

“Structural Disaster” Long Before Fukushima: A Hidden Accident*

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This paper attempts to shed fresh light on the structural causes of the Fukushima accident by illuminating the patterns of behavior of the agents involved in the little-known but serious accident that occurred immediately before World War II. Despite the expected incalculable damages caused by the Fukushima nuclear power plant accident, critical information was restricted to government insiders. This state of affairs reminds us of the state of prewar Japanese wartime mobilization in which all information was controlled under the name of supreme governmental authority. This paper argues that we can take the comparison more seriously as far as the patterns of behavior of the agents involved are concerned. The conceptual tool that is employed to that end is the “structural disaster” of the science-technology-society interface. This paper will contextualize the sociological implications of this prewar accident that happened long before the Fukushima accident for all of us who face the post-Fukushima situation with particular focus on the subtle relationship between success and failure.

Keywords: *Structural Disaster, Secrecy, Fukushima Accident, Functional Disintegration, Science-Technology-Society Interface*

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Introduction

The Fukushima nuclear power plant accident was extremely shocking, but what is even more shocking in the eyes of the present writer is the devastating failure in transmitting critical information about the accident to the people when the Japanese government faced unexpected and serious events after March 11, 2011. Secrecy toward outsiders has generated this failure; secrecy toward the people who were forced to evacuate from their birthplaces, toward the people who wanted to evacuate their children, toward the people who have been suffering from tremendous opportunity loss such as giving up entering college, and others. It is virtually impossible to enumerate all of the individual instances of suffering and aggregate them in an ordinarily calculable manner. Despite such expected incalculable damages, critical information was restricted to government insiders. This state of affairs seems to be similar to the state of prewar Japanese wartime mobilization in which all information was controlled under the name of supreme governmental authority.

One might consider such a comparison with the prewar state to be merely rhetorical. This paper argues that we can take the comparison more seriously as far as the patterns of behavior of the agents involved are concerned. It is true that the prewar Japanese military regime was oriented toward mobilization for war while the postwar regime has been prohibited by the constitution from mobilization for the purpose of war of any kind. In this respect, there is a large discrepancy between the prewar and postwar regimes as to their purpose.¹ However, the surprising but telling similarity of the patterns of behavior of the agents in such discrepant regimes is evident if we look into the details of a hidden accident that took place just before the outbreak of World War II (abbreviated to WWII hereafter).

This paper attempts to shed fresh light on the structural causes of the Fukushima accident by illuminating the patterns of behavior of the agents involved in the little-known but serious accident involving naval vessels that occurred immediately before WWII, focusing particularly on the subtle relationship between success and failure in the complex science-technology-society interface. Similarities and differences will then be contextualized and

¹ As far as sociological implications of “structural disaster” are concerned, there could be structural similarities between the two regimes as will be detailed below. For further details, see Matsumoto (2012a).

their sociological implications drawn for all of us who face the post-Fukushima situation. The conceptual tool that is employed here to that end is the “structural disaster” of the science-technology-society interface.

The “Structural Disaster” of the Science-Technology-Society Interface

The “structural disaster” of the science-technology-society interface is a concept developed to give a sociological account of the repeated occurrences of failures of a similar type (Matsumoto 2002, pp. 25-7, 2012a). In particular, it is developed to clarify a situation where novel and undesirable events happen but without a single agent to blame, to allocate responsibility for the events, or to prescribe remedies. The reason for denominating this failure as the failure of the science-technology-society interface rather than that of science, or of technology, or of society is worthy of attention to understand the development of my argument. For example, if nuclear physics is completely successful in understanding the process of chain reaction, technology such as nuclear engineering could fail in controlling the reaction as in the case of Chernobyl and its aftermath such as the “Cambrian sheep” incident (Wynne 1996).² Or if nuclear engineering is almost completely successful in containing radioactive materials within reactors, social decision-making could fail as in the case of the Three Mile Island accident (Perrow 1984, 1999; Walker 2004). Or if society is completely successful in setting goals for the development of renewable energy technologies, science and/or technology could fail as in the case of Ocean Thermal Energy Conversion (Matsumoto 2005).

In a word, the success or failure of science, technology, and society cannot be overlapped automatically (Latour 1996). In particular, there seems to be something missing in-between, which has unique characteristics of its own. The failure of interface is intended to explore this state. What are in-between could be institutional arrangements (Frickel and Moore 2006), organizational routines (Vaughan 1996; Eden 2004), and tacit interpretations of a formal code of ethics, invisible customs, or the networks of interests of different organizations. This paper focuses on, among other things, the structural similarity in terms of the patterns of behavior of heterogeneous agents that come into play in the science-technology-society interface in a

² For a different view on the relationships, see Collins (2011).

specific social condition.

If the elements of “structural disaster” can be substantiated based on other independent cases, then we will be in a stronger position to obtain pertinent sociological implications from the Fukushima accident as a “structural disaster” and to extend these implications to potential future extreme events. What follows is an independent substantiation of these elements by examining the almost unknown accident that happened long before the Fukushima accident.

The Basic Features of “Structural Disaster”

According to Matsumoto (2012a, p. 46), there are five elements that constitute “structural disaster.”

1. Following wrong precedents carries over problems and reproduces them.
2. Complexity of a system under consideration and the interdependence of its units aggravate problems.
3. Invisible norms of informal groups virtually hollow out formal norms.
4. Patching over problems at hand invites another patching over for temporary countermeasures.
5. Secrecy develops across different sectors and blurs the locus of agents responsible for the problems in question.

