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Original research article

Commentary: *New Currents in Science: The Challenge of Quality,* examining the discrepancies and incongruities between Japanese techno-scientific policy and the citizens' science movement in post-3/11 Japan

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ABSTRACT

This commentary is inspired by my participation in the conference on post normal science: New Currents in Science: The Challenges of Quality, 2016, Ispra.

First, I will describe Japanese commitment to PNS, which consists of a part of the long history of the Japanese response to European citizens' science/technology movement, in the framework of the introduction of Post-Normal Science in East Asia.

Then I will re-examine the relationship between techno-science and democracy after 3/11 Japan, where triple disaster has radically changed the relationship between science/technology and society, and hence the very nature of Japan as a democratic society. Japan had been returning to an authoritarian state and technocratic nation in the aftermath of 3/11. As for the citizens' sphere, since 3/11, Japanese society has been badly divided; in fact, the current division of Japanese society is as bad as that of the Trumpian US.

I have applied several conceptual tools to analyze this post-3/11 situation of Japan, that it was created by a combination of 'disaster capitalism' (a concept described by Naomi Klein (2008)), and 'normalcy bias'. The new political climate in post-3/11 Japan results in part from the politics of emergency, and partly from the manipulation and distortion of democracy.

From the viewpoint of democracy and science, cases of thyroid cancer in Fukushima and its surroundings are a serious and even pathetically painful issue. One hundred seventy two children in and around Fukushima have already had their thyroids removed in surgical operations. But any suggestion of causality between the Fukushima incident and thyroid cancer is officially rejected. It is announced by the authority's voice that "radioactivity risk is safe, take it, because risk creates chance", like the proclamation given in the novel 1984 by George Orwell. Behind this is another historical psychology, that Japan has overcome Hiroshima and Nagasaki and made a great success in economic development. Post 3/11 Japan is judged as not a good place to discuss science and technology in a deliberate manner supported by a reasonable democracy with mutual understanding and value-free examination of techno-science in action. But, in this time of serious social divide and political populism, can PNS and a citizens' science approach now lead the way to fill in the gap? Are there any lessons from PNS that can be applied to post3/11 Japan? The question is still open.

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1. Introduction

This commentary is inspired by my participation in the conference on post normal science: *New Currents in Science: The Challenges of Quality,* 3–4 March 2016, Ispra, Italy. The guest-editors of this special issue invited me to provide an Asian perspective on this conference, and more broadly, on post normal science in practice. Although I was the only Japanese attendee at the conference, and, in fact, I was one of the very few Asian scholars involved in this series of symposiums and conferences on post normal science, I do not want to presume my personal perspective presented in this commentary as representing 'Asia'.

In retrospect, this fact that I was one of the few Asians present there (although I am not representing the Asian/Japanese mentality as such) may in itself reflect the fact that post-normal science (PNS) is, so far, mainly a European tradition (or, at most, Euro-American). This may sound like a truism, since this conference was organized under the framework of the European Commission. However, problems of science/technology and society should not be geographically limited, because by their nature, these problems easily transcend regional boundaries, even though there are different patterns of cultural adaptation and diversity. I am confident that we can learn something from the European practices, and lessons from European experiences in the field of post normal science could be relevant in the context of other cultures.

With this in mind, the following two questions occur to me: Is PNS a universal or global concept that can analyze and critically reflect on the relationships among science, technology and society? Or is PNS somehow restricted to specific locations, limited to a specific geopolitical/socio-cultural framework? For these questions, we can answer both yes and no. The real problem is that there is no clear demarcation of yes and no in answering these questions. Rather than seeking a simple yes or no answer, we need to discuss why, how, where, when and in which socio-cultural and political-economic context PNS is limited or applicable.

My general impression from the Ispra conference is that PNS is very European. This was my first time attending a conference organized under an EU framework, and, as a matter of fact, some presentations given by EU bureaucrats clearly reflected a scientific view based on simple imagery derived from the Enlightenment, an epistemic position that is criticized by PNS (e.g. Funtowicz & Strand, 2007). However, at the same time, I believe that the lessons of every European case discussed at Ispra can be applied to other cases of techno-scientific problems in other cultural/political contexts, including issues in Asian communities. It is also necessary to clarify the conditions for effective PNS in different cultures at some other places on the earth. How should PNS be used and in what kind of socio-political circumstances, and how does it relate to the democratic/economic environment?

