Trust and Acceptance of Risks

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This study sought to understand the determinants of risk acceptance. Thus, we implemented a survey (n = 200) to ask participants which policy measures would make approve each of the following risks: nuclear power plants, traffic accidents, food safety, electrical appliances, and medical mishaps. These results indicate that risk acceptance cannot be fully explained only by objectively achieved security, but other factors, such as scientific understanding and trust in workers and organizations, were also found to be important for increasing risk acceptance.

1. Introduction

Daily life incurs many risks. For example, a large earthquake may strike Japan in the next twenty to thirty years, traffic accidents occur daily, and human error has led to nuclear power plant disasters, such as at TMI or Chernobyl; furthermore, no one knows when the next infectious disease, such as SARS, will emerge. Unfortunately, few Japanese have the option of living in a place without earthquakes; we cannot drive a car without traffic accident risks, and our energy-consuming lifestyles lead us to rely on nuclear power plants. Even eating the food we need to survive incurs the slight risk of food poisoning. We can never truly free ourselves from risk.

There is a growing concern with risk and safety in Japan. This concern has been attributed to an increase in technological accidents that have occurred in recent years, as well as to scientific uncertainty over the probability of risks. While we must assiduously work to reduce technological risks, we still have to accept these risks, to some extent, because it is impossible to eliminate such risks completely.

Therefore, the practical problem with which this research was concerned was to understand how people accept risks, given the impossibility of achieving zero-risk status.

To examine determinants of risk acceptance for several risk events, we surveyed 200 Tokyo residents to find their response to a variety of risks.

2. Risk Acceptance

When do people accept risks? Researchers have investigated this question for decades [1]. The simplest answer is that people do not accept risks and, instead, work to eliminate risk. If all risks are eliminated, security is guaranteed and a zero-risk state is achieved. Although risk-reduction efforts are necessary, society will always face some risks. Achieving zero-risk status might not be a realistic aim to strive for.

Another answer is that people rationally accept risks if they expect the expected benefit of an activity to exceed the expected cost [2]. For example, people may drive a car, knowing the risk of a traffic accident, if they believe that car use is beneficial. People may also accept nuclear plants, as long as the energy produced improves the quality of their lives.

However, many empirical studies (c.f. [3] [4] [5] [6]) have contradicted the above claims. These studies have found that personal decision making frequently deviates from theories such as the “expected utility theory,” [7] or the “subjective expected utility theory,” [8], which assume rational, decision making based on cost and benefit. Cost and benefit expectations can be important determinants of risk acceptance, but they do not fully explain the process. No one yet knows the probabilistic distribution of some risks, such as endocrine-disrupting chemicals. Other risks, such as risks from electromagnetic fields, remain controversial. We cannot evaluate these risks by science, or by costs and benefits, alone.

We compared the relative weight of two components of risk: the possibility of risk and the damage from risk. These two possible determinants are closely related to cost expectation, which is assumed to determine decision making in rational choice models, such as the expected utility theory. We also investigated the effects of compensation after risk events have occurred. Compensation is expected to reduce or to eliminate the cost of risks. Additionally, we examined how understanding the scientific causes of a risk affected risk acceptance. Scientific understanding may reduce the extent of unknown risks [2] and may lead to risk acceptance.

3. Trust and Risk Acceptance

We presumed that trust in workers and regulatory agencies constitutes another important determinant of risk acceptance. Instead of controlling risks by themselves, individuals may trust in, and delegate power to, organizations or institutions. This situation can be represented through the “Trust Game” [9].

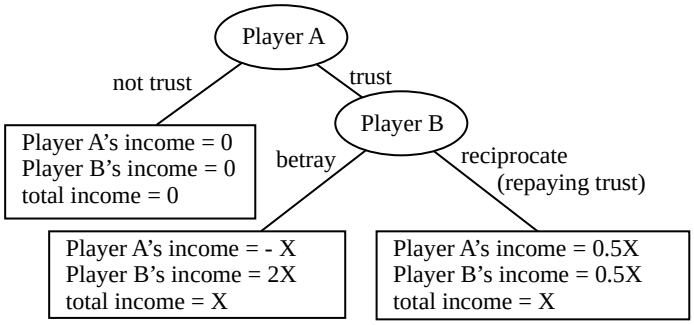

Figure 1. An example of the Trust Game

The Trust Game has two players: Player A (the truster) and Player B (the trusted). Player A can "trust" Player B by sending a monetary endowment X (see Fig. 1). Player B then receives double what player A has sent (i.e., 2X). Player B must choose between "reciprocating" (returning 1.5X and taking 0.5X for himself) and "betrayal" (taking all he has received, i.e., -2X). In this game, if Player A trusts Player B, the total monetary amount that Player A and Player B have increases by X. However, if Player A does not trust Player B, there is no collective increase. In this situation, trusting behavior is collectively beneficial. However, if Player B betrays Player A, Player A loses X. If Player A fears this risk, he does not trust Player B, which results in no collective benefit.