The relevant element running through the above-mentioned prewar accident and the Fukushima accident is secrecy. To be accurate, the development of secrecy in “structural disaster” is decomposed into organizational errors, secrecy, and chain of secrecy to hide such errors. And to capture the nature of secrecy in this connection, the following fact about the Fukushima accident should be kept in mind in approaching the almost unknown accident that occurred long before the Fukushima accident: There have arisen repeated occurrences of similar patterns of behavior that have run through various different instances, which in the end have led to secrecy.

It is true that the emergency situation during and after such an extreme event as the Fukushima accident can provide a good reason to expect confusion and delay in transmitting information. But the degree and range of confusion and delay went far beyond those to be expected from an emergency situation alone. For example, the System for Prediction of

Environmental Emergency Dose Information (abbreviated to SPEEDI hereafter) was developed with the assistance of more than ten billion yen to make early evacuation of affected people smoother and safer. The first recommendation for evacuation was made by the Japanese government on March 12. The prediction obtained from SPEEDI was made public for the first time on April 26, despite the fact that its prediction had been made immediately after the accident. As a result of this secrecy, residents affected by the accident were advised by the government to evacuate without reliable information at the critical initial phase when they were exposed to a high level dose of radiation (Matsumoto 2012a, 2012b).

All they could do was to decide between trusting the government or not. SPEEDI had been awarded the first nuclear history award by the Atomic Energy Society of Japan in 2009 (Atomic Energy Society of Japan 2009), but its prediction made immediately after the Fukushima accident was never made public when it was needed. Organizational errors have intervened behind this state of affairs. This is the basic point of reference in approaching the almost unknown accident that happened long before the Fukushima accident as “structural disaster” and in securing a broader perspective for obtaining sociological implications from the Fukushima accident and the almost unknown accident that happened long before it.

The almost unknown accident mentioned here is the accident of the marine turbine developed by the Imperial Japanese Navy that occurred immediately before the outbreak of WWII. This accident enables us to redefine the complex relationship between success and failure in the science-technology-society interface both in peacetime and wartime. The accident was treated as top secret because of its timing. The suppression of information about this accident means that it has not been seriously considered as an event in the sociology of science and technology up to now. However, the description and analysis of this accident will suggest that the reality of the science-technology-society interface can depart significantly from a simplistic understanding in terms of success or failure.

Ships and Tips: The Development Trajectory of the Kanpon Type and Its Pitfalls

To understand the reality of this almost unknown accident, it is to the point to introduce two important keywords, “ships” and “tips,” as these keywords pinpoint the locus of the complex relationship between success and

failure. “Ships” here mean naval vessels of the Imperial Japanese Navy built until immediately before WWII. They symbolize the Navy’s success in Japan’s development of self-reliant technologies. “Tips” here are the broken pieces of naval turbine blades, which symbolize the completely unexpected failure of technologies. The technology taken up is the Kanpon type turbine, Kanpon being the Technical Headquarters of the Navy. The Kanpon type turbine was developed by the Imperial Japanese Navy around 1920 to substitute entirely self-reliant technologies for imported ones. This naval turbine provides the key to understanding the connection between ships and tips. The reason is that the Kanpon type was the standard turbine for Japanese naval vessels from 1920 to 1945, and behind the broken pieces of its blades laid a serious but little-known failure that occurred immediately before WWII. The core of the connection between ships and tips consists in the background against which the Kanpon type turbine was developed.

From the time of the first adoption of the marine turbine in the early twentieth century (1905) after intensive investigations and license contracts, the Imperial Japanese Navy accumulated experience in domestic production of marine turbines. Throughout this process, the Navy carefully monitored the quality of British, American, and various other Western type turbines and evaluated them.³ To replace imported turbines, the Kanpon type turbine achieved standardization in design, materials, and production method “that is independent of foreign patents” (Shibuya 1970, Vol. 1, Chap. 4, pp. 133-4). The Kanpon type turbine was also expected to achieve cost reduction and flexible usage for a wide range of purposes, which would be made possible by standardization.

The first Kanpon type turbine was installed in destroyers built in 1924 (see figure 1).⁴

³ The British type originated in Parsons turbine and the American type in Curtis turbine, respectively. The first demonstration of the Parsons turbine at the Naval Review in 1897 caused a sensation in a complicated manner (Legett 2011). Regarding the Curtis turbine, see Somerscale (1992). And the license contracts with the Curtis and the Parsons types were due to expire in June 1923 and August 1928, respectively. Considering this situation, the Navy started to take official steps to develop its own type. On detailed descriptions and analyses of these dual strategies of the Navy outlined here, see Matsumoto (2006, pp. 54-63).

⁴ For a detailed account of this first Kanpon type turbine, see Hakuyō Kikan Gakkai Hakuyō Kikan Chōsa Kenkyū Iinkai (The Research Committee of the Marine Engineering Society of Japan), Nippon Hakuyō Kikan Shi Jōki Tābin Hen Sōkō (An Unpublished Manuscript of the History of Marine Engineering in Japan: The Steam Turbine), appended tables.

complex, the key factor leading to “structural disaster” embodied by the almost unknown accident. The military-industrial-university complex hereafter means an institutional structure made up of the governmental sector, particularly the military, the private industrial sector, and the universities—mutually autonomous in their behavior but expected together to contribute to national goals (Matsumoto 2006, p. 50).⁵

The Significant Failure Kept Secret

In December 1937, a newly built destroyer encountered an unexpected turbine blade breakage. Since the failure involved a standard design engine of the Kanpon turbine, it caused great alarm. However, it is extremely difficult to look into further details of this accident because there is little evidence to prove what is stated by official accounts (Sendō 1952; Itō 1956; War History Unit of the National Defense College of the Defense Agency 1969; Japanese Shipbuilding Society 1977; Institute for the Compilation of Historical