It might be possible to adapt most of the presentations to different issues in Japan (where I know most) and neighboring nations such as South Korea and Taiwan, and maybe in Hong Kong as long as freedom of speech is taken for granted in the area. However, somewhat obvious fact is that my perspective is limited and inevitably rooted in my experience as a historian and STS researcher concentrating on Japanese case studies. Japan is a developed society, and that is assumed before I approach problems of science or technology and society. But this does not mean I intend to ignore problems in the developing world. Rather, PNS and 'the challenges of quality' are more applicable to the developed than the developing world, that any discussion of the issues primarily relates to societies that already have a foundation of democracy with proper socio-economic development. The concept of 'quality of science' is useful in investigating problems related to a technological social setting like that of Japan. It is also my immediate impression that the concept of 'the challenges of quality' is especially important in a difficult situation like post-3/11 (3/11 is a disaster that happened on the March 11th in 2011: a triple disaster of Earthquake, Tsunami and Fukushima melt-down accident of nuclear power plants) in Japan. There the conflict between techno-science and society is harsh and vivid, society is badly divided, and trust in techno-science is irretrievably broken.

I would therefore like to clarify my position: first, I will introduce myself and describe my commitment to PNS, which consists of a part of the long history of the Japanese response to European citizens' science/technology movement.

2. The origins of post-normal science in east asia

In 1977, the leading historian of science in Japan, Shigeru Nakayama (1928–2014), first introduced Jerry Ravetz's work to the Japanese readers with his translation of *Scientific Knowledge and its Social Problems* (1971) into Japanese. The Japanese title is not a direct translation of the original English title. The Japanese title translates literally as *Critical Science: In Order to Criticize Industrialized Science.* This demonstrates that the translator added his own interpretation to the work, describing how 'industrialized science' has prevailed over academic science and discussing how to overcome it with 'critical science' by citizen's movement. The translation was well received by the public. The 1970s was a time for Japan to have reviewed her environmental policy, in order to manage the so-called public nuisance problems as happened in Minamata. This was a wide spread disease among fishermen caused by organic mercury contamination, most notoriously at Minimata but also elsewhere (Yorifuji, Tsuda, & Harada, 2013). Nakayama's translation was a response from academics to the series of environmental disaster, and introduction of Ravetz's work was considered to be a part of Nakayama's Sartrean efforts on "engagement" to public affairs and citizen's movements.

One of Nakayama's leading students, Hitoshi Yoshioka (1953-), elaborated these concepts, developing the field of sociology of science. He used this methodology of critical science to analyze the Japanese nuclear industry in detail. Together, Nakayama and Yoshioka conducted a research project on contemporary history of Japanese science, technology and society, and their results are published in a series, *Science, Technology in Contemporary Japan.* The series is still in the process of being published in Japanese. A four-volume English translation of the earlier parts was published from 2001 to 2006. In the meantime, the STS (Science, Technology and Society) movement reached Japan in the 1990s; the STS Network Japan (STSNJ) involved students in Tokyo, and the Japanese Society for STS was established in 2000.

My own academic career started with studying the inorganic analytical chemistry of heavy elements like lanthanoid. Later I began

to study the history of science and STS.I joined the Nakayama school as one of its junior members. Nakayama was the master of this field in Japan, a collaborator of Joseph Needham. Nakayama recommended me for a post-doctoral fellowship at the Needham Research Institute in Cambridge, UK, after I completed my Ph.D. in history of medicine in 1993 in Leiden, the Netherlands. Around the time of my return to Japan in 1994, Yoshioka then became a leading figure of Nakayama's school, and the research projects of that school have guided my work. With the collaboration to them, I was a founding member of the Japanese Society for STS and a steering committee member for the first ten years of its existence. In this academic genealogy, Ravetz's legacy with Nakayama was succeeded by Yoshioka, and I am proud to have contributed to it even a little bit.

