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Impossibility of Narrative Bridges across Boundaries: Case Study of Fukushima-Daiichi Accident

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Abstract

This case study identifies human factors that ought to be considered when studying industrial accident conditions, focusing on lessons learned from government involvement in the Fukushima Daiichi nuclear accident, which occurred on 11 March, 2011 in Japan. Chronological accounts of the accident have focused on the government's emergency response, using official reports and published testimonies. This multi-level analysis examines how the high degree of centralization and isolation among crisis management actors created obstacles that left them unable to build narrative bridges among themselves. It will argue that in the aftermath of the accident, the successive "explosion" of three narrative bridges – structural, interactional, contextual – prevented them from reacting more effectively to the disaster.

Introduction

Governments are generally expected to play a central role in crisis situations by making crucial decisions, protecting the interests of populations, and acting as the public interface of crisis management operations. Postcrisis, however, this role means that crisis management challenges governments in their ability to govern (Gilbert 1992) in unstable, uncertain, and complex environments (Andersen 2008; Borraz and Cabane 2017). Governments seek to play a dual role in such situations, at once protecting the welfare of their citizens and policing their behavior in order to preserve national integrity and maintain order, including economic continuity.

In the aftermath of crises, the question arises of what actions might have been taken to prevent them (Aldrich 2017). Following major disasters, investigations into sociotechnical failures are often conducted to avoid recurrences (Dedieu 2010; Juraku 2017). Precrisis safety standards are questioned, especially those relating to engineering safety, as well as crisis preparedness (Lochbaum et al. 2014; Sagan and Blandford 2016).

Additionally, the governance of crisis management is also called into question. Challenges governments face are growing as science and technology progress, making the idea of capricious nature less and less acceptable; increasingly, the means are sought to control it (Dupuy 2010). Both human-made disasters (Turner and Pidgeon 1997) and natural ones are now considered to be the result of human activity, and human activity is therefore expected to be able to provide support in their aftermath. Governments are expected to be able to define and sense the nature of an evolving, ambiguous, and unpredictable situation in order to determine when and where assistance or intervention are required, and from whom. According to Huret (2010), for example, Hurricane Katrina was not a natural disaster but rather the consequence of the retreat of the American welfare state and the privatization of population protection, which resulted in the abandonment of the poor.

In order to ensure the public's compliance, organizations are designed both to participate in providing solutions and to establish their own credibility (Barton 2005; Boin 2005; Rosenthal et al. 1991). Lack of knowledge is often blamed for problems in coordination across government agencies and other organizations (Kellogg et al. 2006). However, given the problematic nature of knowledge in practice (Dougherty 1992), as well as incompatible codes, routines, and protocols (Carlile 2002), fostering understanding across organizational boundaries can be complex. Cultural differences may also give rise to communication problems, as has been frequently pointed out (Kellogg et al. 2006; Pratt and Lee Carr 2017). Often, community members use their expertise within particular contexts of action specific to where they are (Lave and Wenger 1991; Schön 1987), making it difficult to communicate with others in other contexts (Levina 2001).

For all these reasons, governments are often criticized for their tendency to concentrate power in their own hands (Alberts and Hayes 2003; Boin et al. 2009). The literature on risks and accidents attributes this phenomenon of centralization to context, both institutional and emergency-related, because leadership and authority tend to be extended and expanded in crisis situations (Neal and Phillips 1995; Quarantelli 1988). For Quarantelli (1988), “even if there is inadequate information flow during a disaster, officials usually continue to exercise their formal authority and fulfil their normal duties and responsibilities.”

Crisis management cannot be disentangled from the ordinary functioning of organizations and their ordinary power relationships (Borraz and Gisquet 2019; Gilbert 2005); indeed, power relationships in times of crisis are often merely extensions or amplifications of existing power relationships in organizations (Dedieu 2010). As a result, a crisis is very likely to become an arena in which various stakeholders promote different approaches (Boin 2005) and solutions (Allison 1971; Rosenthal et al. 1991).

In disaster situations or industrial accidents, governments may become overly involved or intervene too heavily in crisis management (Macey 2011) in order to promote specific understandings and explanations of events (Maitlis and Christianson 2014). Indeed, political authorities are often criticized for striving to do this even in cases where they lack the capacities and information needed to assume this type of responsibility effectively (Quarantelli 1988; Weick 1988). Centralization may also be actively desired by subordinates. In the uncertain context of a disaster and under extreme threat, power and authority tend to shift up the hierarchy and into the hands of political leaders and chief executives (Quarantelli 1988; Rosenthal and Kouzmin 1997; T’Hart et al. 1993).

Centralization in such cases comes about due to power issues relating to leadership: some wish to seize power whereas others prefer to delegate or shift it away from themselves (Dynes and Aguirre 1979). In all cases, however, the tendency toward centralization differs considerably in terms of effectiveness, efficiency, and acceptability (Lipsky and Olson 1977). The decision-making process can be slowed considerably because various organizations and interorganizational levels must all coordinate with each other, define their various roles and tasks, and achieve consensus (Crozier 1964).

Case of Fukushima

Nowadays, discussions of the Fukushima-Daicchi accident focus mainly on its consequences for surrounding populations (Argyris and French 2017), as well as for Japanese society at large, particularly with regard to future energy policy (Caldicott 2014; Gill et al. 2013; Pidgeon 2011; Samuels 2013).

However, the question of what might have been done to prevent the Fukushima accident in its immediate aftermath has often been raised as well (Aldrich 2017), and much research has been conducted on both the accident and the lessons to be learned from it at various levels.