TABLE 1
REFERENCES TO THE LITTLE-KNOWN PREWAR ACCIDENT

Year of Reference	Author/Editor
1952	Former Engineering Rear Admiral of the Navy
1956	<i>Mainichi</i> newspaper reporter (Graduate of the Naval Academy)
1969	War History Unit of the National Defense College of the Defense Agency
1977	Japanese Shipbuilding Society (editor-in-chief and several members of the editorial committee were former technical officers of the Navy)
1981	Institute for the Compilation of Historical Records on the Navy

⁵ There is no implication herewith that the complex was designed in Japan by the “rich nation, strong army” policy in a top-down manner. Rather, the complex in Japan had an endogenous origin. See Matsumoto (2006, chapter 3). As for the “rich nation, strong army” policy, see Samuels (1994). The endogenous origin of the complex could also be detected in Britain as shown by the connection between physics and engineering in the life of Lord Kelvin. See Smith and Wise (1989). For a study on the complex with reference to American science and technology in the Cold War period, see Leslie (1993).

Records on the Navy 1981). All the authors/editors of the official accounts were parties connected with the Imperial Japanese Navy (see table 1).

It appears that the accident was kept secret because it occurred during wartime mobilization. To confirm this, an examination of government documents from around the time of the accident is in order. The government documents consulted here are the minutes of the Imperial Diet sessions regarding the Navy. The minutes of the 57th Imperial Diet session (held in January 1930) to the 75th Imperial Diet session (held in March 1940) contain no less than 7,000 pages of navy-related discussions (Kanbō Rinji Chōsa Ka 1984). These discussions include ten naval vessel incidents summarized in table 2.

It is noteworthy in these discussions that the Fourth Squadron incident of September 1935, one of the most serious incidents in the history of the Imperial Japanese Navy, was made public and discussed in the Imperial Diet sessions within a year (on May 18, 1936).⁶ The accident in question occurred on December 29, 1937, and was handed down informally within the Navy and counted as a major incident on par with the Fourth Squadron incident.⁷

More than two years after the accident, however, there is no sign in the government documents indicating that it was made public and discussed in the Imperial Diet sessions. Reports on the accident had already been submitted, as will be detailed below, during the period from March to November 1938 (the final report was submitted on November 2). Nevertheless, the Imperial Diet heard nothing about the accident or any details of the measures taken to deal with it. The accident was so serious that it would have influenced the decision on whether to go to war with the U.S. and Britain. The Fourth Squadron incident was also serious enough to influence the decision after the London naval disarmament treaty was concluded in 1930.⁸ But it was made public and discussed in the Imperial Diet sessions.

In this respect, there is a marked difference between the handling of the

⁶ The *Tomozuru* incident of March 11, 1934 was the first major one for the Imperial Japanese Navy. Only one-and-a-half years after this, a more serious incident occurred on September 26, 1935, which was the Fourth Squadron incident.

⁷ Based on interviews by the present writer with Dr. Seikan Ishigai on September 4, 1987 and June 2, 1993, and with Dr. Yasuo Takeda on September 25, 1996 and March 19, 1997.

⁸ The purpose of this treaty was to restrict the total displacement of all types of auxiliary warships other than battleships and battle cruisers. This London treaty obliged the Imperial Japanese Navy to produce a new idea in hull design enabling heavy weapons to be installed within a small hull, which, however, proved to be achieved at the expense of the strength and stability of the hull, as the incident dramatically showed.

TABLE 2
DISCUSSIONS IN THE IMPERIAL DIET REGARDING NAVAL VESSEL ACCIDENTS, ETC.
JANUARY 1930-MARCH 1940

Date	Description
February 13, 1931	Questions about the cause of the collision between cruisers Abukuma and Kitakami. (Shinya Uchida's questions were answered by the Minister of the Navy, Abo, at the Lower House Budget Committee, the 59th Imperial Diet session)
March 2, 1931	Questions about the measures taken before and after the collision between cruisers Abukuma and Kitakami during large-scale maneuvers in 1930 and the responsibility of the authorities (Tanetada Tachibana's questions were answered by the Minister of the Navy, Abo, at the House of Lords Budget Committee, the 59th Imperial Diet session)
March 17, 1933	Questions about the Minister of the Navy's view on the expenditure (12,000 yen) on repairs to destroyer Usugumo and on the fact that the destroyer struck a well-known submerged rock (Shinya Uchida's questions were answered by the Minister of the Navy, Ōsumi, at the Lower House Budget Committee, the 64th Imperial Diet session)
March 2, 1935	Request for information about the results of investigation into a scraping incident involving four destroyers, apparently on training duty in Ariake Bay, reported in newspapers (Yoshitarō Takahashi's questions were answered by the Minister of the Navy, Ōsumi, at the Lower House Budget Committee, the 67th Imperial Diet session)
May 18, 1936	Request for information about the seriousness of the collision between submarines I-53 and I-63 and the amount of money drawn from the reserve as a remedy (Kanjirō Fukuda's questions were answered by the Accounting Bureau Director, Murakami, at the Lower House plenary session, the 69th Imperial Diet session)
May 18, 1936	Request for detailed information about the degree of damage to two destroyers due to violent waves in September 1935 (Kanjirō Fukuda's questions were answered by the Accounting Bureau Director, Murakami, at the Lower House plenary session, the 69th Imperial Diet session)
February 6, 1939	Brief explanation of the accident of submarine I-63 (The Minister of the Navy, Yonai, explained at the House of Lords plenary session, the 74th Imperial Diet session)