In 2002, the concept of post-normal science was introduced to Japan for the first time at the Annual meeting of the STSNJ. Earlier that year, I had met PNS scholar Jeroen van der Sluijs for the first time in Leiden, where we both attended the university as Alma Mater, and he spoke to me about the merits of PNS, based on his growing list of scholarly achievements in applying PNS to European science-policy cases. When I returned to Japan after meeting with Jeroen, I immediately encouraged my students to read papers on PNS. As a result, Aoi Horiuchi, who was then a student of my laboratory at Kobe University, made a short introduction of PNS to a group of students and STS scholars at a STSNJ annual meeting. In this presentation, Horiuchi reported on his research in progress and introduced two articles from *Futures*: J. Ravetz and S. Funtovicz, 'Post-normal science: an insight now maturing', (1999) and J. Ravetz, 'What is post-normal science?' (1999). Later, rough Japanese translations of both articles were also included in a booklet with background papers on the occasion of Jeroen's visit to Japan for an international workshop on "Present and Future of Global Climate Risk Management" of a research project named ICA-RUS on climate change and risk, organized by the Japanese Environmental Agency in 2013. This booklet also included rough translations of Turnpenny, Jones, and Lorenzoni (2011), Petersen, Cath, Hage, Kunseler, and Van Der Sluijs (2011) van der Sluijs et al. (2005) and Kloprogge, van der Sluijs, and Petersen, (2011).

Ravetz's book, *No Nonsense Guide to Science* (2006) has also been translated into Japanese and published in 2012. After 3/11, I wrote two further articles mentioning PNS in Japanese: Tsukahara (2012b, 2012c).

With those presentations, translations, and a few articles about PNS in Japanese, PNS has received some attention and has been introduced to the Japanese public. You may notice that Japanese STS and environmental studies have paid an attention to the works of J. Ravetz since the pioneering work of historian Nakayama. The work of PNS scholar Jeroen van der Sluijs inspired my work which I published in Japanese, that has gained some success in disseminating the ideas of PNS among Japan's academia and in the public sphere.

Also worth mentioning is *EASTS (East Asian Science, Technology and Society: An International Journal),* which was first published in 2007. This seasonal journal based on Taiwan has enjoyed success in East Asia and has recently published its tenth volume. A strong community of East Asian STS journals has emerged in the last ten years. The current editor in chief is Kuo Wen-Hua from Taiwan, and I have served as an Associate Editor since the inauguration of this journal. PNS has not yet been extensively discussed in this journal, but it has described and analyzed a number of case studies in East Asia that could benefit from a PNS perspective.

In East Asian STS, most interestingly, a German educated and Ulrich Beck-inspired Taiwanese sociologist, Chou Kuei-Tien, has discussed PNS in the framework of risk studies. His works have relevance to PNS framework, also mentioned in Kuei-Tien (2007b, 2007a), and Kuei-Tien (2008).

In summary, the concept of PNS has certainly been introduced in Asia and seemingly recognizable for the Japanese public and most East Asian STS communities. To some degree, European scientific policy is seen as a model that Japan should follow, and PNS is part of that policy.

3. The role of post-normal science post 3/11

But the biggest problem for Japan (and East Asia) now is 3/11. Before applying a PNS perspective in the Japanese and East Asian context, we must re-examine the relationship between techno-science and democracy after 3/11. The 3/11 disaster has radically changed the relationship between science/technology and society, and hence the very nature of Japan as a democratic society.

The aftermath of the Fukushima Disaster of 3/11 had complex and multi-layered effects. Post 3/11 Japan is a good subject for scientific studies on how a non-Western, highly techno-scientific, developed society reacts to an emergency caused by a technological disaster. I would like to offer my analysis of post 3/11 Japan and of how Japan's public has reacted in the aftermath of the disaster before I apply the critical perspective of post-normal science to post 3/11 Japan.