At a human and organizational level, the need to build more reliable organizations capable of preventing an accident from occurring despite tremendous technical complexity has often been highlighted (French et al. 2017; Fujikawa 2017; McMillan and Overall 2017), and the lack of emergency preparedness and training has frequently been noted (Lochbaum et al. 2014; Sagan and Blandford 2016).

Much has also been written about governance in the nuclear industry and what might have been done at that level to prevent this kind of crisis. Here, a lack of rigor with regard to safety standards on the part of nuclear safety organizations has often been blamed (Lochbaum et al. 2014); in addition, inadequate discipline and independence from safety authorities have been identified as particularly harmful (National Diet of Japan 2012; Nakamura and Kikuchi 2011).

With regard to the accident itself, the National Diet of Japan Fukushima Nuclear Accident Independent Investigation Commission (NAIIC) investigated TEPCO's preparedness for a nuclear emergency and its chain of command, searching for any delays in decision-making or faulty judgments in their response to the crisis that might have been prevented. The Commission concluded that the situation continued to deteriorate because the government's crisis management system, the regulators, and other responsible agencies did not function correctly. The boundaries defining the roles and responsibilities of the parties involved were unclear.

However, aside from noting a general trend toward centralization, there has been little work done on the industrial site's relationship to governments and regulators. The Japanese government's centralized and heavy involvement in the Fukushima-Daiichi accident in March 2011—even in highly technical decisions—has been widely criticized (Aoki and Rothwell 2013; Nakamura and Kikuchi 2011; Perrow 2011). For Aoki and Rothwell (2013), the government's choice to interfere in the performance of certain tasks, with a view to controlling their relevance and correct performance,

undermined effective emergency response management regulation(Aoki and Rothwell 2013) and led to delays in delivering critical decisions from the center (Nakamura and Kikuchi 2011).

Narrative bridges

This article will use the concept of the “narrative bridge” to designate the elements that make it possible to construct a narrative of the event that reveals what might otherwise have gone unnoticed in emergency operations at the site of the nuclear reactor. It will be demonstrated that the collapse – or complete lack – of narrative bridges during the crisis led to a high degree of centralization and isolated the actors involved in its management.

Inspired by the work of Diane Vaughan (Vaughan, 1996), who aims to account for the production and transmission of emergency alerts, this article considers three different levels of narrative bridge structural, interactional, and contextual, in order to analyze how narratives of the accident were put together. These three types of narrative bridges shed new light on what happened on the ground. First, the *structural bridge* organizes communication, structuring exchanges and interactions among the different parties involved in crisis management. Second, the interactional bridge provides the content of the narrative, helping people to make sense of what is happening. Third, the contextual bridge helps define the nature of relationships and the varying degrees of trust between actors, enabling them to listen to and understand the narrative of the accident under the right conditions.

These three “narrative bridges” help clarify incidents that took place in the industrial site; they establish a story of the current accident that includes outside actors and government officials. By allowing the government to picture a situation and its evolution, narrative bridges make diagnosis possible while imparting distributive and performative powers (i.e. “we will do what we say”). making it possible for the government to picture the situation and its evolution. The narrative bridges have a function of authorization for it opens a “legitimate theater for practical actions” (De Certeau, 1984), involving the management of the nuclear power plant (NPP) and the government, which were not expected to be in direct contact.

The case of Fukushima demonstrates that if narrative bridges cannot be built between the licensee and the government during the crisis, coordination becomes extremely difficult. It reveals a border that should have been obliterated from the government – in this case, the Prime Minister's Office - to the NPP. In the case of Fukushima, the failure of coordination between them did not come about because they were unused to working together, but rather because they each were accustomed to working within their own systems in which the stakes were not the same. Without a shared system

between the licensee and the government, narrative bridges collapsed and communication channels were disrupted; information sharing had to face many barriers, all leading to contextual mistrust. A collapse of narrative bridges causes a collapse of meaning, giving rise to a "total" accident or "over-accident," caused by a multitude of incidents of various origins (Dedieu, 2010; Gilbert, 2005). When the construction of narrative bridges fails, direct contacts between the site and the central government generate rigid relationships, as the central government (and everything relating to it) is automatically associated with hierarchical authority. With the Fukushima incident, as is often the case in other accidents, centralization and isolation went hand in hand, mutually reinforcing each other (Crozier 1964): resorting to formal rules to prescribe the detailed performance of tasks creates a very centralized power. However, since formal rules can never cover the extent of reality, other informal rules overlap them, which further reinforces the centralization and differences with regard to local situations. The next section will explain how the process of centralization was a response to difficulties in communication and understanding during the Fukushima Daiichi accident.

The relationship between government and licensee

According to the official emergency plan, the sharing of information required between licensee and government is not based on routine, bureaucratic links, but rather on links that, while hierarchical, are not permanent. At the time of the Fukushima disaster, in order to ensure coordination in crisis management, especially between the government and the licensee, different provisions were included in an official crisis management plan (Figure 1). According to Article 15 of the Act on Special Measures Concerning Nuclear Emergency Preparedness, the licensee had to inform the Nuclear and Industrial Safety Agency (NISA) that an accident had occurred. Then NISA informed the government, which in turn raised the alarm and established a Nuclear Emergency Response Headquarters (NER-HQ).

The Prime Minister served as director-general of the NER-HQ; its vice-director-general was the Minister of Economy, Trade and Industry (METI). The NER-HQ members were the Ministers at the head of each Ministry served as members of the NER-HQ, advised by the Nuclear Safety Commission (NSC), a small committee of five experts.