The basic structure underlying risk problems in our society may be seen as resembling that of the Trust Game, assuming that lay people represent Player A and risk experts represent Player B. Social benefits may increase if lay people "trust" risk experts by asking them to administer risks. Risk experts may "reciprocate" by successfully managing the risk, or "betray" by failing to effectively manage risks. If people expect experts to reciprocate, trust and social benefits may increase. However, if people expect betrayal by the experts, trust and social benefits may not increase. For example, social benefits could increase if electricity companies repay the trust of the public by managing nuclear plants successfully. Social benefits would not increase if nuclear plants ceased operations due to a lack of public trust. If electricity companies fail in repaying public trust due to a serious nuclear plant problem, social benefits will decrease.

4. Methods

4.1. Sample

Tokyo residents living within 50 km of the city center were randomly selected as participants for the August 2002 survey. A surveyor first visited the residents to ask them if they would participate in the survey. If the resident agreed to participate, a questionnaire

was left at the home. After a few days, the surveyor again visited the home and collected the questionnaire.

4.2 Measures

As discussed above, we assumed that risk acceptance is determined by factors beyond subjective expectations of costs and benefits. We assumed that trust in persons and regulatory agencies in charge of risk would be another important determinant. Thus, we asked respondents to evaluate political policies or decisions implemented by administrators and the government. In the questionnaire, we asked respondents to consider six risk management measures and to choose three out of the six measures that would increase their risk acceptance for each of the following risks: nuclear power plants, traffic accidents, food safety, electrical appliances, and medical mishaps. The six choices were:

(1) Decrease the probability that the risk occurs.
(2) Minimize the damage when the risk occurs.
(3) Compensate for damages when the risk occurs.
(4) Know that the government adequately manages the risk.
(5) Know that workers and regulatory agencies are trustworthy.
(6) Know that scientific mechanisms of accidents and mishaps are well understood.

These six measures correspond to determinants of risk acceptance, as discussed in the first section. In the questionnaire, the following phrasing framed the question related to each risk:

With respect to (type of risk inserted here), how do you achieve a feeling of "*an-shin*"? Of the following six statements, which do you consider the first-, second-, and third-most important factors in creating a sense of "*an-shin*"?

An-shin in Japanese corresponds to "security" in English, but connotes, additionally, peace of mind. People may lack *an-shin* even when they are guaranteed security. People may have peace of mind, even when they are not guaranteed security from risks.

To ask participants directly whether they would be willing to accept certain risk events might not be appropriate, as almost all risks in our society exist *as if* they have already been accepted. Therefore, we measured *an-shin* instead of directly asking about risk acceptance. Note, that in the next section, we use the term "risk approval" for this measure of *an-shin*.

5. Results

Table 1 Distributions and means of ranks of the six policy actions according to perceived effectiveness to increase risk approval.

		medical mishaps		food		electric appliance		nuclear plants		traffic accidents	
		freq.	%	freq.	%	freq.	%	freq.	%	freq.	%
decrease the probability that the risk occurs.	1st	46	23.0	55	27.5	51	25.5	49	24.5	103	51.5
	2nd	49	24.5	43	21.5	55	27.5	24	12.0	45	22.5
	3rd	44	22.0	39	19.5	43	21.5	48	24.0	29	14.5
	>=4th	61	30.5	63	31.5	51	25.5	79	39.5	23	11.5
	mean rank	2.91**		2.87**		2.73***		3.18**		1.98***	
minimize the damage when the risk occurs.	1st	23	11.5	19	9.5	36	18.0	42	21.0	31	15.5
	2nd	37	18.5	45	22.5	49	24.5	57	28.5	79	39.5
	3rd	48	24.0	31	15.5	47	23.5	40	20.0	30	15.0
	>=4th	92	46.0	105	52.5	68	34.0	61	30.5	60	30.0
	mean rank	3.51*		3.64		3.08*		2.91***		2.90**	
compensate for the damages when the risk occurs.	1st	6	3.0	3	1.5	8	4.0	1	0.5	15	7.5
	2nd	18	9.0	10	5.0	28	14.0	10	5.0	26	13.0
	3rd	37	18.5	39	19.5	40	20.0	24	12.0	66	33.0
	>=4th	139	69.5	148	74.0	124	62.0	165	82.5	93	46.5
	mean rank	4.24		4.40		4.02		4.59		3.65*	
know that the government adequately manage the risk.	1st	7	3.5	38	19.0	11	5.5	40	20.0	18	9.0
	2nd	17	8.5	28	14.0	8	4.0	21	10.5	13	6.5
	3rd	18	9.0	23	11.5	8	4.0	28	14.0	21	10.5
	>=4th	158	79.0	111	55.5	173	86.5	111	55.5	148	74.0
	mean rank	4.43		3.59*		4.58		3.61		4.24	
know that workers and regulatory agencies are trustworthy.	1st	99	49.5	74	37.0	30	15.0	38	19.0	20	10.0
	2nd	45	22.5	47	23.5	30	15.0	34	17.0	19	9.5
	3rd	23	11.5	30	15.0	26	13.0	20	10.0	26	13.0
	>=4th	33	16.5	49	24.5	114	57.0	108	54.0	135	67.5
	mean rank	2.12***		2.52***		3.69		3.53		4.06	
know that scientific mechanisms of accidents and mishaps are well understood	1st	19	9.5	11	5.5	64	32.0	30	15.0	13	6.5
	2nd	34	17.0	27	13.5	30	15.0	54	27.0	18	9.0
	3rd	30	15.0	38	19.0	36	18.0	40	20.0	28	14.0
	>=4th	117	58.5	124	62.0	70	35.0	76	38.0	141	70.5
	mean rank	3.81		4.00		2.91**		3.19*		4.19	