The 3/11 disaster had a deep psychological effect. It was considered as a crucial failure in Japan, not to have sufficiently prepared the nuclear plant for a strong earthquake and a resulting tsunami. Not only a failure in prediction, but even more the failure to implement precautionary and preventative measures broke public trust in science. Such disappointment led to a general decrease of trust in science and technology, and also in its institutions. Historically speaking, Japan has accepted and adapted technology and science from the West ever since the mid-19th century, and it has been very successful in its adoption. The Japanese always felt that Japan is superior to the other Asian nations, and one argument for this stresses Japan's command of science and technology. But, clearly, the events occurred around the 3/11 disaster in total represent a technological failure with very far reaching impacts. It is recognized as a historical black episode, something that a technologically outstanding nation such as Japan should never have experienced.

It has been worsened because it is one of the only two accidents of level seven on the International Nuclear Event Scale, associated with the other one notoriously happened by socialist Russia in the 1986 Chernobyl nuclear disaster. In the Japanese mind, Russia is usually regarded as the opposite of Japan in many ways. This is partly because of Russia's adoption of a socialist system that Japan long rejected, and also because of Russia's historical defeat by Japan in the Russo-Japanese War at the beginning of 20th century. Russia has traditionally been viewed as an outdated, bad example of an old European style, which has been overtaken by the

technologically superior, rising nation of modern Japan. The 3/11 disaster was traumatic for the Japanese psyche, because her techno-confidence and her pride in her swift history of modernization has been badly jeopardized.

Politics also changed drastically after 3/11. The Democrats were in power two years before 3/11, but they failed to manage this disaster, it was only confusion and disappointment widely spread among public. As al result, pretty quickly after 3/11, the Liberal Democrats smashed them in a landslide victory in the 2012 election, and Shintaro Abe became prime minister. Abe is a conservative, nationalistic and militant politician, and he is promoting technocratic techno-science policies that existed in Japan from the cold-war and high economic growth period. Most notably, rather than abandoning and restricting nuclear power after Fukushima severe accident, the Abe administration re-activated several nuclear power plants and returned to its previous nuclear policy. Moreover, the Abe administration promotes specific trade (exportation) policies, that emphasizes the export of Japanese technology, particularly in the sectors of military and nuclear technology. This policy is claimed to restore psychological confidence in, and strength of, the patriotic vigor of the Japanese technology. These return to previous technocratic policy raised concerns in civil society.

As for the citizens' sphere, since 3/11, Japanese society has been badly divided; in fact, the current division of Japanese society is as bad as that of the Trumpian United States. Like in the US, the Japanese public searched for strong leadership in the time of perceived crisis. This sense of crisis was generated first by the triple disaster of 3/11, but it was enhanced by geopolitics, that is, claims made repeatedly by Abe and his self-defined patriots that Japan was threatened by her neighbors. Geopolitics are often simplified in East Asia: as China has become very strong, so it is easy to whip up fear of this potential enemy. In general, therefore, the socio-political situation of post-3/11 Japan is not favorable for democratic and deliberate discourse on science and technology; the current moment is a time of distress and crisis for deliberative consideration and democratic decision-making on techno-scientific issues in the public sphere.

But one difference between Japan and the US is that the division in Japanese society is not obvious, thanks to the so-called Japanese attitude for the preference of peer pressure. Japanese society even appears quite stable, and opinion polls rate the Japanese government as high as ever. This can be understood as a phenomenon typical in Japanese, which is rather strange in a democratic nation. In fact, the Abe government's popularity stems from populist, authoritarian supporters, even as the divide in society grows larger.

For instance, current opinion polls by Asahi Newspaper in 2016 et al. show that more than 70% of Japanese people are opposed to nuclear power, and prefer natural energy in general. But despite this public resistance to atomic energy in the wake of 3/11, the Abe administration has restored Japan's earlier nuclear policy and encouraged the nuclear industry to export Japan's nuclear power plant technology. This is a peculiarly twisted situation: the Abe administration commands a policy that is completely opposite to the wishes of the public, but the public is still supporting this government. My explanation of this contradiction includes several causes: there is widespread distrust across different sectors of society, the gap between the rich and poor is becoming serious, and a desperate public wishes to have a strong commander in chief. An ocean away, Trump even appeals to members of Japanese society who are struggling.