According to Article 64(3) of Japan's Nuclear Reactor Regulation Law, in the case of a nuclear emergency, the competent Minister was authorized to issue an order for a nuclear operator to take any action that the government considered necessary. This emergency organization provided only a general organisational framework, encompassing the central and local governments, the Nuclear Safety Commission (NSC), and relationships among concerned parties, as described in Japan's Act on Special Measures Concerning Nuclear Emergency Preparedness (1999).

The Fukushima Daiichi nuclear power plant itself was part of the Tokyo Electric Power Company (TEPCO), the largest utility company in Japan. In the event of an accident, its superintendent, Masao Yoshida, was responsible for making decisions regarding the control and operation of the plant onsite, in accordance with the Nuclear Operator Emergency Action Plan at the Fukushima Daiichi Nuclear Power Station (ICANPS Interim, p. 96-97). Offsite, as necessary, the emergency response centre at TEPCO's headquarters was to provide advice and guidance. However, in this instance, "the primary decision-making authority was the site superintendent of the nuclear power plant" (NAIIC 2012, Chapter 3, p.7). As the TEPCO report explains, the Shift Supervisor had the authority to determine conditions and direct operations: "*The conditions and actions in the control rooms were therefore very important to the management of the accident. Nevertheless, this particular crisis shortly required the coordination of external assistance; a task was beyond the parameters of the control room and managed by the plant's emergency response center (ERC). During the accident, the decision-making procedure where the Shift Supervisor made determinations and the ERC at the power station made verifications was generally adhered to.*" (TEPCO, 2012 p. 55)

The NPP and the Government were not expected to be in direct contact: they were to communicate through the NER-HQ, limiting hierarchical pressures in order to facilitate the flow of information. However, the emergency plans provided only a very general framework (Clarke, 1999), which was still the case at the time of the Fukushima Daiichi accident (Aoki and Rothwell 2013). Actors were required to position themselves rapidly in the midst of crisis management, and they adjusted their roles. While, as explained, the licensee and the government were expected to interact with each other only indirectly, through the NER-HQ, it has been demonstrated that crisis situations generally make the government and licensee highly interdependent (Quarantelli 1988).

Methodology

Unlike existing literature on the accident, this article seeks to analyze the interactions between the licensee and the government during the crisis not in terms of what concrete actions were or were not undertaken, but in terms of *narrative actions*. It investigates how narratives organize space and mark out boundaries while at the same time making it possible to gain a deeper understanding of what is going on inside an NPP. It uses an inductive approach (Bansal, Smith, & Vaara, 2018; Gehman et al., 2018), examining materials that shed light on the elements that formed the narrative of the accident as it was deployed and employed between the Fukushima Daiichi NPP and the government.

Our work, inspired by sociological works on disaster analysis (Vaughan 1996; Dedieu 2010), used the relevant literature to craft a qualitative method that accounted for the actors' practices as closely as possible. This has the advantage of revealing the logic of actors' actions as a means of better understanding the centralisation trends highlighted by existing literature on Fukushima (Perrow 2011; Aoki and Rothwell 2013). In line with these sociological approaches (Vaughan 1996) we distinguished three types of narrative bridges – structural, organizational and contextual, and individual – the exploration of which can deepen our understanding of crisis situations such as this one.

Our analysis uses materials from the field, including official documents and testimonies that provide information about the interfaces between the Prime Minister and the Fukushima Daiichi site over the first few days of the accident, from 11 to 15 March 2011, which constituted the heart of the crisis. We identified the key moments in which these interfaces occurred: sounding the alarm, the need for venting, the visit of the Prime Minister, the explosion of Reactor Unit 1, and the injection of the sea water. Among the 5 official reports published in English by the Japanese authorities, we focused on two official reports published just after the accident (between 2011 and 2012). These two reports were selected because they provide information concerning the interfaces between the Fukushima Daiichi Site and the Kantei.

The Investigation Committee on the Accident at the Fukushima Nuclear Power Stations (ICANPS) was established by the Japanese Government. This committee was composed of ten members from academic and other fields, and chaired by Yotaro Hatamura (professor emeritus at the University of Tokyo and professor at Kogakuin University). Their investigation to determine the causes of the accident led to the publication of two reports: an Interim Report in December 2011 (ICANPS Interim, 2012) and a Final Report in July 2012 (ICANPS Final, 2012). They conducted interviews with 772 different subjects, including plant workers, government officials and evacuees.

The Nuclear Accident Independent Investigation Commission (NAIIC) was created by Act of Parliament to investigate the Fukushima accident, and composed of scientific experts (a seismologist, a chemist, physicists, and politicians). It published a report in July 2012, based on 1167 interviews (including plant workers, government officials and evacuees).

TEPCO's report was also taken into consideration, as it provides a detailed and well-documented understanding of the accident and its evolution. However, most likely because cases are still being tried in court, it is hesitant in its analysis of the management of the crisis by key actors (Kobayashi 2019), lessening its relevance to understanding the licensee's interfaces with the Prime Minister. But if the TEPCO report does not mention relations with the government in its description of measures

taken to mitigate the accident, its silence on the subject may be explained by the absence of structural, contextual, and interactive narrative bridges with the government, which could already be felt in the everyday life of these organisations before the accident.

Numerous others institutional reports on Fukushima Daiichi accident were excluded from the scope of this analysis because they did not provide information collected directly from the field (documents, interviews and testimony) regarding interactions between Fukushima Daichii NPP and the government during the accident. Mostly they focused on descriptions of failures in technical and organizational systems in view of offering interpretations and recommendations for the nuclear field.

