage). Data on frequencies of such events are readily available, thus, statistical analyses are feasible with high accuracy. Limiting the events also make ways for experiments and observation-based analyses. These evaluations are much more accurate than risk evaluations of natural disasters. On the other hand, among social disasters, those with low frequencies like wars to global pandemic apply methods similar to risk evaluation of natural disasters.

As scientific technology advances, phenomena are better clarified, and analysis methods are enhanced and significances of risk evaluation for both types of disasters are higher. At this point, however, from cause and effect relations, risk evaluations of social disasters tend to lead to direct and actual measures and preparations. Since the two risk evaluations differ in their purposes and accuracies, comparing the two by putting them on the same table is not advisable. We must understand the meaning of the quantitative evaluations from the methods and their purposes.

3.2.4 Discussion on Global Risk

Among the globally discussed risks in the contemporary societies, those counted as significant, with the magnitudes of effect and possibilities of occurrence, are

"extreme weather events", "natural disasters", "large-scale involuntary migration", "terrorist attacks", "cyberattacks" and "failure of climate-change mitigation and adaptation" (World Economic Forum 2017). If we look at specific regions, the possibilities of occurrence drop; however, for the entire world, the odds are high, and they will affect the entire world. These risks were identified as combined wisdom by specialists and experts and although, not quantitative, we can acknowledge them as our primary global risks.

For each of these risks, quantitative risk evaluation is in progress for purpose, e.g. commodities are available in insurance and investment industries. Concerns on extreme weather events and natural disasters led the United Nations to form frameworks, agreements and organizations for them, and these topics are now discussion items among the world countries. Risk evaluations are discussed there based on legitimate data to set target standards for each country.

As technology advances, people, capital and information travel beyond borders of countries raising potential risks within our societies. We now need to form cooperative systems to take measures against them. For our cooperative efforts of risk recognition and risk mitigation, the common language of "risk-related mathematics" is playing a big role.

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