In the divided, wretched landscape created by 3/11, the Japanese public desired a stronger leader, and ended up choosing the populist and authoritarian leader. This is often understood as a reaction to the indecisive Democratic government, and the sense of crisis and psychological instability that the Japanese electorate felt in the 3/11 disaster. I see this also as a symptom that Japan's deliberate democratization and the STS approach (which was a priority of Democratic policymakers) failed to manage the 3/11 disaster. It could not gain enough popularity to maintain the Democratic government, because it led to a lack of clear and reliable decisions at the time of the emergency created by 3/11. As a result, in my opinion, most unfortunately, Japan had been returning to an authoritarian state and technocratic nation in the aftermath of 3/11.

I have applied several conceptual tools to analyze this post-3/11 situation of Japan, and I consider that it was created by a combination of 'disaster capitalism' and 'normalcy bias'. The new political climate in post-3/11 Japan results in part from the politics of emergency, and partly from the manipulation and distortion of democracy. 'Disaster capitalism' is a concept described by Naomi Klein (2008) in her book *The Shock Doctrine;* I thought Japan's situation deserves Klein's analysis, that it is operated within the set of policies elaborated by 'disaster capitalism'.

Psychological rationalization is also important in the emergent situation; 'normalcy bias' is called for in times of emergency. It is a psychological function that distorts one's judgement of the current trouble, leading one to rationalize and claim that the extra-ordinary situation is normal and ordinary. This leads to biased judgements, saying "abnormal is normal": as a result, the victimized people often rely on this bias, and their suffering continues. (For a more detailed explanation and my analysis of the concepts of 'disaster capitalism' and 'normalcy bias' in post-3/11 Japan, see the following articles: Tsukahara (2011), Tsukahara (2012a), Fujigaki and Tsukahara (2011)

Cases of thyroid cancer in Fukushima and its surroundings are a serious and even pathetically painful issue. One hundred seventy two children in and around Fukushima have already had their thyroids removed in surgical operations (number of children reported in a Japanese science journal, *Kagaku* [Science], 2016, vol.86, no.8. This journal is comparable to *Nature/Science* in English-language media.), however, the details of this public health issue have mostly been concealed and classified as confidential cases. The medical authorities responsible for this issue, mostly those at Fukushima Medical University − supported by and in cooperation with the IAEA (International Atomic Energy Agency) − have denied any causal relationship with the Fukushima nuclear power plant incident. They call it as simply accidentally caused, and these statistically significant patients discovered are claimed to be merely a simple result of over-screening.

Having seen such a flagrant and blatant contradiction, not only distrust but also despair prevailed. Some more questions are raised: Shall we then encourage farmers to cultivate their land and to grow crops and vegetables, and shall we help fishermen catch fish off the wretched coast of Fukushima? If the resulting food causes thyroid cancer, is it likely to also trigger other diseases, disorders or physical dysfunctions? Amazing numbers of health disorder after 3/11 not only in the vicinity of Fukushima, but also all

over Japan is reported in a scientific paper by E. Ochiai (2015). Would you eat this food or give to your children and family members? More than 170,000 evacuees are still in exile, and some are waiting to return to the area or are refusing to return to the contaminated land where they once lived. Their plight is dire: Their communities have been destroyed and a number of families have been divided by this massive exile in the modern developed state of Japan. What can we do for them, and what shall we do for their ordeal and misery?

Any suggestion of causality between the Fukushima incident and thyroid cancer is officially rejected.It is announced by the authority's voice that "radioactivity risk is safe, take it, because risk creates chance", like the proclamation given in the novel *1984* by George Orwell. Behind this is another historical psychology, that Japan has overcome Hiroshima and Nagasaki and made a great success in economic development, so that, again in the 21st centry, Fukushima can be a risk but this risk should be taken by Japanese people. Their patience would be rewarded economically, and their ordeal would eventually be overcome with a patriotic determination.