Previous researchers have pointed out that even these official reports, including the ICANPS and the NAIIIC reports selected for our analysis, are not value-free (Travadel, Guarnieri, & Portelli, 2018): different interpretations of the facts they present are possible. We recognize these limits, but our approach has been to rebuild the chronology of actions from the point of view of the actors carrying them out as reported in these documents, rather than to work from their interpretations of the accident as a whole.

Among the many testimonies, we have paid particular attention to that of Yoshida, which was collected for the ICANP's report, an unabridged version of which was later published in French (Guarnieri, Travadel, Martin, Portelli, & Afrouss, 2015). This official interview with Yoshida, who died of cancer in 2012, is one of the most complete and detailed available. Former Prime Minister Kan has continued his political career, and now campaigns against nuclear power. His interview, conducted by the journalist Kadota in the year following the accident, remains one of the most complete and objective regarding his role in the management of the accident (Kadota, 2014). We used these interviews with Superintendent Yoshida and Prime Minister Kan to reconstruct the logic of action of these two key figures. We were limited to these secondhand sources because it was not possible to conduct interviews with either of these people. In-depth interviews might have helped to dig deeper into the relationships between the government and the licensee as the crisis unfolded (as well as before), and, in particular, to further explore the nature of the information they exchanged.

The first part of this article presents the three narrative bridges that contributed to actors' understanding of the situation: the interactional bridge (the content of the story), the structural bridge (the circuit through which information was gathered), and the contextual bridge (whether and how actors were inclined to interpret the narrative transmitted). We then present how these three narrative bridges collapsed. In the final section, the consequences of the collapse – the centralization of crisis management – will be analysed.

The case study

An Interactional Bridge

Sounding the alarm

On March 11, 2011, an earthquake in eastern Japan caused the electrical grid connection of the Fukushima-Daiichi nuclear power plant to trip. Its emergency generators started, then suddenly failed due to a tsunami caused by the earthquake, which began at 3:27 p.m. What ensued was beyond the design and the scope of any predictions: the nuclear power plant went into a total station blackout.

Although an emergency cooling system malfunction had not yet been confirmed, at 4:45 p.m., TEPCO, the operator, reported to NISA, the nuclear safety authority, that a nuclear emergency situation as defined by Article 15 of the Nuclear Emergency Preparedness Act had occurred. NISA then had to determine whether Article 15 was actually applicable to the event. Once that had been determined, NISA's Director General went to the Prime Minister's office and requested that a Nuclear Emergency Declaration be issued, which would trigger the formal establishment of the national and local NER-HQs. The NAIIC report specifies that this was not a simple formality. Rather, it became a long discussion during which the Prime Minister asked detailed questions about the situation, such as, "Did they really lose all of the batteries?", "Shouldn't there be backup batteries there?", "Why did this happen?", and "Have all possibilities really been exhausted?" The emergency was not declared until 7:03 p.m. on March 11. The press conference to announce it was not held until 7:45 p.m.

Information processing problems and management difficulties in assessing critical situations are recurrent pathologies in crisis situations (Allison 1971). In the Fukushima-Daiichi case, procedural factors made it more difficult to issue an alert, but the government's need to "make sense" of what happened (Boin 2005; Weick 1995) also slowed the process. Although the Nuclear Emergency Declaration was supposed to be issued immediately, it was delayed for two hours after TEPCO alerted the government: "Prime Minister Kan persisted in wanting to understand the technical causes and relevant legal procedures to justify the issuance of the Nuclear Emergency Declaration" (NAIIC, p. 47). Rather than acting as a mere executor or transmitter of information and applying crisis plans according to protocol, the Prime Minister required that elements be provided so that he could understand and interpret what was happening.

Need for Venting

For several hours, with most indicators failed, the operators attempted to restart the backup systems in the dark. They opened and closed valves, attempting to restore electricity in the control room. At 6:25 p.m. on March 11, the shift team in the Main Control Room realized that given the situation, they would almost certainly need to vent the reactor. If cooling could not be restored quickly, the pressure in the core would rise, risking a loss of containment that would release catastrophic amounts of radiation into the environment and leave the core exposed. Worse, this would make any intervention in the surrounding reactors all but impossible, starting a chain reaction that would lead to a massive combined meltdown. It was necessary to vent the reactor to release the pressure before this happened.

At around 1:30 a.m. on March 12, TEPCO informed the authorities of its intention to vent the two reactors and received approval to do so, even though approval was not strictly required. The Prime Minister's consent is not normally required for venting to occur. Formally, the Prime Minister's responsibility was to ensure that the population had been evacuated before venting began because venting would release radioactive elements, but the Prime Minister's approval for the decision to vent was sought nonetheless.

At this point, venting had not in fact taken place, although it was becoming increasingly urgent to save the plant. Prime Minister Kan, having given his consent, became increasingly frustrated that no concrete information was provided to explain the delay in implementing the venting and contacted TEPCO Headquarters during the night, to no avail: the information transmitted appeared too incomplete to fully explain the reasons for the delay (Guarnieri et al. 2015, p. 109).

The relationship between the licensee and the government became increasingly formal and authoritarian. At 6:50 on 12 March, "a venting order was issued by METI Minister Kaieda, in accordance with Article 64, Section 3 of the Law for the Regulation of Nuclear Source Material, Nuclear Fuel Material and Reactors" (NAIIC, p. 52). The TEPCO liaison in the Prime Minister's group also attempted to explain conditions, but he, too, had little information.