TABLE 2
(CONTINUED)

Date	Description
February 7, 1939	Brief explanation of the accident of submarine I-63 (The Minister of the Navy, Yonai, explained at the Lower House plenary session, the 74th Imperial Diet session)
February 25, 1939	Request for a brief explanation of the sinking of a submarine due to a collision during maneuvers (Takeo Kikuchi's questions were answered by the Director of the Bureau of Military Affairs, Inoue, at the House of Lords Budget Committee, the 74th Imperial Diet session)
February 1, 1940	Brief report on the completion of the salvage of the sunken submarine I-63 (Minister of the Navy, Yoshida, reported at the House of Lords plenary session, the 75th Imperial Diet session)

two incidents. Regarding the Fourth Squadron incident, Director of the Naval Accounting Bureau (Kaigun Keiri Kyoku) Harukazu Murakami was forced to give an answer to a question by Kanjirō Fukuda (Democratic Party) at the 69th Imperial Diet session held on May 18, 1936 (Kanbō Rinji Chōsa Ka 1984, Vol. 3, Part 1, p. 86).

Although his answer gave no information regarding the damage to human resources (all members of the crew confined within the bows of the destroyers died), it accurately stated the facts of the incident and the material damage incurred, which amounted to 2.8 million yen in total. Even the damage due to the collision between cruisers about five years earlier in table 2 was only 180 thousand yen. The answer from a naval official clearly attested that the Fourth Squadron incident was so extraordinarily serious as to oblige him to disclose this fact to the public (Kanbō Rinji Chōsa Ka 1984, Vol. 1, Part 2, p. 831). It should be noted here that remedial measures for the problem of the turbines of all naval vessels disclosed by the accident in question were expected to cost 40 million yen (Shibuya n.d.).

Nevertheless, no detailed open report of the accident was presented at the Imperial Diet. This fact strongly indicates that the accident was top secret information and not allowed to go beyond the Imperial Japanese Navy. What, then, were the facts? This question will be answered based on documents owned by Ryūtarō Shibuya who was the engineering vice admiral of the Navy and was responsible for the turbine design of the naval vessels at the time

(these documents will be called the Shibuya archives hereafter).⁹

The Hidden Accident and the Outbreak of War with the U.S. and Britain: How Did Japan Deal with “Structural Disaster” in the Past?

According to the materials of the Shibuya archives, a special examination committee was established in January 1938 to investigate the hidden accident (The Minister of the Navy’s secretariat Military Secret No. 266, 1938, issued on January 19). It was organized as follows (Rinkicho Report, Top Secret No. 35, 1938, Appended Sheets):

(a) General members who did not attend subcommittee meetings

Chair: Isoroku Yamamoto, Vice Admiral, Administrative Vice Minister of the Navy

Members: Rear Admiral Inoue, Director of the Bureau of Naval Affairs, Ministry of the Navy, and five other members

(b) Subcommittees

First subcommittee for dealing with engine design and planning

Members: Leader: Shipbuilding Vice Admiral Fukuma, Director of the Fifth Department (including the turbine group), Technical Headquarters of the Navy, and nine other members

Second subcommittee for dealing with maximum engine power and suitable load/volume

Members: Leader: Rear Admiral Mikawa, Director of the Second Department, Naval General Staff, and eleven other members

Third subcommittee for dealing with prior studies/experiments/systems and operations

⁹ The archives are enormous, consisting of more than 4,000 materials on subjects ranging from steam turbine blades to casualties of the atomic bomb (see appendix). Even though we chose only the materials directly related to the hidden accident in question, it is impossible to present a full analysis here of all the details gleaned from these voluminous materials.

Members: Leader: Rear Admiral Iwamura, Director of the General Affairs Department, Technical Headquarters of the Navy, and ten other members

Ignoring duplication of members belonging to different subcommittees and arranging the net members by section, we obtained the following result (see table 3). All members of the committees are insiders of a single sector, the military sector.

In accordance with the voluminous reports of 66 committee meetings held over a period of ten months, the improvement of 61 naval vessels’ turbines was indicated as remedial measures (Rinkicho Report, Top Secret No. 1, 1938 through Rinkicho Report, Top Secret No. 27, 1938).¹⁰ However, the blade breakage in the accident was significantly different from those that occurred in the past. In impulse turbines, for instance, blades in most cases were broken at the base where they were fixed to the turbine rotor. In contrast, one of the salient features of this accident was that the tip of the blade was broken off. The broken off part amounted to one third of the total length of the blade. Figure 2 is a photograph showing the locus of the breakage (Rinkicho Report, Top Secret No. 1, 1938).

TABLE 3
MEMBERS OF THE SPECIAL EXAMINATION COMMITTEE BY SECTION¹¹

Section	Number
Administrative Vice Minister of the Navy	1
Bureau of Naval Affairs	8
Naval General Staff	5
Technical Headquarters of the Navy	15
Naval Staff College	3
Naval Engineering School	1
TOTAL	33

¹⁰ When we classify previous turbine failures during the period from 1918 to October 1944 by location, failures involving turbine blades account for 60 percent of the total (Seisan Gijutsu Kyōkai 1954, pp. 1-2). The Imperial Japanese Navy had thus had many problems with turbine blades for many years and accumulated experience in handling them. Accordingly, it is unsurprising that the special examination committee took the failure as a mere routine problem from the outset based on such a long and copious experience.

¹¹ Calculated based on the Rinkicho Report, Top Secret No. 35, 1938, Appended Sheets.