There is some counter argument, that is even claiming that the US and the IAEA are working behind the scenes, and they have conspired to refute this causality and escape responsibility. This is considered as an extension of the conspiracy between the US and Japan which has been alleged since ABCC (Atomic Bomb Casualty Commision) began to conduct medical research on Hiroshima-Nagasaki victims (For ABCC, see Susan Lindee, 1994). Treatment of thyroid cancer patient children at the Fukushima Medical University is often regarded as an extention of ABCC activities, and also a part of this US-IAEA conspiracy. Fukushima Medical University, therefore, is regarded for some people as playing an institutional role of agency of the ABCC that was once done to atomic bomb victims in Hiroshima-Nagasaki.

This thyroid cancer has several consequences, that wider scale food contamination by radioactivity all over Japan, and evacuation and re-activation of nuclear plants are issues that cannot be settled by those corrupt experts. Here we see a serious divide, that the general public regards scientists and engineers, and some medical doctors, as the most corrupt, untrustworthy members of society. At stake for us concerning scientific citizenship and democracy in techno-science is the difficulties and such a distorted divide created in post 3/11 Japan.

A comparison of Fukushima with Chernobyl can help us examine how scientific citizenship are similar in some ways, but mostly different, to each other. This comparison also highlights differences in 'biological citizenship' as described by Adriana Petryna (2004). The political context of the two disasters is easy to compare. In the case of Chernobyl, the administration and method of decision-making was socialist state authoritarian, which is easy to blame. Fukushima, however, occurred under a democratic system − which was actually very corrupt − a so-called corporate capitalist industrial system under the protection of the state technocracy. This system is more difficult to analyze and criticize. It is easy to dismiss the scientists and engineers involved in the Chernobyl disaster; under the socialist (normal science) system. Their level of scientific skill was simply inferior and less competitive to the systems deployed in the capitalist industrial system. Scientists at Fukushima, however, although corrupt and authoritarian practitioners of science in the sociological sense of Ziman's PLACE (Proprietary, Local, Authority, Commissioned, Expert) principle (Ziman, 2000), they were industrial scientists as also defined by Ravetz, so they cannot be so easily dismissed, In any case they are an integral part of our industrial knowledge production system.

After the Chernobyl disaster, citizens and international civil organizations were involved in the rescue, cleanup and finally confinement within the sarcophagus. Western concern for the contamination of radioactivity in the local region and beyond, and care for inhabitants in its surroundings, was taken for granted. It also occurred during the last stages of the Cold War and led to the fall of the Soviet Union, which made it easier for the rest of the world to blame the disaster, and the disaster was even symbolized as a symptom of death to a failing nation. In Fukushima, however, it was difficult for outside organizations to get involved because Japan is an independent, capitalist nation with a stable government and successful economy. Neighboring Korea, Taiwan and China expressed concern, but such voices are often politicized and tend to be rejected by the Japanese public. For instance, regarding food contamination, Korea and Taiwan actually banned the import of several types of food. Japanese media reported such measures as 'overreactions without a scientific standard' and 'irrational and emotional'. In reaction, the media also strongly encouraged farmers to increase their cultivation of the contaminated areas and fishermen to fish in areas with tons of contaminated water pouring in every day. Meanwhile, concerned mothers in the area avoid feeding any food from that area to their children.

The political consequences of Chernobyl are considered that it led to, and was also accompanied by, the collapse of the Soviet Union and the birth of a new nation with 'biological citizenship'. The Japanese case, meanwhile, it seems to embrace opposite end: the level 7 accident has led to utter public distrust of scientists and engineers, and exacerbated a badly divided society. Such distrust and dividedness has brought about the emergence of a nationalist, militant–populist politics. The new government led by Abe has announced that new Japanese techno-scientific policy that will support the rebirth of techno-Japan with restored psyche of Japanese techno-modernity as its brilliant state legacy, in the process of constructing even stronger economy by means of a vigorous export policy of nuclear and military technology.