At the onset of the accident, Madarame, the Head of the Nuclear Safety Committee, managed to infer what was happening from fragmented information (Kadota 2014, p. 78):

The flow of information was still fragmental, but the fact that the situation was deteriorating was perfectly clear. (:::) They told us that they didn't have enough power cables, or even if the cables would reach, they couldn't connect them. We

didn't know how to make sense of it. (:::). I began to wonder whether their need for cables meant that the whole power system was down.

It was clear that this strategy had its limits: it was difficult for political authorities to gain access to information that was in the hands, minds, or files of other institutions. At the Fukushima Daiichi site, Superintendent Yoshida was said to be “too busy to communicate with the outside” (Guarnieri et al. 2015, p. 137). In order to prevent external stress, Yoshida sometimes chose to mute direct video conferencing with TEPCO Headquarters in order to take certain conversations off camera: “Some information was relayed, but for other information reported by the staff, the microphone was shut down” (Guarnieri et al. 2015, p. 137).

In the meantime, Yoshida reported that it was difficult for him to talk to the Prime Minister because of his lack of specialized knowledge. It was as if Yoshida and Prime Minister Kan were not in a position to discuss the matter at hand: without the same level of knowledge, they could not share perspectives on the accident. Until they actually took the time to discuss it face to face, the lack of understanding between the Prime Minister and the superintendent increased to the point that in his testimony, Yoshida reported feeling “furious” and wishing to tell Prime Minister Kan, “if it is so simple, do it yourself” (Guarnieri et al. 2015, p. 156). Competing motivations are inherent to crisis management (Weick 1988), and the difficulty of sharing information and points of view fosters mistrust among already isolated groups.

The frustration of the Prime Minister and his advisors grew throughout the early hours of the morning; although they had been urgently informed of the plan to vent the plant to save it, the venting process was not happening. Although the TEPCO liaison in the Prime Minister’s group tried to explain what was happening, he, too, had little information to go on: “the team on the fifth floor of the Kantei began to wonder if they were being told the whole story, and were frustrated by the inability to accurately grasp the situation).”

The Head of the Local NERHQ, METI Senior Vice Minister Ikeda, and other personnel moved from the Fukushima Prefecture Nuclear Emergency Response Center (the Off-site Center) to the Fukushima plant in order to handle Prime Minister Kan’s visit. There is no evidence that there was any impairment of the emergency response due to their movement, but the holding of the first meeting of the heads of the functional squads, which had been scheduled at the off-site center, was delayed until after Prime Minister Kan departed from the Fukushima plant. When he arrived at the power plant at 7:11 a.m., the Prime Minister was met by TEPCO Vice-President Muto and METI Senior Vice-Minister/Local NER-HQ Director-General Ikeda, who had come from the off-site center to receive him. The group went to the conference room, where they had to wait briefly for Site Superintendent

Yoshida. Yoshida was able to explain to the Prime Minister some of the difficulties impeding the implementation of the venting, and Kan later confirmed that Yoshida was the first person to explain the situation to him satisfactorily (Kadota 2014, p. 110):

Yoshida said that this was what we wanted to do, and this was how we were doing it. So, in a very short time he was able to tell me, nicely and clearly what they were doing and why. That was fine with me. If he had gone into details, I wouldn't have understood it anyway (:::). He managed to convince me that he knew what was going on.

This first incursion of the Prime Minister into decisions concerning the plant can be regarded as an event that initiated centralization; after that, he exercised his formal authority by assigning tasks to people who were to act and execute.

When the Prime Minister left the plant, Yoshida himself issued the command to vent Reactor 1 by 9:00 a.m., but without electrical power, TEPCO could not respect this deadline. This inability to do so increased suspicion and mistrust, tightening the control exerted by the Prime Minister. From that point on, the Prime Minister and his team of experts were systematically sought out for major decisions about the plant. As the crisis worsened, Kan and his advisors became more and more adamant that they must be informed of all activities taking place on the site, as if they no longer trusted TEPCO's ability to manage the event.

In addition to information pertaining to accident management, the government requested answers to broader questions, which neither TEPCO nor the experts could provide. Until then, the NSC had not considered how it might respond to questions during emergency situation, and, took time to provide accurate answers, which, unfortunately, did not appear particularly convincing. The pertinence of the questions they faced, especially those that did not directly concern technical matters, was not clear: "What will happen if migrating birds fly from Fukushima to Tokyo?", "We've had local residents evacuate, but what do we do about livestock?", and "How should we handle the bodies of tsunami victims that have been exposed to radiation?" (National Diet of Japan 2012, p. 42).

As time passed, the Prime Minister's office became increasingly isolated, not only because of the lack of information or an adequate representation of the accident: among all ongoing rescue operations, the Prime Minister's logic focused on controlling plant management and specifically on venting. Venting became the prism through which the TEPCO's accident mitigation was assessed. An interactional bridge was lacking: not only would it have kept the Prime Minister's office informed about the actions undertaken, it would also have helped them to see what was going on within the site and why venting was not so easy to undertake.

A structural Bridge

Constructing a narrative of the accident was also difficult due to the nature of the structural bridge.

The NER-HQ was finally set up at around 8:30pm on 11 March. However, the Prime Minister found the Crisis Management Centre to be “noisy” and “came to the conclusion that it was not appropriate for him to deal with the accident there” (ICANPS Final 2012), p. 219). The Crisis Management Centre (ICANPS Final Report, p. 219) faced another issue, which continued to be a problem for those working there: due to information security concerns, mobile phones did not work in that area, hampering communications (ICANPS Interim 2012 , p.72). The Prime Minister and several close advisors, including

METI Minister Kaieda, several politicians, NSC Chairman Madarame, and TEPCO officials, including TEPCO “Fellow” Takekuro, all removed themselves to the Prime Minister’s office, a separate area in the same building. From then on, the government was essentially embodied by the Prime Minister’s office at the Kantei.