Note: For calculating mean ranks, ranks for options that were not selected as top three options were assumed as "5.5" that is mean ranks between 4th and 7th.

*** the highest-ranked policy, ** the second-highest-ranked policy, * the third-highest-ranked policy

Table 1 shows the distributions and mean ranks of the six risk management measures, according to perceived effectiveness with regard to increased risk approval. The table shows that measures to decrease the probability of risk occurrence and measures to minimize damages from risk were evaluated as effective in increasing risk approval for the risks listed in the questionnaire. The former was the most effective in increasing risk approval for electrical appliance and traffic accidents, while the latter was the most effective in increasing risk approval for nuclear plants.

Respondents indicated that measures that decrease the expected cost of the risks (that is,

measures minimizing the damage and probability of the risks) were also effective for medical mishaps and food risks. However, increasing trust in workers and regulatory agencies was evaluated as more effective than decreasing expected costs. Thus, increasing trust is the most effective risk management measure with regard to food risks and medical mishaps. Regarding electrical appliance and nuclear power plant risks, respondents chose scientific understanding and explanation of accident mechanisms. These two risks differ from the other risks, such as traffic accidents, food, and medical mishaps, in that they are caused by more advanced technologies, which are less likely to be understood, even by risk experts.

Compensation for risk damages was not chosen as effective in increasing risk approval, except for the traffic accident risk. Respondents indicated that risk approval for traffic accidents may increase with the compensation measure. This may be because damage from traffic accidents is generally less than damage from the other risks presented in the questionnaire. Additionally, it is likely that many people will actually face traffic accidents in their lives.

6. Discussion

This study sought to understand the determinants of risk acceptance. Thus, survey participants were asked which policy measures would make them feel "*an-shin*", as an indicator of risk approval. The results showed that the risk management measures that would increase risk approval depended on the respective risks. The following three findings emerged from the survey.

1) For traffic accidents, nuclear power plants, and electrical appliance risks, the most effective measure for risk approval was that of minimizing the damage or the probability of accidents.
2) For food and medical mishap risks, the most effective policy was that of increasing trust in workers and regulatory agencies, rather than that of minimizing the damage or the probability of accidents.
3) Risk approval for electrical appliances and nuclear power plants could increase if people knew that the scientific mechanisms of accidents and mishaps were well understood.

A possible reason why trust in workers and organizations is so important for food and medical mishap risks is that medical and food workers, and their organizations, are assumed to have relatively more control over these risks, unlike the other risks presented here. Electrical appliance and nuclear accidents, on the other hand, are assumed to stem more from mechanical error than from human error. This explanation also agrees with the finding that better understanding of scientific mechanisms is important for electrical

appliance and nuclear plants risks. Conversely, the mechanisms of food and medical mishaps may be simpler than problems associated with nuclear power and electrical appliances. Thus, people may believe that increasing accident prevention among workers and organizations is most effective in this case. Traffic accidents were assumed to be less under the control of workers and organizations (such as the police in charge of traffic) than accidents from medical mishaps and foods. We believe this is why trust was not considered as an important determinant for traffic accident risk approval.

These results indicate that risk acceptance cannot be fully understood by adopting a rational choice theory, which assumes that people maximize the expected benefits and/or minimize the expected costs. Minimizing damage and the probability of accidents were assumed to be just two examples of effective risk management measures for increasing risk approval or, in more commonly used words, risk acceptance. In other words, the feeling of *an-shin*, or risk approval, cannot be explained only by objectively achieved security. Other factors, such as scientific understanding and trust in workers and organizations, were also found to be important for increasing risk acceptance.

This indicates that those who wish to increase the public's risk acceptance should appear trustworthy and try to understand the scientific mechanisms of accidents; they should also try to minimize risk damage and probability. Trust is important, especially for risks where accidents can be prevented relatively easily by workers and/or organizations. These risks include those associated with food and medical mishaps. Scientific understanding of risk mechanisms is also important for risk acceptance, especially for risks involving mechanisms that are relatively complex, such as nuclear power and electrical appliance risks.

7. References

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