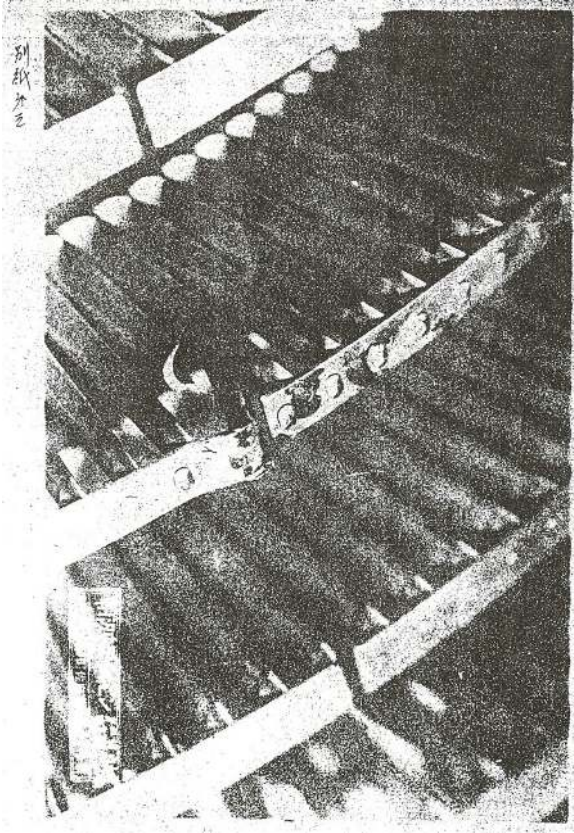


FIG. 2.—Broken part of a blade in the turbine failures.

Turning our attention to wartime mobilization of the day, the Japanese government enacted the Wartime Mobilization Law on April 1, 1938 for the purpose of “controlling and organizing human and material resources most efficiently.....in case of war” (Clause 1). Naval vessels came first in the specification of the law as “resources for wholesale mobilization” (clause 2).¹² Against this background, the naval engine failure caused by small tip fragments of the main standard engine was a very delicate matter for anyone to raise. And yet, for the reason mentioned above, the cause of this failure seemed to be significantly different from any previous routine problems. The complete test for detecting the cause of this peculiar accident required the

¹² Ishikawa (1982, p. 412). The author was in charge of drafting the national mobilization plan at the Cabinet Planning Board (Kikaku In) in the prewar period.

Navy to construct from scratch a full-scale experimental apparatus designed for the load test of the standard Kanpon turbine, which was only completed in December 1941, the month the war with the U.S. and Britain broke out.

As a result, the schedule for identifying the cause, which was originally expected to be completed in November 1940, was extended to mid-1943 (Kaigun Kansei Honbu Dai 5 Bu 1943). Thus, it is probable that all of Japan's naval vessels had turbines which were imperfect for some unknown reason when the country went to war with the U.S. and Britain in 1941.

What was the true cause?¹³ The true cause was binodal vibration. Previous efforts to avoid turbine vibration had been confined to one-node vibration at full speed since multiple-node vibration below full speed had been assumed to be hardly serious and unworthy of attention based on rule of thumb (Sezawa 1932; Pigott 1937, 1940). The final discovery of the true cause of the hidden accident drastically changed the situation. It revealed that marine turbines were susceptible to a serious vibration problem below full speed. It was in April 1943 that this true cause was eventually identified by the final report of the special examination committee—almost one and a half years after war broke out (Kaigun Kansei Honbu Dai 5 Bu 1943; see figure 3).

Strictly in terms of the technology involved in the accident without hindsight, therefore, the evidence suggests that the Japanese government went to war in haste in 1941, notwithstanding the fact that it had highly intricate and serious problems with the main engines of all its naval vessels. And that fact was kept secret by the military sector from other sectors in the military-industrial-university complex, not to speak of the general public. The rarity of breakdowns of naval vessels due to turbine troubles during the war is a completely different matter, a kind of hindsight. Thus, the hidden accident strongly suggests that practical results alone (for example, rarity of breakdowns of naval vessels due to turbine troubles) during wartime, possibly in peacetime as well, do not prove the essential soundness of the development trajectory of technology, and that of national decision-making along the trajectory.

¹³ For the detailed disentanglement of heterogeneous socio-technical factors which led to the detection of the true cause, see Matsumoto (2006, Chapter 6).

臨時機関調査委員會報告ニ関スル
主タービン改造茲ニ実験研究ニ関スル報告 別冊
昭和十八年四月一日
海軍艦政本部第五部

Fig. 3.—The front page of the final report of the special examination committee.

The Sociological Implications for the Fukushima Accident: Beyond Success or Failure

The above description and analysis of an independent case, a hidden accident that happened long before the Fukushima accident, provides an important guideline for understanding the Fukushima accident as a “structural disaster” beyond the simplistic dichotomy of success or failure. For one thing, critical information on significant failures in an emergency situation was made secret to outsiders of the governmental sector in both the prewar accident and the Fukushima accident. Secondly, both accidents occurred after a long history of successful technological development: The prewar hidden accident that happened long after a successful operation of the naval turbine in question, Kanpon type, since the 1920s reminds us of its structural similarity to the Fukushima accident that happened after a long successful operation of nuclear reactors closely associated with the myth of safety.¹⁴

Most importantly, the sociological implications of this prewar hidden accident pertain to the social context of organizational errors. The social context of the prewar accident is the wartime mobilization of science and technology, which was authorized by the Wartime Mobilization Law of 1938 and the Research Mobilization Ordinance of 1939. This formal legal foundation gave rise to the structural integration of the military-industrial-university complex under the control of the military sector. The military sector controlled the overall mobilization, in which the industrial sector and the universities had to obey orders given by the military. This was also associated with an extremely secretive attitude of the military toward outsiders. According to Hidetsugu Yagi who invented a crucial component technology of radars in the form of the pioneering Yagi antenna and in 1944 became the president of the Board of Technology, the central governmental authority specially set up for the wartime mobilization of science and technology, the military “treated civilian scientists as if they were foreigners”