Just a few hours after the accident, in other words, the Prime Minister changed the emergency response organization, breaking with planned communication procedures to set up an *ad hoc* emergency organization. According to Lanzara’s work (Lanzara, 1983), it could be said that the planned emergency response organization changed mainly because it was not suitable for the crisis context: the Fukushima case study highlights how planned emergency responses may shift *in situ*, in this case because the planned response did not correspond with the interaction framework that the Prime Minister required.

This meant that almost immediately, the crisis management structure diverged from the organizational methods laid out in the emergency plan; in other words, it was as if crisis management standards fit poorly with organizational standards (Clarke, 1999). The Prime Minister organized his scope of action, changing and creating procedures according to what he thought was best for the situation – but in so doing, he and his advisors disregarded established procedures, broke lines of communication, and blurred the roles to be taken in future actions. The fact that the NER-HQ was not disbanded led to further confusion, as some stakeholders continued to communicate with the NERHQ, leaving the Prime Minister’s group out of the loop - and vice versa. At this point, the role system collapsed. “What to communicate” and “with whom to communicate” was no longer known, creating distance between the two groups of actors.

This new, emergency crisis organization might be compared with Lanzara's (1983) ephemeral organisations, with an important difference: in this case, other structures had been planned, often in some detail, before the crisis hit. As they faced conditions similar to what Lanzara (Lanzara, 1983) describes as conducive to the emergence of ephemeral organisations, the groups of actors began to shift, becoming less like formal organisations in which "rules and procedures define the activities" and more like "emergent ephemeral organisations [in which] activities tend to generate rules and procedures." (Eriksson-Zetterquist, Lindberg, & Styhre, 2009). Lanzara compares ephemeral organisations to action nets, in which it is actions, rather than actors, that drive organisations. Czarniawska (Czarniawska, 2009) draws on this concept to suggest ways to look at improvisation in organisational crisis response as action-driven.

Within this ephemeral organization, the structural narrative bridge foreseen by the crisis organization collapsed. Consequently, the Prime Minister's office and the NPP entered into direct contact, rather than communicating through NISA.

Even in cases where the government's direct authority does not come into play, the more people are close to the government, the more they are vested with its authority. Thus, the TEPCO fellow in charge of liaison between the government and the site very quickly took on a role of hierarchical authority associated with the central government - even though they belonged to TEPCO. In this way, Yoshida had the impression that he was receiving instructions directly from the government via TEPCO Fellow Takekuro (NAIIC 2012, Chapter 3, p.7). To some extent, the prime minister and those close to him attempted to frame accident management at the plant directly, using the formal and authoritarian tools they had at their disposal. On 12 March, they used Article 64 of Japan's Nuclear Reactor Regulation Law to issue an order for TEPCO to vent the reactor, despite the fact that these orders and rules were not suitable for the situation at the Fukushima Daiichi Nuclear Power Plant, having been produced at a distance without full knowledge of the difficulties of the situation.

The partitioning of the plant itself offers a tidy metaphor for what went on: each unit, maintained in its place by the pressure of the system, remained completely disconnected from other units, preferring to maintain their autonomy and power by communicating as little as possible with others.

Contextual bridge

The construction of a narrative of the accident also depends on context. The governance of nuclear energy in Japan was seen with some suspicion, within a general context of distrust for nuclear energy (Portelli 2017). This may be attributed to the fact that the agencies that regulate and promote the

nuclear industry are all the purview of the Ministry of Economy, Trade, and Industry (Nakamura and Kikuchi 2011). Academics and members of the media also contributed to this “atomic circle” (Hasegawa 2012), and Regulatory Guides for reactors seem not to have accounted for catastrophic accidents (Funabashi 2012). Such an accident was broadly considered to be highly unlikely, and some have argued that Japanese society as a whole failed to take responsibility for nuclear power governance and ought to have been more involved in political decisions (Kosai and Yamasue 2019).

Adding to this context, Prime Minister Kan had just exposed a devastating scandal in which untreated, HIV-tainted blood was provided to hospitals, infecting numerous patients:

The scandal represented government–business collusion at its worst, and Kan became a household name. The electric power industry was also infamous for its close ties to bureaucrats and for keeping academics on its payroll. (Kushida 2014)

On the morning of March 11, 2011, Naoto Kan was 9 months into his job as Prime Minister of Japan:

It was a stunning victory for Naoto Kan over Japan’s omnipotent bureaucracy, but one that deepened his distrust of the mandarins and the big private conglomerates that he still regards as representing the most insidious form of collusion. (Willacy 2013)

The Prime Minister’s outsider position in a party that was new to power contributed to his suspicion of both industry and the mechanisms that his predecessors had set up to regulate it (Onishi and Fackler 2011).

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Because conflicting motivations are inherent to crisis management (Weick 1988), part of the work of the actors involved is to probe the motivations of the other actors in order to reassure themselves of their intentions. In the case of Fukushima, nothing could reassure the government as to TEPCO’s intentions. Although lack of information left room for every possible suspicion, the mistrust originated in factors that predated the accident. Onishi and Fackler (2011) have shown that the Prime Minister’s outsider position, in a party that was new to power, contributed to his suspicion both of the industry and the mechanisms that his predecessors had set up to regulate it.

In the context of such an accident, trust makes it possible for actors to cope more efficiently with problems of mutual concern (Andersen 2008) and to develop a cooperative relationship (Flynn 2007). Conversely, lack of trust renders cooperation far more difficult, and makes it impossible to build narrative bridges: actors are isolated and have even more trouble communicating and understanding one another.