As I mentioned above, post-3/11 Japan is judged as not a good place to discuss science and technology in a deliberate manner supported by a reasonable democracy with mutual understanding and value-free examination of techno-science in action. But, in this time of serious social divide and political populism, can PNS and a citizens' science approach now lead the way to fill in the gap? Are there any lessons here that can be applied to post-3/11 Japan? The question is still open.

References

Fujigaki, Y., & Tsukahara, T. (2011). STS implications of Japan's 3/11 east asian science. *Technology and Society: An International Journal*, *5*(3), 381–394.
Funtowicz, S., & Strand, R. (2007). Models of science and policy. In T. Traavik, & L. C. Lim (Eds.), *Biosafety first: Holistic approaches to risk and uncertainty in genetic*

engineering and genetically modified organisms. Trondheim: Tapir.
Klein, N. (2008). *The Shock Doctrine – The rise of disaster capitalism*. Picador.
Kloprogge, P., van der Sluijs, J., & Petersen, A. (2011). A method for the analysis of assumptions in model-based environmental assessments. *Environmental Modelling & Software*, *26*(3), 289–301.
Kuei-Tien, C. (2007a). Biomedtech island project and risk governance: Paradigm conflicts within a hidden and delayed high-tech risk society. *Soziale Welt*, *58*, 123–143.
Kuei-Tien, C. (2007b). Conflicts of technology policy and governance paradigm in a knowledge-based economy: A case analysis of the construction of the Taiwanese biobank. *Issues & Studies*, *43*(3), 97–130.
Kuei-Tien, C. (2008). Glocalized dioxin: Regulatory science and public trust in a double risk society. *Soziale Welt*, *2*, 181–198.
Lindee, S. (1994). *Suffering made real: American science and the survivors at Hiroshima*. Chicago U.P.
Ochiai, E. (2015). The human consequences of the fukushima dai-ichi nuclear power plant acciednets. *Asia-Pacific Journal Japan Focus*, *13*(September (38)) [Number 2 also accessible to http://apjjf.org/-Eiichiro-Ochiai/4382].
Petersen, A., Cath, A., Hage, M., Kunseler, E., & Van Der Sluijs, J. P. (2011). Post-normal science in practice at the Netherlands environmental assessment agency. *Science Technology Human Values*, *36*(3), 362–388.
Petryna, A. (2004). Biological citizenship: The science and politics of chernobyl. *Osiris*, *19*, 250–265.
Tsukahara, T. (2011). Activation of disaster capitalism in 3/11: What should we learn from Kobe, twice destroyed after the quake. *Revue De La Pansee d'aujourd'hui*, *39*(7), 202–211 [in Japanese].
Tsukahara, T. (2012a). Four (Baconian) idolas of 3/11: Science, normalcy bias and the colonial character of Japanese nuclear technology. *Revue De La Pansee d'aujourd'hui*, *40*(4), 200–214 [in Japanese].
Tsukahara, T. (2012b). New definition of social responsibility of scientists by post-normal science. *Revue De La Pansee d'aujourd'hui*, *39*(10), 98–120 [in Japanese].
Tsukahara, T. (2012c). Public sphere of science in the post-normal age. *Science*, *83*(3), 334–342 [in Japanese] (Iwanami publ. in Japanese).
Turnpenny, J., Jones, M., & Lorenzoni, I. (2011). Where now for post-normal science? A critical review of its development, definitions, and uses. *Science Technology & Human Values*, *36*(3), 287–306.
Yorifuji, T., Tsuda, T., & Harada, M. (2013). *Minamata disease a challenge for democracy and justice. Late lessons from early warnings: Science, precaution, innovation*, . Copenhagen: European Environment Agency, 92–130 [EEA Report No 1/2013, Available online: http://www.eea.europa.eu/publications/late-lessons-2/late-lessons-chapters/late-lessons-ii-chapter-5].
Ziman, J. (2000). *Real science*. Cambridge University Press.
van der Sluijs, J. P., Craye, M., Funtowicz, S. O., Kloprogge, P., Ravetz, J. R., & Risbey, J. S. (2005). Combining quantitative and qualitative measures of uncertainties in model based environmental assessment: The NUSAP system. *Risk Analysis*, *25*(2), 481–492.