¹⁴ As to the little-known prewar accident, the recognition of binodal turbine blade vibration as the true cause was beyond the knowledge of most turbine designers of the day. This type of problem is supposed to have been unrecognized until the postwar period. In the postwar period, avoiding turbine blade vibration caused by various resonances still provided one of the most critical topics for research on turbine design (Trumpler Jr. and Owens 1955; Andrews and Duncan 1956; Visser 1960). In fact, a similar failure occurred even in 1969 in the QE2's turbine (Report on QE2 turbines 1969).

(Report on Scientific Intelligence Survey in Japan 1945).¹⁵

Thus, cooperation, not to speak of coordination, with the military sector was very limited even among the central governmental authorities specially set up to integrate every effort for the wartime mobilization of science and technology, and the military-industrial-university complex began to lose its overall integration. What is important here is the fact that this functional disintegration of the network of relationships linking the military and the other sectors was taking place just at the time the strong structural integration of the complex was formally being reinforced by the Wartime Mobilization Law of 1938 and the Research Mobilization Ordinance in the next year.

This coexistence of structural integration and functional disintegration during wartime mobilization provides a suitable background for redefining success or failure not only in prewar Japan's context but in the current context of the Fukushima accident. If the Fukushima accident is "structural disaster," it could have some characteristics similar to the coexistence of structural integration and functional disintegration. For example, functional disintegration of the network of relationships linking the government, TEPCO officials, and the reactor designers of heavy electric equipment manufacturers might be taking place just at a time when the strong structural integration of the government-industrial-university complex was formally reinforced by the seemingly well-organized ordinances and laws revolving around the "double-check" system within a single ministry in the past and that between two ministries now, between METI (Ministry of Economy, Trade and Industry) and the Ministry of the Environment, ministry-bounded in either case.

As long as this kind of functional disintegration of the science-technology-society interface continues to exist and to operate behind the façade of structural integration, this state of affairs can lead to similar serious failures in quite a different and larger-scale social context. The possibility of functional disintegration through structural integration coupled with secrecy and the suppression of negative information under the name of communication activities in the current context could be one of the important symptoms of "structural disaster" embodied by the Fukushima accident.

For example, while various communication activities to facilitate links

¹⁵ These are Yagi's words on September 11, 1945, when interrogated by General Headquarters of the U.S. Armed Forces, Pacific Scientific and Technical Advisory Section.

between science, technology, and society had been carried out with public funds as represented in Café Scientifique before the Fukushima accident, it turns out that there had been only one Café Scientifique on anything nuclear (held on July 24, 2010) out of 253 carried out in the Tohoku district including Fukushima prefecture. And yet the topic taken up then had nothing to do with any kind of risk from nuclear power plants, not to speak of extreme events.¹⁶ This implies various activities that are supposed to facilitate well-balanced links between science, technology, and society in reality did nothing in advance about the communication of the negative aspect of nuclear power plants and, therefore, played no role in early warning against extreme events such as the Fukushima accident.

If the “structural disaster” thus embedded in the social context of the Fukushima accident continues to exist in a path-dependent manner, the science-technology-society interface surrounding the Fukushima accident would probably be unable to tolerate another impact that could be given by serious and unexpected events such as a second huge earthquake and tsunami and/or the difficulty of decontamination within some of the reactors in question and their abrupt uncontrollability.¹⁷

Therefore the most important lesson to learn from the Fukushima accident as “structural disaster” in light of the hidden one that happened much earlier immediately before the outbreak of WWII is how to avoid the worst of this kind. That is to say, the seemingly structurally robust but functionally disintegrated science-technology-society interface due to secrecy should be changed. It should be changed by the will of the people who are suffering from the Fukushima accident and a significant structural remedy should be instituted beyond countermeasures that only temporarily patch over individual troubles coming to light at that moment.

Conclusion: Prospects for the Future

From the viewpoint of “structural disaster,” there are two different kinds of similarities between the prewar hidden accident and the Fukushima accident: one relating to the timing of secrecy, the other to the social context

¹⁶ What is mentioned here is confirmed on November 18 through the following portal website on Café Scientifique in Japan. <http://cafesci-portal.seesaa.net/>

¹⁷ Although the question of high-level radioactive waste disposal has not been discussed in Japan in association with the Fukushima accident up to now, the disposal question should be added to the list of “serious and unexpected events” (Matsumoto 2010; Macfarlane 2012).

of organizational errors.

First, regarding the timing of secrecy in relation to technological trajectory, both accidents took place after dozens of years of successful operation of domestically produced technologies. This situation made it extremely difficult for the agents involved in the two accidents to make the accidents public even at a critical moment of decision-making because disclosing the accidents should have drastically destroyed the trust of the agents in the public sphere. In that particular sense, secrecy in both accidents could be the result of the need for face-saving of the agents who went through “self-reliant failure” for the first time.

Second, there is a similarity between the two accidents in terms of the social context of organizational errors. That is to say, the coexistence of structural integration and functional disintegration observed in the prewar accident could similarly reside in the Fukushima accident, together with asymmetrical relationships between the governmental sector and other sectors. In this connection, nuclear-industrial-university complex in the current context could be a “dysfunctional” equivalent to military-industrial-university complex in the prewar period.