Narrative Bridges Exploded

A few hours later, Reactor 1 was finally vented. But at 3:36 p.m. on March 12, an explosion in Reactor 1 marked a point of no return for the management of the crisis: TEPCO did not directly inform the political authorities that it had occurred. The experts working with the Prime Minister learned about it from a televised news program rather than through official channels (ICANPS 2012b, p. 76). Nor did the Prime Minister's office itself learn about it from TEPCO; rather, received reports of the explosion from the National Police Agency: "incidentally, the first and second reports related to the explosion at Unit 1 of the Fukushima plant, made by a police officer of the Fukushima Prefectural Police, were conveyed to the Kantei via the National Police Agency" (NAIIC Report, Chapter 3, p. 40). This was clear demonstration of the government's isolation from TEPCO, and for the political authorities, the explosion confirmed the limits of TEPCO's competence, as well as its unwillingness to provide information.

Trend toward Centralization

The explosion in the reactor was explosive at all levels, in the sense that it also permanently broke down the narrative bridges between groups of actors. The Prime Minister and his closest advisers, wishing to control the actions of the licensee directly, resorted to exercising direct authority and imposing impersonal rules. Twice on March 12, Kaida, the METI Minister, threatened to order a water injection for the reactors (3:04 and 5:55 p.m.), despite the fact that the entire staff at the Fukushima-Daiichi site had already been working for several hours to configure the lines that would allow for the injection of water directly into the reactor. The minister's orders urged actions that the plant workers were already struggling to carry out to the best of their ability

Of course, the explosion had a serious impact on what the workers were able to do: it damaged the hoses and fire engines waiting on site to inject sea water into the reactor, as well as scattering radioactive debris throughout the working area. It was necessary to assess injuries, as well as to confirm that a hydrogen explosion had taken place and that it had not damaged the containment or the core itself. It was some time before Site Superintendent Yoshida allowed workers back to the

site, and once they returned, the reconstruction of the line of hoses for injecting seawater took further time. Once again, the impatience of the politicians waiting at the Prime Minister's office grew, intensifying and affirming their decision to resort to authoritarian procedures and rules. An order was issued by METI Minister Kaieda to TEPCO to fill the reactor vessel of Unit 1 with seawater based on Article 64(3).

Meanwhile, the isolation and misunderstanding among the Prime Minister and his close advisers increased on the fifth floor of the Kantei, as some claimed that a hydrogen explosion was impossible. This may explain why they did not hear of the METI Minister's order for seawater injection: the team at the plant was finally able to begin injecting seawater into the reactor of Unit 1 while the meeting with the Prime Minister was taking place, at 7:04 p.m. on March 12. Although the information was transmitted to the authorities and announced at the Emergency Operations Team table, it did not reach the group in the meeting on the fifth floor of the Kantei.

When the meeting was over, TEPCO official Takekuro immediately telephoned Site Superintendent Yoshida at the plant to try to get information from him to relay back to the Prime Minister. When he began to ask about the seawater injection, Yoshida responded that it was underway. Takekuro was completely astonished: "what do you mean? You can't do that! You have got to stop it." (Kadota 2014, p. 158).

The centralization trend in the management of the crisis contributed to the confusion of roles. Takekuro interpreted the wishes of the Prime Minister, and, more broadly, the hierarchical line that ought to be followed, whereas for his part, Yoshida was confused by Takekuro's reaction and very disappointed by the order to stop the procedure. He did not know whether he was required to follow Takekuro's order or whether it was just an opinion.

The confusion of roles led to a misunderstanding of the other side's intentions, further complicating the decision-making process. Given this uncertainty, TEPCO headquarters preferred to maintain consistency with the political sphere, thus continuing the trend toward centralization. TEPCO headquarters chose to comply by centralizing the decision making; although they remained convinced it was necessary to inject seawater and indeed had already begun to do so, they chose to submit to the authority of the Prime Minister and ask Yoshida to stop the seawater injection. Concerned that doing so would be dangerous, Yoshida checked with TEPCO headquarters and with TEPCO Vice President Muto at the off-site center, but they agreed with Takekuro that as long as the Prime Minister's office had not made a decision, it was hard to continue the seawater injection without the Prime Minister's approval; therefore they had no option but to suspend the injection." (ICANPS 2012b, p. 198)

The Prime Minister had not issued any orders on this subject. The desire to await the Prime Minister's approval was the result of a confusion of roles, leading to misinterpretation of intentions. TEPCO headquarters to maintain the centralization of the decision-making process at all costs: it was not simply a matter of submitting to authority—it also meant that TEPCO appears to have been trying to avoid accountability for the outcome of its emergency response by complying with instructions and requests from the Kantei and NISA rather than respecting the decisions of the Fukushima plant, based on the actual conditions at the accident site.

Local Arrangements It is often the case that those at the top of the hierarchy do not have access to the most up-to-date information from the ground, preventing them from providing optimal support (Helsloot 2005). Therefore, one frequent consequence of a high degree of centralization is the development of parallel power relationships that meet the requirements in the field (Crozier 1964; Quarantelli 1988). Although Superintendent Yoshida respected the need to show that the decision making was indeed centralized, at the same time he remained firmly convinced that the injection should continue. He therefore arranged to pretend to stop the injection, without actually stopping it. When the Prime Minister finally gave his approval at around 8:00 p.m., Yoshida “made the TEPCO head office believe he was suspending seawater injection, but in reality he continued it” (NAIIC, Chapter 3, pp. 53, 55).