Of course, there are differences between the two accidents. Among other things, the difference in the way organizational errors came to be detected and corrected is noteworthy. In the prewar accident, the conclusion once reached based on the voluminous reports of the special examination committee and yet authorized by the organization in question was dynamically changed by carefully observed facts of the locus of sheered tip regardless of past experience accumulated in the organization. Such a dynamic reconsideration of alternative possibilities that must have upset the face-saving procedure within a specific organization triggered the restart of the examination leading to a drastically different conclusion.

In contrast, there has been no sign up until now of the working of this kind of dynamic correction of organizational errors in the Fukushima accident. Looking at inside stories of TEPCO, former NISA, newly set up NRA (Nuclear Regulation Authority), and other governmental bodies that have been disclosed one after another, one might rather well suspect the working of mutual “cover-ups” within and/or between those organizations in question, though the possibility of the dynamic correction of organizational errors might still be left open.

This difference is noteworthy because, even with the working of such a dynamic correction of organizational errors and reconsideration of alternative possibilities, the timing of the realization of the true cause of the

prewar accident was too late for Japan to check the soundness of national decision-making before going to war in 1941.

In sum, putting together the similarity between the prewar accident and the Fukushima accident as “structural disaster” and the difference as to whether the dynamic correction of organizational errors and the reconsideration of alternative possibilities work, it is crucial for us in the current context to be fully aware of the risk of being too late in two senses. First, we should not be too late in bringing the minimum essentials of the still ongoing accident to the public sphere through breaking secrecy and the chain of secrecy. Secondly, we should not be too late in correcting organizational errors because of the face-saving of the organizations in question. These two points are crucial for the Fukushima accident as “structural disaster,” because delayed timing could mean the start of something devastating, uncontrollable, and irreversible to all of us.

Appendix

Materials of the Shibuya Archives

Item	Number of Materials
Marine Engineering	
Steam Turbines (Blades, Rotors)	85
Steam Turbines (Domestic)	237
Steam Turbines (Foreign)	133
Reduction Gearing	108
Condensers	48
Propellers/Propulsion Shafting	145
Boilers (General)	228
Boilers (Velox Boiler)	19
Boilers (Feed Water)	56
Boilers (Automatic Control)	22
Auxiliaries (General)	151
Auxiliaries (Steering Gear, etc.)	50
Auxiliaries (Distilling Plant)	34
Piping	152
Internal Combustion Engines	392
Gas Turbines	91
Rinkicho Failures	45
Materials	206
Fuel/Lubricant	47
Submarines	53
Compendium & Design of Marine Engines	149
Trial Reports	80
Vibration/Noise	34
Bearing	32
General Reports/Bye-laws	62
Miscellaneous	104
Naval Architecture	
Technical Reports	49
Design	47
Hull Structure	125

Item	Number of Materials
Materials/Hull Corrosion	79
Welding	58
Tanker/Bulk Carriers	57
Fishing Vessels	21
Miscellaneous	80
Nuclear Power	170
Weapons/Weapons Systems	
Guns	7
Gunpowder	17
Materials	72
Torpedoes	7
Ship Electrical Systems ²²	
Navigation Systems	5
Warplanes	55
Miscellaneous	
Including manuscripts, memoranda,	585
Photographs, etc.	
Total	4,219

SOURCE: Based on Shibuya Bunko Chosa Iinkai, Shibuya Bunko Mokuroku (Catalogue of the Shibuya archives), March 1995.

References

- Andrews, F. and J. P. Duncan. 1956. "Turbine Blade Vibration: Method of Measurement and Equipment Developed by Brush." *Engineering* August 17:202-8.
- Atomic Energy Society of Japan. 2009. <http://www.aesj.or.jp/awards/2008/2008-119-120.pdf> (ascertained on 21 March 2013).
- Collins, Harry. 2011. "The Third Wave of Science Studies: The Development and Politics." *Japanese Journal for Science, Technology & Society* 20:81-106.
- Eden, Lynn. 2004. *Whole World on Fire: Organizations, Knowledge, and Nuclear Weapons Devastation*. Ithaca: Cornell University Press.
- Frickel, Scott and Kelly Moore. 2006. *The New Political Sociology of Science: Institutions, Networks, and Power*. Madison, Wisconsin: The University of Wisconsin Press.
- Hakuyō Kikan Gakkai Hakuyō Kikan Chōsa Kenkyū Iinkai (The Research Committee of the Marine Engineering Society of Japan) (ed.). n.d., *Nippon Hakuyō Kikan Shi Jōki Tābin Hen Sōkō* (An Unpublished Manuscript of the History of Marine Engineering in Japan: The Steam Turbine).
- Institute for the Compilation of Historical Records on the Navy. 1981. *Kaigun* (The Navy).
- Ishikawa, Junkichi (ed.). 1982. *Kokka Sōdōin Shi* (The History of National Mobilization). Fujisawa: Kokka Sōdōin Shi Kankō Kai Compiled Materials.
- Itō, Masanori. 1956. *Dai Kaigun o Omou* (On the Imperial Japanese Navy).
- The Japanese Shipbuilding Society (ed.). 1977. *Shōwa Zōsen Shi* (The History of Shipbuilding in the Shōwa Period). Tokyo: Hara Shobō.
- Kanbō Rinji Chōsa Ka (Temporary Research Section, the Minister of the Imperial Japanese Navy's Secretariat) (ed.). 1984. *Teikoku Gikai Kaigun Kankei Giji Sokki Roku* (Minutes of Imperial Diet Sessions Regarding Navy-related Subjects). reprinted edition. Tokyo: Hara Shobō, 3 vols.
- Kaigun Kansei Honbu Dai 5 Bu. 1943. *Rinji Kikan Chōsa Iinkai Hōkoku ni kansuru Shu Tābin Kaizō narabini Jikken Kenkyū ni kansuru Hōkoku* (Report on the Remedy and the Experimental Research of the Main Turbines in connection with the Rinkicho Report), April 1.
- Latour, Bruno. [1993] 1996. *Aramis or the Love of Technology*. Translated by Catherine Porter. Cambridge, Massachusetts: Harvard University Press.
- Legett, Don. 2011. "Spectacle and Witnessing: Constructing Readings of Charles Parsons's Marine Turbine." *Technology and Culture* 52(2):287-309.
- Leslie, S. W. 1993. *The Cold War and American Science: The Military-Industrial-Academic Complex at MIT and Stanford*. New York: Columbia University Press.
- Macfarlane, Allison. 2012. "The Nuclear Fuel Cycle and the Problem of Prediction." *Japanese Journal for Science, Technology and Society* 21:69-85.