The appearance of centralized decisions was superficial. In every case, orders given by political authorities urged actions that the plant workers were, to the best of their ability, already struggling to execute. Those orders had little impact, if any, on the management of the plant, other than perhaps adding stress. Their distance from operations meant that government and central authorities could hardly manage the problems of the plant or lead the decision-making process. Parallel powers developed to pick up the slack, making possible the adjustments needed for local work that would otherwise have been paralyzed by the rigidity of centralization. However, due to their clandestine and illegitimate nature, these adjustments were fragile and had the potential to generate tensions, leading to negative consequences.

Findings

The literature has already highlighted that centralization is largely the consequence of “communication difficulties” that are the result of the confusion of roles and of conflicting attempts to intervene among different actors involved in the crisis management process (Boin 2005). In particular, political leaders do not just collect information or coordinate actors but also give a great

many orders because of the specific features of their power and personality (Quarantelli 1988; Janis 1989; Aoki and Rothwell 2013). Consequently, information often bypasses support staff, rendering them unable to provide optimal support, which further reinforces centralization (Helsloot 2005).

This analysis of the case of Fukushima-Daiichi has demonstrated that centralization is largely the result of the isolation of crisis management actors from one another, which arises when narrative bridges are not preserved.

Three types of narrative bridges are required to build narratives of an accident. In the case of Fukushima-Daiichi, however, they successively collapsed. First, the structural bridge ensuring the flow of information between the NPP site and the government via dedicated support staff failed. This narrative bridge was not only what would have allowed information to cross into and out of the perimeter of the plant; it is also what made it possible to keep a safe distance from it. The government's temptation was to shorten this bridge and tighten contact with the NPP, but this encouraged the development of formal and hierarchical relationships. Here, had it not collapsed, the narrative bridge could have helped not only to account for the situation, but also to keep some distance from it to prevent the government from interfering in the management of the accident, to the point of becoming a direct contractor with the operator.

Second, an interactional bridge was needed to give not only a description of what was happening on the site but also a representation of the situation. Instead, descriptions given were mainly in terms of actions—of doing rather than of seeing. The collapse of this narrative bridge meant that no picture of what was going on within the plant's enclosure was available to key actors outside to ensure they understood what was going on and what might happen next.

Third, a contextual bridge could have helped to frame the exchanges between the NPP and the government, which were overshadowed by their relationship prior to the accident. A contextual narrative bridge acknowledges the importance of social environment, helping to foster fair, transparent, and efficient dialogue among industry, experts, regulators, and government. The lack of this bridge meant that the credibility of the narrative given was assessed more according to reputation than to objective considerations regarding the time it took for information to be transmitted, the many communication channels, and other factors. Bridges are not built from thin air: preexisting channels of communication, in the form of memory and reputation, act as foundations for new ones. Narrations are composed of fragments of past history, which also have the function of founding and articulating narrative bridges (De Certeau 1984). Bridges give meaning to chaos, and familiarity to strangeness and should put in place in daily life, long before the occurrence of a crisis.

These three narrative bridges are in fact based on three very distinct categories of action: the way an action is organized (structural), the way the action is discussed (interactive), and the way work is done together (contextual). Essentially, a disjoin exists among these three narrative bridges, and from the moment a narrative bridge is under threat, the all three of them are endangered.

Just as bridges are built interdependently, they collapse in interdependently. A narrative bridge whose structure is abridged undermines the interactional bridge. The information flow is thrown into disorder, and people no longer receive expected information at the right levels, which may lead to both misunderstanding and mistakes.

The construction of structural and interactional narrative bridges depends in large part on contextual narrative bridges. If an atmosphere of mistrust exists before an accident, it may make those involved reluctant to begin organizing a crisis response. Because they are aware that such a response requires ongoing coordination and communication throughout the event, they may as a result be reluctant to set up a structural bridge. And even if a structural bridge is set up, an atmosphere of distrust linked to a bad reputation might lead to the poor interpretation of information as it is being exchanged. Existing relationships among the different parties may in turn make it difficult to set up an interactional bridge, as well.

Once these three narrative bridges had collapsed, contact between the site and the government became rarer and more direct, mostly occurring among a small handful of people. The result in such situations is always a high concentration of power and privilege and an atmosphere of exclusivity and secrecy, especially toward support staff (Crozier and Thoenig 1976). Indeed, the centralization of crisis management is a functional response to the rigidities and the lack of understanding engendered by the isolation of groups of actors following the collapse of narrative bridges.

Conclusion

Crisis governance relies on access to a narrative of the crisis and on the capacity of all the actors involved in crisis management to build and maintain narrative bridges. Narratives organize space and mark out boundaries; at the same time, they enable actors to transcend them, making it possible to abolish borders and find a way to think about the present (De Certeau 1984).

Emphasizing the role of these narratives also means emphasizing the human factor of crisis management, and the approach developed in this article has attempted to offer an alternative to the analysis of the logic of actions in crisis management by providing an analysis of narrative actions.

Logics of action do not exist on their own: it is just as important to understand how these logics of action are told and how they are perceived by other actors. “To be human is to be endlessly entwined in complex relationships of difference that don’t settle comfortably into neat, prefabricated categories” (Scott 2011). Taking the time to analyze the narrative requires one to analyze the rationalities that underlie the representations and changing relationships one actor has with another; it gives access to actors’ interpretative frameworks, which opens a “legitimate theater for practical actions” (De Certeau 1984).

Data Availability statement

All data, models, and code generated or used during the study appear in the submitted article.

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