- Matsumoto, Miwao. 2002. *Chi no Shippai to Shakai* (The Structural Failure of the Science-Technology-Society Interface). Tokyo: Iwanami Publishing Co.
- _____. 2005. “The Uncertain but Crucial Relationship between a ‘New Energy’ Technology and Global Environmental Problems.” *Social Studies of Science* 35(4): 623-51.
- _____. 2006. *Technology Gatekeepers for War and Peace*. Basingstoke: Palgrave Macmillan.
- _____. 2010. “To Understand, or not to Understand?: Nuclear Waste Questions Posed to the Sociology of Science and Technology.” *Proceedings of SNU-UT Joint Forum* 1-10.
- _____. 2012a. *Kozosai* (The Structural Disaster). Tokyo: Iwanami Publishing Co.
- _____. 2012b. “The ‘Structural Disaster’ in the Science-Technology-Society Interface.” *Proceedings of SNU-UT Joint Forum* 70-9.
- Minister of the Navy’s Secretariat Military Secret No. 266. 1938. issued on January 19.
- Perrow, Charles. 1984. *Normal Accidents: Living with High Risk Technologies*. New York: Basic Books.
- _____. 1999. *Normal Accidents: Living with High Risk Technologies: With a New Afterword and a Postscript on the Y2K Problem*. Princeton: Princeton University Press.
- Rinkicho Report. Top Secret No. 35. issued on November 2, 1938. Appended Sheets.
- _____. Top Secret No. 35. 1938. issued on November 2.
- _____. Top Secret No. 1. 1938. issued on February 18.
- _____. Top Secret No. 1. 1938. issued on February 18 through Rinkicho Report, Top Secret No. 27, 1938, issued on October 13.
- Pigott, S. J. 1937. “Some Special Features of the S.S. Queen Mary.” *Engineering* CXLIII:387-90.
- _____. 1940. “The Engineering of Highly Powered Ships.” *Engineering* CLXX:410-2.
- Report on QE2 turbines. 1969. *Shipbuilding and Machinery Review* March 13: 24-5.
- Report on Scientific Intelligence Survey in Japan. 1945. Vol. III (GHQ/SCAP Records Box No. 8354 ESS (1)-00727).
- Samuels, Richard J. 1994. *“Rich Nation, Strong Army”: National Security and Technological Transformation of Japan*. Ithaca: Cornell University Press.
- Seisan Gijutsu Kyōkai. 1954. *Kyū Kaigun Kantei Jōki Tābin Koshō Kiroku* (Record of the Failures of Naval Turbines of the Imperial Japanese Navy). Tokyo: Seisan Gijutsu Kyōkai.
- Sendō, Michizō. 1952. *Zōsen Gijutsu no Zenbō* (A Conspectus of Warship Construction Technology).
- Sezawa, Katsutada. 1932. “Vibrations of a Group of Turbine Blades.” *Zōsen Kyōkai Kaihō* (Journal of the Society of Naval Architects) 50:197-206.
- Shibuya, Ryūtarō. 1970. *Kyū Kaigun Gijutsu Shiriyō* (Technical Materials of the Imperial Japanese Navy). Tokyo: Association for Production Technologies, 4 vols.

- Shibuya, Ryutaro. n.d. *Jūgo Zuihitsu* (Essays).
- Smith, Crosbie and M. Norton Wise. 1989. *Energy and Empire: A Biographical Study of Lord Kelvin*. Cambridge: Cambridge University Press.
- Somerscale, E. F. C. 1992. "The Vertical Curtis Steam Turbine." *Transactions of the Newcomen Society for the Study of the History of Engineering and Technology* 63:1-52.
- Trumpler, W. E. Jr. and H. M. Owens. 1955. "Turbine-blade Vibration and Strength." *Transactions of the American Society of the Mechanical Engineers* (April):337-41.
- Vaughan, D. 1996. *The Challenger Launch Decision: Risky Technology, Culture, and Deviance at NASA*. Chicago: The University of Chicago Press.
- Visser, N. J. 1960. "Turbine Blade Vibration." *VMF Review* 2:61-2.
- Walker, J. Samuel. 2004. *Three Mile Island: A Nuclear Crisis in Historical Perspective*. Berkeley: The University of California Press.
- The War History Unit of the National Defense College of the Defense Agency. 1969. *Kaigun Gensenbi* (The Military Equipment of the Navy).
- Wynne, Brian. 1996. "Misunderstood Misunderstandings: Social Identities and Public Uptake of Science." pp. 19-46, in *Misunderstanding Science?: The Public Reconstruction of Science and Technology*, edited by A. Irwin and B. Wynne. Cambridge: Cambridge University Press.

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